Imagination is More Important than Knowledge: A Thesis Defense in Three Acts

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The University of Prince Edward Island

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1:00 PM – 5:00 PM

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In Defense of:

TRULY NONCOOPERATIVE GAMES

A THESIS

Presented to the Faculty of The University of Prince Edward Island,
in Candidacy for the Degree of Master of Arts in Island Studies.

Recommended for Acceptance by Dean Richard Gordon Kurial,
May, 2010

Imagination is More Important than Knowledge

Very good, Matt.

Hi I am a deep sea diver.
Because I want to be an.
Underwater scientist because.
I want to learn about the.
Yours Matt

DISCLOSURE

[Do not] believe *anything* that I suggest! Please do not believe a word! I know that that is asking too much, as I will speak only the truth, as well as I can. But I warn you: I know *nothing*, or *almost nothing*. We all know nothing or almost nothing. I *conjecture* that that is a basic fact of life. We know nothing, we can only conjecture: we guess.

Karl Popper, *All Life is Problem Solving*, 1999

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PRELUDE

The Task of Scientific Activity

Knowledge consists in the search for truth – the search for objectively true, explanatory theories.

It is not the search for certainty….

In science, a mistake we make - an error - consists essentially in our regarding as true a theory that is not true… To combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods.

This is the task of scientific activity.

Karl Popper, *In Search of a Better World*, 1992

ACT I

Economic Development Strategy

- Land Mass
- Agricultural Capacity
- Biogeographical Insularity
- Military Power
- The Human Factor

Ellen Semple, *Influences of Geographic Environment*, 1911…

The... development of island peoples bears always... the stamp of isolation; but... isolation may lead to opposite cultural results. It may mean in one case retardation, in another accelerated development. Its geographical advantages are distinctly relative, increasing rapidly with a rising scale of civilization. Therefore in an island habitat the [human] factor may operate with or against the geographic factor in producing a desirable historical result. If the isolation is almost complete, the cultural status of the inhabitants low, and therefore their need of stimulation from without very great, the lack of it will send them deeper in barbarism than their kinsmen on the mainland.

Feature Presentation

Prince Edward Island Development Plan

National Film Board of Canada (2006). 113 minutes.

Liner notes: "Two videos, six months apart, …both dealing with the comprehensive social and economic development plan for PEI. In essence they are a study of the dynamics of the plan, the relationships and communication (or lack of) between the planners and the planned-for, and between the planners and the governments involved."

The Funk Line

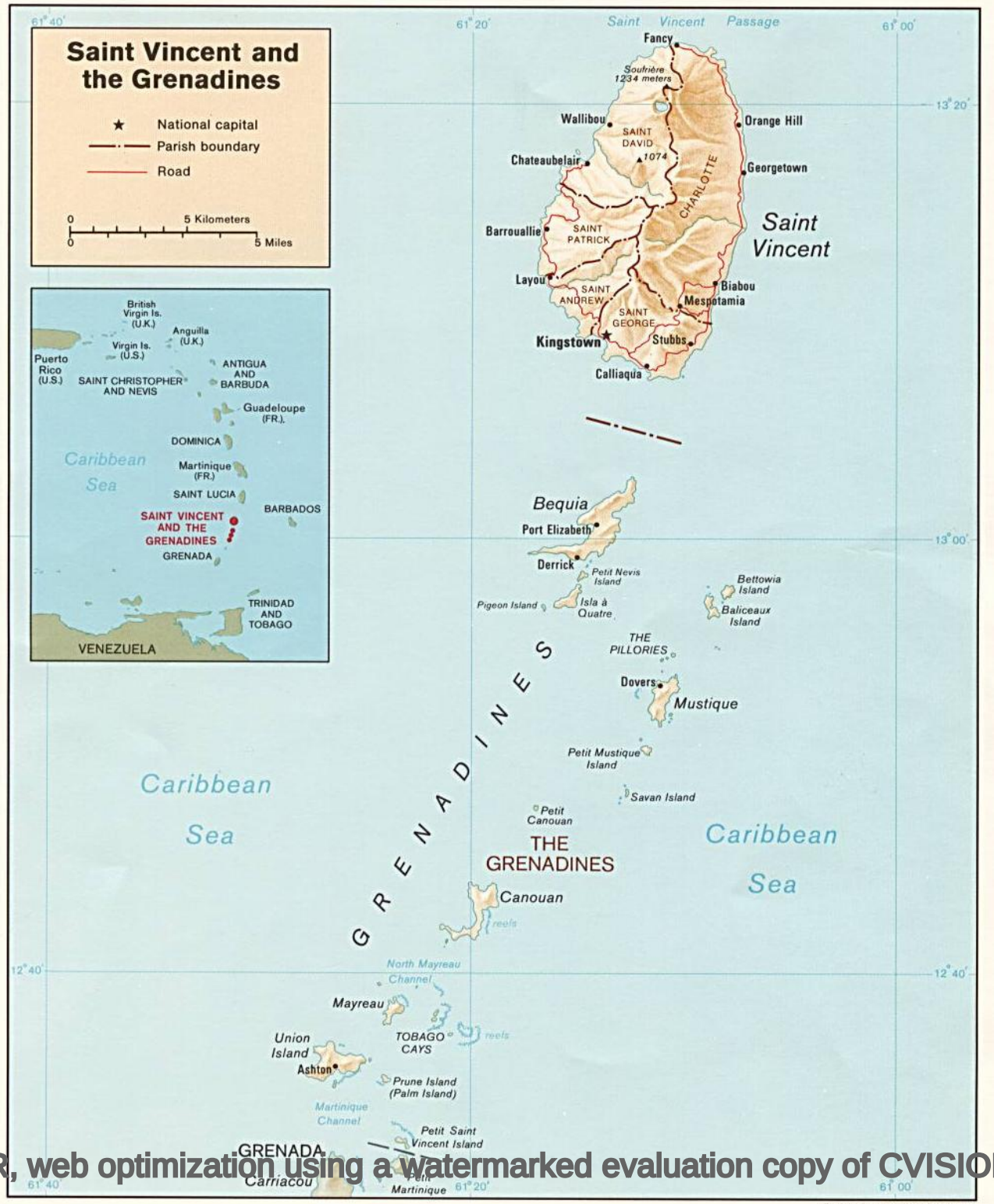
The Funk Line unifies and extends *The Wallace Line*. In essence, it brings "the human factor" (politico-economics) to the biogeographical arena:

http://www.youtube.com/watch?v=CoM3ubcknqM

"There is no other example on the globe of an island so closely surrounded by other islands on every side, yet preserving such a marked individuality in its forms of life; it is, so far as yet known, absolutely unique."

Alfred Russel Wallace, *Island Life*, 1881

CENTRAL AMERICA AND THE CARIBBEAN



Base 801136 (546180) 3-88

St. Vincent & the Grenadines (SVG)

Archipelago of 50 islands and cays in the Eastern Caribbean. The largest, St. Vincent. is 133 square miles, while the Grenadine islands which run for forty miles to its southwest are in total 17 square miles. The population is 120,000, 90% of which live on the main island of St. Vincent.

St. Vincent & the Grenadines (SVG)

- 22% unemployment.
- Highest population densities & poverty levels within the Organization of Eastern Caribbean States.
- 37.5 % of the population live below the poverty line; 25.7 % are indigent.
- 7.3% of households do not have access to toilet facilities, and thus resort to the sea, rivers and streams for faecal waste disposal.

The Grenadines

The Grenadines, including Mustique, lie on the Grenadine Bank extending some 120 km between Grenada and St. Vincent, and occupy about 1,500 km² of the bank. This area supports the most extensive coral reefs and related habitats in the south-eastern Caribbean. Tourism and fishing are the major sources of employment.

Mustique

- Amongst the lesser of the lesser Antilles
- No water
- No natural resources
- *Moustique* = mousquito
- Windward: Salt spray
- Leeward: Sand flies
- No $ support from SVG

Neoclassical Economic Overview

- Small: 1391 acres ; ≈3 miles by 1.5 miles
- No fresh water
- Small airport
- No harbour
- No minerals
- No oil or natural gas
- No commercial agriculture
- No manufacturing
- No exclusive economic zone
- No off-shore finance
- No export industry

But…

Mustique

- 0% unemployment
- 0% population living below poverty line.
- 10% of SVG GNP with 1% of the population (1,000).
- Lowest crime rate in SVG
- Healthiest coral reefs & ecology in SVG
- Best health care in SVG
- Healthiest population in SVG
- Highest literacy rate in SVG
- Most valuable real estate in SVG.
- Federal transfer payments=0

Why?

Central Problem

The assumption that *economists* can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers.

FA von Hayek, *The Trend of Economic Thinking*, 1991

Most Fundamental Problem

The most fundamental… problem is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued.

George Stigler, *The Process and Progress of Economics*, 1982

The Problem of Value

First let us be aware that there exists at present no universal system of economic theory and that, if one should ever be developed, it will very probably not be during our lifetime.

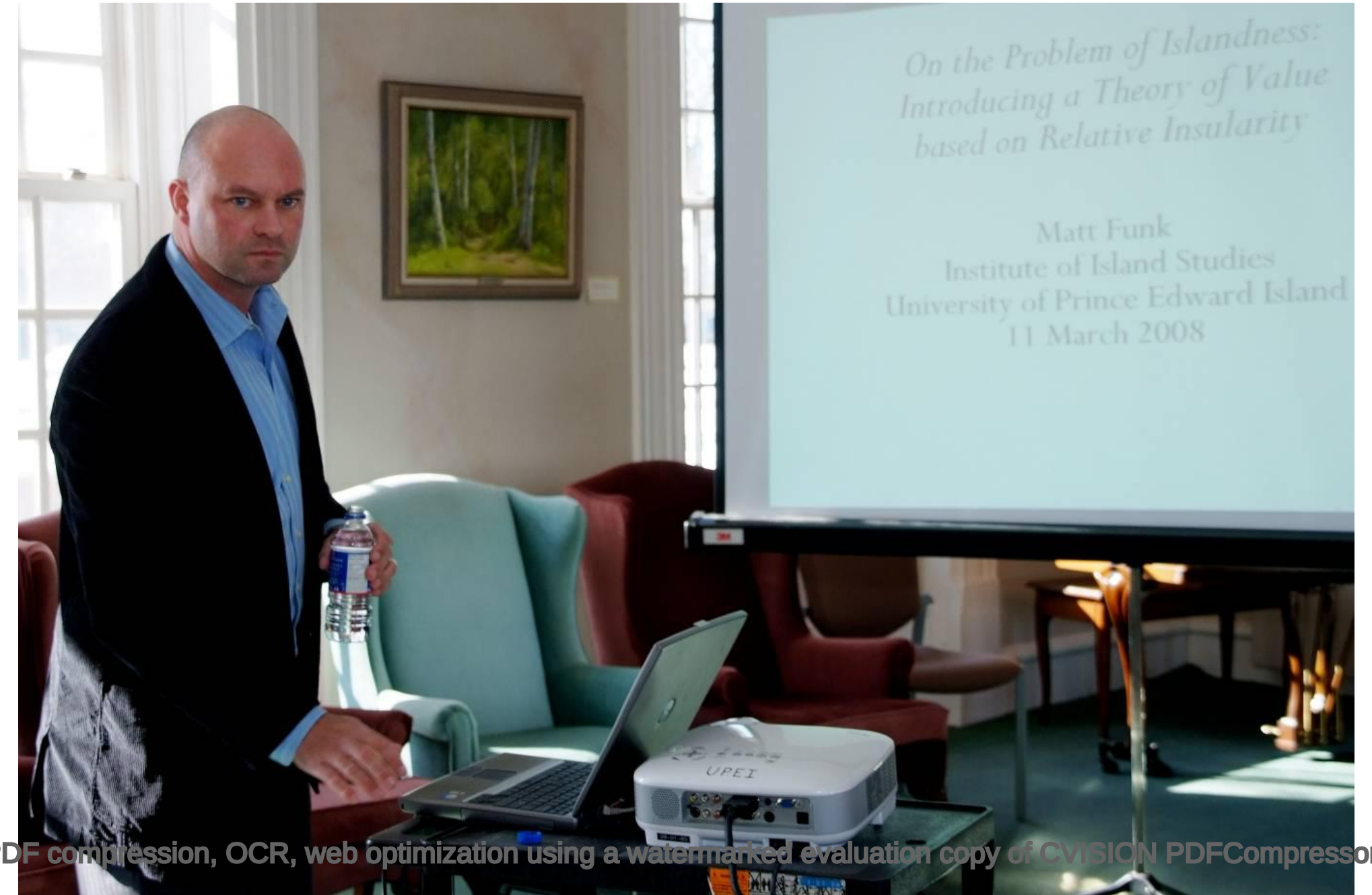
John von Neumann & Oskar Morgenstern,
Theory of Games and Economic Behaviour, 1944

The Problem of Value

John von Neumann:
1903-1957

Oscar Morgenstern:
1902-1977

The Birth of a Theory



Unified Theory of Value

$$V = f'(I_R)$$

Value (V) is a *derivative function* (f') of *relative insularity* (I_R).

Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds.

James Clerk Maxwell, *Nature*, 1873

Value is a derivative function of relative insularity.

What do we mean by "derivative"?

Example:

On the Problem of Economic Power:
Lessons from the Natural History of the Hawaiian Archipelago
http://mpra.ub.uni-muenchen.de/19371/

Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war or the threat of war....

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide... who shall be allowed to stand upon a given piece of land and to put things into it and take things from it.

Bertrand Russell, *Power: A New Social Analysis*, 1938

What does this mean insofar as “island” economic development strategy is concerned?

The Problem of Value

Economically, socially, psychologically, the construction of a fixed link will reduce our insularity. It moves in the direction of peninsularity, which as the work itself expresses, is a state of being almost an island.

David Weale, *Islandness*, 1991

The Problem of Islandness

Value is a derivative function of relative insularity.

An Island Economic Model

There are many small islands throughout the world that people have attempted to develop, but not always with the interests of the environment in mind. Since its inception in 1968, the Mustique Co. has recognized both the aesthetic and economic value of a healthy environment and has tried to protect the island from ad hoc and adverse development.

This was accomplished by partitioning the island into a limited number of plots, having the island and surrounding waters… declared a Conservation Area, and commissioning studies and reports to monitor environmental issues and concerns as they arose. The result of this is an island that is still mostly covered with green space – nearly 70% with a diverse collection of plant communities, habitats, and the creatures that depend upon these. The dominant categories of vegetation on Mustique remain unchanged…

The Company recognizes that all parts of a small island's ecosystem are interrelated and therefore all are important to maintain a healthy environment. The sea salt ponds are not only important for bird life, they also provide a sink for the soil that runs down the hillside during heavy rains. This in turn helps prevent runoff of silt from entering the sea and covering our sea grass beds and coral reefs. The coral reefs not only provide food and shelter for fish and other creatures, they also protect our white sandy beaches from storm waves.

The Development Plan created for Mustique is a testament to the company's desire to maintain its valuable natural resources while allowing limited development in carefully selected areas. The goal of environmental management on Mustique is to preserve and use all facets of the environment in such a manner that they will remain in perpetuity for future generations.

Mick Jagger, *A Taste of Mustique*, 2007

Comparative Island Study

- *The Prince Edward Island Development Plan*
- *The Mustique Company Development Plan*

On the Truly Noncooperative Game of Island Life: Introducing a Unified Theory of Value & Evolutionarily Stable Island Economic Development Strategy

http://mpra.ub.uni-muenchen.de/19049/

Island Economic Development Strategy

Ecological Health=Economic Health

Island Economic Development Strategy

RIS Strategy	*Short-Term Payoff (1-40 years)*	*Long-Term Payoff (20-30) years*
Maximum Economic Development	*$-Rich/Land-Poor*	*$-Poor/Land-Poor*
Maximum Ecological Preservation	*Land-Rich/$-Poor*	*Land Rich/$-Rich*

Table 1: *'Island' Economic Development Strategy Payoff Matrix*

Conclusion

- *The Prince Edward Island Comprehensive Development Plan* was and remains a failed attempt to create economic value (on an island rich in natural resources) with little regard for ecology. The result was brief economic growth, ecological destruction, and medium and long-term economic disaster.
- *The Mustique Co. Development Plan* was created to ensure ecological preservation (on an island poor in natural resources) with little regard for economic growth. The result was ecological preservation, short-term economic loss, and the creation of extraordinary long-term economic value.

ACT II
TRULY NONCOOPERATIVE GAMES

But larger questions remain…

Does the “winning” strategy on islands apply for “Global Economic Military Superpowers”?

The “island” of Earth?

No.

Although value is indeed a derivative function of relative insularity and thus remains the winning strategy, *achieving* and *maintaining* relative insularity at the continental and global levels isn't so simple, requires far greater efforts, and is fairly counter-intuitive.

And this presents a difficult dilemma…

A TWO*PERSON DILEMMA

Two men, charged with a joint violation of law, are held separately by the police. Each is told that

(1) if one confesses and the other does not, the former will be given a reward of one unit and the latter will be fined two units,

(2) if both confess, each will be fined one unit.

At the same time each has good reason to believe that

(3) if neither confesses, both will go clear.

This situation gives rise to a simple symmetric two-person game (not zero-sum) with the following table of payoffs, in which each ordered pair represents the payoffs to I and II, in that order:

		II	
		confess	not confess
I	confess	(-1, -1)	(1, -2)
	not confess	(-2, 1)	(0, 0)

Clearly, for each man the pure strategy "confess" dominates the pure strategy "not confess." Hence, there is a unique equilibrium point* given by the two pure strategies "confess." In contrast with this non-cooperative solution one sees that both men would profit if they could form a coalition binding each other to "not confess."

The game becomes zero-sum three-person by introducing the State as a third player. The State exercises no choice (that is, has a single pure strategy) but receives payoffs as follows:

		II	
		confess	not confess
I	confess	2	1
	not confess	1	0

*see J. Nash, PROC. NAT. ACAD. SCI. 36 (1950) 48-49.

Stanford, May 1950

A. W. Tucker

When the goal is to give advice to all of the players in a game (*i.e.*, to advise each player what strategy to choose), any advice that was not an equilibrium would have the unsettling property that there would always be some player for whom the advice was bad, in the sense that, if all other players followed the parts of the advice directed to them, it would be better for some player to do differently than he was advised. If the advice is an equilibrium, however, this will not be the case, because the advice to each player is the best response to the advice given to the other players.

Holt & Roth, *The Nash equilibrium: A perspective*, 2004

Noncooperative Games

A game is non-cooperative if it is impossible for the players to communicate or collaborate in any way.

John Nash, *Two-Person Cooperative Games*, 1950

Truly Noncooperative Games

There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness [makes] the situation truly non-cooperative.

John Nash, *Noncooperative Games*, 1951

Axioms

One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps to justify and clarify the other.

John Nash, *Two-Person Cooperative Games*, 1950

Axioms

A set of reasonable desiderata are stated as axioms. Then an important and unexpected conclusion is derived by clear and unassailable… reasoning.

Harold Kuhn, *The Essential John Nash*, 2002

The Socratic Method

Reductio ad absurdum, which Euclid loved so much, is one of a mathematician's finest weapons.

G.R. Hardy, *A Mathematician's Apology*, 1940

The Socratic Method

1. Locate a statement confidently described as common sense.

2. Imagine for a moment that, despite the confidence of the person proposing it, the statement is false. Search for situations or contexts where the statement would not be true.

3. If an exception is found, the definition must be false or at least imprecise.

Alain Botton, *The Consolations of Philosophy*, 2000

The Socratic Method

On the Truly Noncooperative Game of Life on Earth:
In Search of the Unity of Nature & Evolutionary Stable Strategy
http://mpra.ub.uni-muenchen.de/17280/

On the Origin of Mass Extinctions:
Darwin's Nontrivial Error
http://mpra.ub.uni-muenchen.de/20193/

The Socratic Method

Although "ecological economists" refer to their so-called "subject matter" as a "whole-systems" approach, as Sir Karl Popper duly noted, "subject matters do not exist."

And thus it comes of little surprise that they "forgot" *The Problem of Induction*, and, thus, two major "systems", so to speak: 1) *Political* and 2) *Planetary* uncertainties…

Political Uncertainty

The first duty of the sovereign, that of protecting the society from the violence and invasion of other independent societies, can be performed only by means of a military force.

Adam Smith, *On the Wealth of Nations*, 1776

The Problem of Warfighting

But is war rational?

The Problem of Warfighting

Can war be rational?... The answer is yes, it can be. In one of the greatest speeches of all time... Abraham Lincoln said: 'Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came'.

It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem.

Robert Aumann, *War and Peace*, 2006

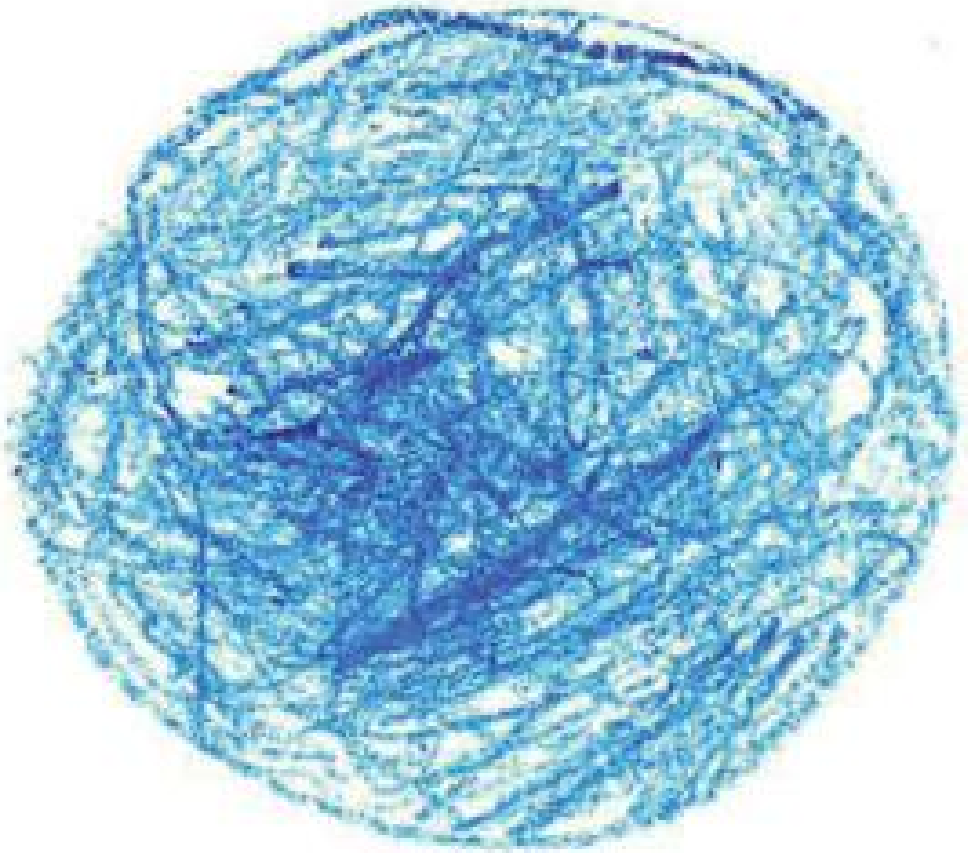
Planetary Uncertainty

- Meteorites
- Super-Eruptions
- Supermassive Star Collapse
- Chaotic Behaviour
- Solar Flux
- Ohmic Decay
- Industrial Agricultural
- Landrace & Richness Loss
- Global Warming
- Ice Ages

A Truly Whole-Systems Approach

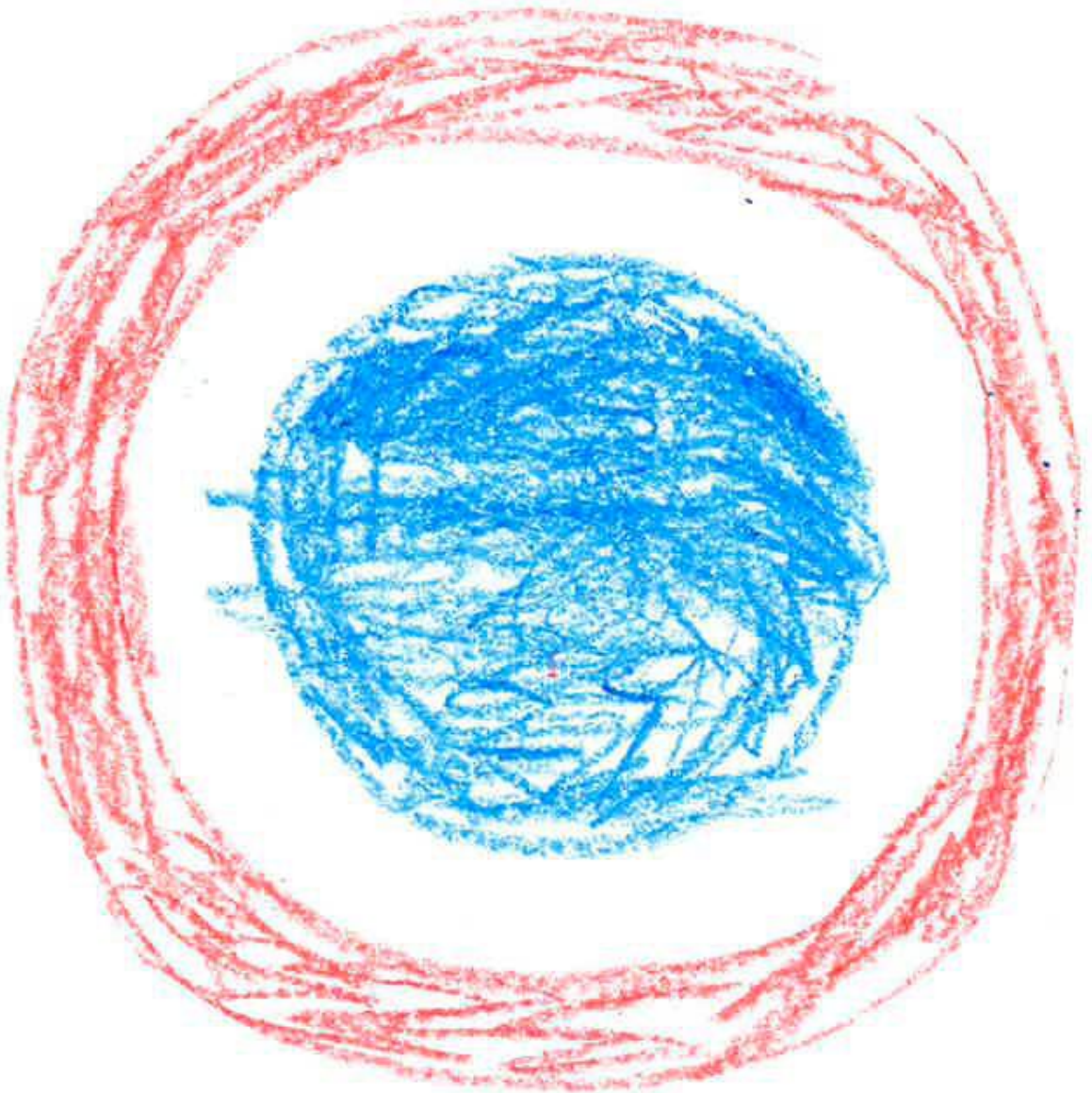
The following work of art (created by my son, William), represents the theoretical framework of so-called "ecological economics."

The blue represents the Earth, the biosphere and all of its inter-connected systems, which are, naturally, beholden to the second law of thermodynamics….

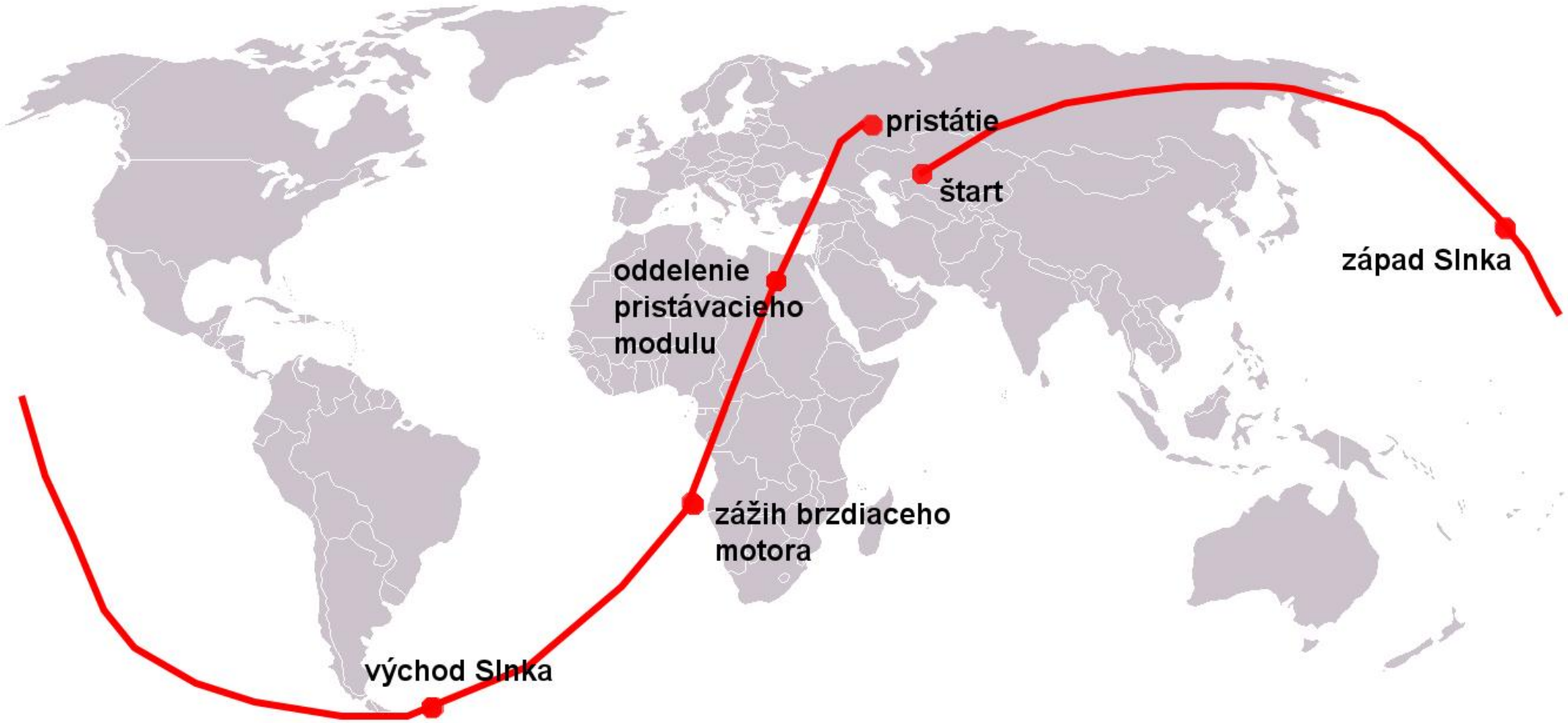


The next excellent drawing represents my core discovery, a unified theory of value, applied at the global level. Note that, in addition to the "whole world" of "ecological economics" (blue), this truly unified framework also recognizes two *additional mission-critical systems*: "political uncertainty" (white), and "planetary uncertainty" (red).

This is the "bigger picture," so to speak…



Value is a derivative function of relative insularity.



On 12 April 12, 1961, Russian cosmonaut Yuri Gagarin became the first human to blast into space:

At 06:07 UTC *Vostok-1* launched from the Baikonur Cosmodrome.

Following ignition and liftoff, the command centre radioed, "LIFT OFF! We wish you a good flight."

Gagarin replied, "*Poyekhali*! (Off we go!)."

At 06:13 UTC, as *Vostok-1* soared toward orbit, Gagarin reported, "The flight is continuing well. I can see the Earth. The visibility is good… I almost see everything."

One minute later, as he passed over Russia, Gagarin reported, "Everything is working very well. All systems are working."

And, in this spirit, on this 21st day of June, I hope you have enjoyed the flight aboard the first manned-mission into this newfound and uncharted theoretical space.

Despite what many "ecological economists" and other misguided and under-powered cosmonauts may claim, "I can see the Earth. Everything is working very well. All systems are working."

Further Reading

For more details and an exhaustive, ≈1,200 page defense, see:

THE PRINCIPLES OF ECONOMICS & EVOLUTION:
A Survival Guide for the Inhabitants of Small Islands,
Including the Inhabitants of the Small Island of Earth

A Lifeboat Foundation Scientific Advisory Committee Report
Published 5 May 2010

http://lifeboat.com/ex/reports#on_the_principles_of_economics_and_evolution

ACT III

Imagination vs. Knowledge

Why has it taken so long for someone (me) to derive the theory presented here?

Many prominent problems come to mind…

Teleological worldviews, Aristotelian methods (including the belief in 'scientific method'), authoritarianism, dogma, and yes, academia's emphasis upon knowledge over imagination…

There is no such thing as a logical method of having new ideas, or a... reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition'... In a similar way Einstein speaks of the 'search for those highly universal laws. . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these... laws. They can only be reached by intuition, based upon something like an intellectual love ('*Einfühlung*').

Karl Popper, *The Logic of Scientific Discovery*, 1959

The Open Society and Its Enemies

Thus we'll march on with a defense of Socrates, Pericles, Xenophanes, and Popper….

And wage war against Aristotle, Plato, and the misguided methods, influential scholars, and enduring institutions they inspired and created, because…

The Axis of Evil

There is no place for dogma in science. The scientist is free to ask any questions, to doubt any assertion, to seek for any evidence, to correct any error. Where science has been used in the past to erect new dogmatism, that dogmatism has found itself incompatible with the progress of science; and in the end, the dogma has yielded, or science and freedom have perished together.

J. Robert Oppenheimer, *The Open Mind*, 1955

Ally (*c.* 430 BC)

Although only a few may originate a policy, we are all able to judge it.

PERICLES OF ATHENS

Enemy (≈80 years later)

The greatest principle of all is that nobody… should be without a leader. Nor should the mind of anybody be habituated to letting him do anything at all on his own… ; neither out of zeal, nor even playfully. But in war and in the midst of peace—to his leader he shall direct his eye and follow him faithfully. And even in the smallest matter he should stand under leadership. For example, he should get up, or move, or wash, or take his meals… only if he has been told to do so. In a word, he should teach his soul, by long habit, never to dream of acting independently, and to become utterly incapable of it.

PLATO OF ATHENS

The development of thought since Aristotle could… be summed up by saying that every discipline, as long as it used the Aristotelian method of definition, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which… sciences have been able to make any progress depended on the degree to which they have been able to get rid of this essentialist method (this is why… 'social science' still belongs to the Middle Ages.) [But] the problem has been so thoroughly muddled by Plato and Aristotle… that the prospect of dispelling them does not seem very bright.

Karl Popper, *The Open Society and Its Enemies*, 1945

Scientific Method

Does it exist?

Do “subject matters” exist?

Island studies?

Scientific Method

Plato, Aristotle, Bacon…, as well as most of their successors, …believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or… whether some given hypothesis was at least 'probable' to some ascertainable degree….

I assert that no scientific method exists... To put it in a more direct way: (i) There is no method of discovering a scientific theory. (ii) There is no method of ascertaining the truth of a scientific hypothesis, *i.e.*, no method of verification. (iii) There is no method of ascertaining whether a hypothesis is 'probable', or probably true.

Karl Popper, *On the Nonexistence of Scientific Method*, 1956

There are no subject matters; no branches of learning —or, rather, of inquiry: there are only problems, and the urge to solve them. A science such as botany or chemistry… is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

Karl Popper, *On the Non-existence of Scientific Method*, 1956

THE GLOBE AND MAIL

October 6, 2009

Canadian winner bemoans bureaucracy

By Jill Mahoney and Elizabeth Church
From Wednesday's Globe and Mail

Canadian [Willard S. Boyle]... won a Nobel Prize Tuesday. But [he] had to move to the U.S. to do his cutting-edge work. Dr Boyle... warned that managers need to give scientists leeway to come up with the kinds of transformative inventions that are too often stifled by paperwork and red tape. What scientists face today is "almost disgraceful. Do you think... George Smith and I ever wrote a business plan? Not at all... You don't have time to do that kind of baloney."

Dr Boyle… said policy-makers should look at the practices of think tanks that produce Nobel Prize-winners…, instead of "pouring money randomly into [things], expecting the same results."

"Usually… management people or… politicians haven't got the foggiest idea of what science is all about." What is needed is "an appreciation for the free will, free spirit of scientists. Give them a chance to do the things they want to do."

A Conversation with Dr Willard Boyle [2010]: Nova Scotia's first Nobel Prize Winner.

Scholars may be compared to artists, who we expect to express their own original ideas and convictions. We do not simply expect them to produce what the market wants. Production for the market was the rule in the Middle Ages, and painters and musicians were simple artisans who had to do what their customers wanted. But the Renaissance brought a complete reorientation: artists were given the right to express themselves with as few restrictions as possible. The result was an explosion in creativity, Leonardo da Vinci and Michelangelo... being the best-known examples.

If scholars are to be original in a similar way to artists today, they have to be given as much independence as possible. This principle has been accorded to universities a long time ago, and is rightly guarded by them. It has also brought about an explosion of innovation never seen before.

Bruno S. Frey, *Publishing as Prostitution*, 2003

Within the unique university context, the most crucial of all human rights are the rights of freedom of speech, academic freedom, and freedom of research. And we affirm that these rights are meaningless unless they entail the right to raise deeply disturbing questions and provocative challenges to the cherished beliefs of society at large and of the university itself. It is this human right to radical, critical teaching and research with which the University has a duty above all to be concerned; for there is no one else, no other institution and no other office, in our modern liberal democracy, which is the custodian of this most precious and vulnerable right of the liberated human spirit.

University of Toronto Mission & Purpose Statement, 1971

Thank you!

FADE OUT:

THE END

Suggested Reading:

"The World Needs More Rebels Like Einstein"
Walter Isaacson, *Wired*, March, 2007

(encore excerpt follows)…

ENCORE

A Proclamation to Carve on our Blackboards

Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels.... And, as recent research into Einstein's... papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity....

Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern…. Other scientists… were too confined by the dogmas of the day. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics… 'Imagination is more important than knowledge,' Einstein later said. Indeed, if we are ever going to… come up with a unified theory… we should carve that proclamation above all of our blackboards.

Imagination is More Important than Knowledge

A UNIFIED THEORY OF VALUE:

$$V = f'(I_R)$$

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On the Purpose of a University Education: Words of Wisdom from Willard S. Boyle

Journal:	*Journal of Philosophy of Education*
Manuscript ID:	JOPE-0109-Dec-2009
Manuscript Type:	Original Article
Keywords:	scientific method, philosophy of science, Karl Popper, thesis format, thesis content, dissertation

ON THE PURPOSE OF A UNIVERSITY EDUCATION: WORDS OF WISOM FROM WILLARD S. BOYLE[$]

ABSTRACT

If it is true - as Sir Karl Popper emphasized - that neither 'subject matters' nor 'Scientific Method' exist, then does it follow that a 'standard thesis format' cannot exist? This paper explores this conjecture, concluding a 'standard thesis format' does indeed represent a theoretically unsound, counter-productive proposition.

Key terms: scientific method; philosophy of science; Karl Popper; dissertation; thesis format; thesis content; university education; scholarship

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CANADIAN WINNER BEMOANS BUREACRACY

The Canadian inventor of technology that led to the birth of digital photography won a Nobel Prize Tuesday. But physicist Willard Boyle had to move to the United States[$] to do his cutting-edge work. Dr Boyle, who won the award with former colleague George Smith, warned that [we] need to give scientists leeway to come up with the kinds of transformative inventions that are too often stifled…

What scientists face today is 'almost disgraceful'…. What is needed is 'an appreciation for the free will, free spirit of scientists. Give them a chance to do the things they want to do.'

—Willard Boyle, *Globe and Mail*, Tuesday, 6 October, 2009

Attn: Professor
University of Ivory Towers
Welfare Isle
Canada

CC: Dr Willard S. Boyle
1326 Lower Water Street
Halifax, Nova Scotia
Canada

Dear Professor,

I'm writing to inform you that you have made a great mistake.

Your mistake occurred to me while reading this article in the *Globe and Mail,* yesterday.

I emphasize the greatness of your mistake because, despite the fact that this error is neither yours nor this university's alone, that, like many other problems, it may prove especially difficult to solve here in Canada.[£]

$ Perhaps the most haunting lines in Canada's history were written in 1858: 'It will be observed that the basis of Confederation now proposed differs from that of the United States in several important particulars. It does not profess to be derived from the people but would be the constitution provided by the imperial parliament…' These words are from a letter signed by three Fathers of Confederation (*1*, p 3).

£ Twenty years ago, when I was teaching a university course on the American and Canadian constitutions, I covered the Canadian material while a colleague, Walter Berns, presented the American side. We attended classes together, each listening to and commenting on the other's account of his country's constitutional experience. One day after I had been going on for some time about Canada's constitutional debate, Walter turned to me and said, 'Peter, you Canadians have not yet constituted yourselves a people.' I have been brooding about Bern's remark ever since.

As the years rolled by and Canada's constitutional debate went on… with rising levels of intensity, I had to concede that Berns was right (*1*, p ix).

But setting these peculiar Canadian struggles aside, I've completed the final draft of my thesis in which I have addressed several of your points and integrated your advice.

There were two methodological points, however, which I addressed in short-hand, with a reference to *On the Problem of Breathing, Eating, & Drinking Poison: An introduction to problem solving, nobility of purpose under adverse circumstances, and the search for truth with Sir Karl Popper on Prince Edward Island* (*2*). Could you please review this and see if we are in agreement on all of the points here? Once you've had a chance to read, please let me know and I'll send along the final draft for your review.

Sincerely,

(The Student)

> -------- *Original Message* --------
> *On 10 Oct 2009 20:41:28 -0300, The Professor wrote:*
> I have gone through this paper. Looking forward to receiving the final draft in a "standard thesis format" as we discussed in our last meeting.

-------- *Original Message* --------
On 11 Oct 2009 00:20:29 -0300, The Student wrote:
Thanks for reading that preliminary paper (*2*); I appreciate that you took the time to do so; however, it seems perhaps it did not have its intended effect, as the main point I hoped to clarify was, since "scientific method"[$] does

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$ As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(*i*) There is no method of discovering a scientific theory.
(*ii*) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.
(*iii*) There is no method of ascertaining whether a hypothesis is 'probable', or probably true (*3*, pp 5-6).

not exist, then it follows logically that there can be no "standard thesis format"—that the proper thesis format is whatever format is necessary to communicate the thesis at hand, and thus whatever format the thesis adviser and the student are able to agree upon.[$]

Is this conjecture true?

Yes it is.

Is it radical and revolutionary?

Of course it is; and that is *exactly* the purpose of a University Education![£]

It seems that you missed my emphasis upon the fact that the 'literature review' in John Forbes Nash, Jr.'s revolutionary PhD thesis was one short paragraph (*2*, p 25), and that his Bibliography consisted of just two references, one of which was to his own work (*2*, p 26), and that, as Harold H. Kuhn once duly noted, "the entire thesis is 27 typescript, very generously double-spaced. Frankly, I have always considered the most important sections to be the first 6 pages…and the last pages (from twenty-one to twenty-six) on motivation, interpretation, and applications. For many years, I have accused John of padding the thesis in the middle" (*6*, p 5).

And as Kuhn noted, maybe twenty-seven "generously double-spaced" were unnecessary, perhaps the six pages Kuhn had noted would have sufficed? Afterall, the second reference (*7*) in Nash's Bibliography was less than two pages long and it stands today as one of the most influential communiques on Earth (*8*).

And, to this very point, high-calibre theses in well-under six pages are not unheard of: Consider, for example, this excerpt from yesterday's telephone interview with George E. Smith, who was awarded the 2009 Nobel Prize in Physics with Willard S. Boyle (and Charles K. Kao)…

$ There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws. . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these… laws. They can only be reached by intuition, based upon something like an intellectual love ('*Einfühlung*') of the objects of experience' (*4*, p. 37).

£ Within the unique university context, the most crucial of all human rights are the rights of freedom of speech, academic freedom, and freedom of research. And we affirm that these rights are meaningless unless they entail the right to raise deeply disturbing questions and provocative challenges to the cherished beliefs of society at large and of the university itself. It is this human right to radical, critical teaching and research with which the University has a duty above all to be concerned; for there is no one else, no other institution and no other office, in our modern liberal democracy, which is the custodian of this most precious and vulnerable right of the liberated human spirit (*5*).

[Adam Smith]: The first thing is that you, I gather, have a record for having submitted the shortest thesis on record at the University of Chicago - just three pages.

[George Smith]: Something like that, yes.

[Adam Smith]: So, you were obviously a star student (*9*).

Note the interviewers suggestion that a three page-thesis infers that Smith was *obviously a star student,* not an incompetent student merely capable of writing a fraction of the required, 'standard thesis' page-count.

Yes, perhaps we may attribute much of Smith's and Boyle's stylistic choices to fierce independence – and it may prove illuminating to explore potential sources at length. Although this short discourse does not offer the opportunity for in-depth analysis, I will merely speculate that much of Boyle's independence was *not* rooted in dogmatic academia because he was home-schooled by his mother.

And of course we may wish to consider the fierce independence routinely demonstrated by Nash as well,[$] and perhaps in doing so we should also consider the extraordinarily hospitable environment at Princeton during the 1940s and 1950s, an environment shaped by great teachers from Soloman Lefschetz[£] to Albert Einstein[†] to Harold H. Kuhn to Nash's Canadian-American thesis adviser, A.W. Tucker. And, in fact, as you sit in starry-eyed wonder, staring at my 600-page letter-of-introduction to my 1-page thesis (*12*), I encourage your to keep Tucker's answer to the following question emblazoned upon your mind…

$ No one was more obsessed with originality, more disdainful of authority, or more jealous of his independence. As a young man he was surrounded by the high priests of twentieth-century science - Albert Einstein, John von Neumann, and Norbert wiener – but he joined no school, became no one's disciple, go along largely without guides or followers. In almost everything he did – from game theory to geometry – he thumbed his nose at the received wisdom, current fashions, established methods. He almost always worked alone, in his head, usually walking, often whistling Bach. Nash acquired his knowledge of mathematics not mainly from studying what other mathematicians had discovered, but by rediscovering their truths for himself.… His indifference to others' skepticism, doubt, and ridicule was awesome (*10,* p 12).

£ Lefschetz's, hence Princeton's philosophy of graduate… education had its roots in the great German and French research universities. The main idea was to plunge students, as quickly as possible, into their own research, and to produce an acceptable dissertation quickly. The fact that Princeton's small faculty was, to a man, actively engaged in research itself, was by and large on speaking terms, and was available to supervise students' research, made this a practical approach. Lefschetz wasn't aiming for perfectly polished diamonds and indeed regarded too much polish… in a youth as antithetical to later creativity. The goal was not erudition, much as erudition might be admired, but turning out men who could make original and important discoveries (*10*, p 60).

† Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels.… And, as recent research into Einstein's personal papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity.… Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern.… Other scientists had come close to his insight, but they were too confined by the dogmas of the day. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics since Newton. 'Imagination is more important than knowledge,' Einstein later said. Indeed, if we are ever going to… come up with a unified theory… we should carve that proclamation above all of our blackboards (*11*, p 4).

"*What about your philosophy of teaching on the graduate level? What do you see as the purpose of a Ph. D?*

[Tucker]: I felt very strongly that if someone did a publishable piece of research, the *publication* was the acknowledgement….

As a thesis adviser, I felt that my principal role was one of encouragement. Almost all my PhD students seemed quite self-reliant. Very often I really did nothing for them…; I simply was the straight-man against whom they could bounce their ideas (*13*, p 218).

Thus, you (and other faculty members, including my external and internal reviewers) may wish to set my entirely optional 600-page letter of introduction aside for a rainy day and merely concentrate on my 1-page thesis, carefully noting the *publication* which represents the first of my four references.

In short, I have lectured (*e.g., 14*) and written exhaustively on method elsewhere (*e.g.*, *2* ; *15*), but I am well-prepared to go to great lengths to defend my methods, stylistic choices, and, more generally, my intellectual independence, but all this seems quite unnecessary. Don't worry about the format – again, neither 'scientific method' (*3-5* ; *11* ; *16-18*) nor a 'standard thesis format' exists; my sole requirement is to make a contribution to knowledge. As you must surely know, every year countless University students all over the world triumphantly defend double-spaced, standard length thesis formats without making the slightest contribution to knowledge.

So, at this juncture, I ask only that you review my thesis with this single question in mind: "Have I made a considerable contribution to knowledge?"

Afterwards, if you find that I have forwarded an intelligible, well-supported argument in the spirit of the advancement of science, we can address any trivial formatting concerns you may have.

Again, I am willing and quite able to table a strong defense for my stylistic and methodological choices, but this would mark a wholly unnecessary discourse and conflict with my obligation to communicate the truths that I have found as simply as possible - *nothing more, nothing less.*[$]

And please do spend some time thinking about the strong words of advice Willard S. Boyle offered yesterday in his interview with the *Globe and Mail*. How does his message relate to the problem at hand?

Scholars may be compared to artists, who we expect to express their own original ideas and convictions. We do not simply expect them to produce what the market wants. Production for the market was the rule

$ The true responsibility of a scientist… is to the integrity and vigor of his science. And because most scientists, like all men of learning, tend in part also to be teachers, they have a responsibility for the communication of the truths they have found (*17*, p 91).

> in the Middle Ages, painters and musicians were simple artisans who had to do what their customers wanted. But the Renaissance brought a complete reorientation: artists were given the right to express themselves with as few restrictions as possible. The result was an explosion in creativity, Leonardo da Vinci and Michelangelo Buonarotti being the best-known examples. If scholars are to be original in a similar way to artists today, they have to be given as much independence as possible. This principle has been accorded to universities a long time ago, and is rightly guarded by them. It has also brought about an explosion of innovation never seen before (*18*, pp 13-14).

And, I might even go so far as to suggest that it is not ultimately up to the "University" or "Professors" to guide or show "Students" the way, but rather, the reverse.[$]

Thank you for your time and consideration of this weighty matter, Professor. The implications which follow from it travel through the very heart of *The Purpose of a University Education* (*5* ; *13*) and extend well beyond, into some of the most central problems, and tenable solutions relating to the human struggle for life on earth; as a great teacher, leader, warrior, and gentleman who lived in an era where neither man nor nation could escape reality in ivory towers reminds us, "undisciplined free men are superior to veteran slaves."[£]

Yours truly,

(The Student)
Welfare Isle, 7 October, 2009

$ The modern hero, the modern individual who dares to heed the call and seek the mansion of that presence with whom it his our whole destiny to be atoned, cannot, indeed must not, wait for his community to cast of its slough of pride, fear, rationalized avarice, and sanctioned misunderstanding. 'Live,' Nietzsche says, 'as though the day were here.' It is not society that is to guide and save the creative hero, but precisely the reverse (*19*, p 91).

£ John Stark was a product of the frontier he grew up in. Survival was the ultimate achievement. Shaped and molded by the wilderness, he developed and became the embodiment of the virtues that defined most frontiersmen, *i.e.,* modesty, self-discipline, independence, frugality, and resourcefulness coupled with a hefty dose of common sense. These virtues remained the cornerstone of his illustrious career. He was one of our great patriots, rising to the challenges of the times and risking everything to turn the dream of independence and freedom from tyranny into the reality that became our United States of America.....

At the height of the national despair, Brigadier General John Stark, who had earned praise from all who participated in the Battle of Bunker Hill, arrived at Bennington with a New Hampshire militia contingent. Independent, cantankerous, and strong willed, Stark had honed his military and survival skills in the vast wilderness known as the New Hampshire Grants as captain in the fabled Rogers' Rangers. He now reviewed the military situation, and accurately assessed where he could do the most good, disobeying an order from the Continental army to place his command under their control. He steadfastly ignored the demand, leading his formation of irregular fighters against some of the best troops in the world—the British regulars and the Hessian mercenaries. 'Undisciplined free men are superior to veteran slaves,' said General Stark (*20,* p xii-xiii).

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On the Origin of Mass Extinctions: A Thesis

I do hereby recommend to the Faculty of the University of Prince Edward Island, acceptance of *On the Origin of Mass Extinctions: Darwin's Nontrivial Error* [1], in partial fulfilment of the degree of:

MASTER OF ARTS IN ISLAND STUDIES
THE UNIVERSITY OF PRINCE EDWARD ISLAND

_____ _____

[Signature] [Date]

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£ After graduating from the University of Glasgow, Brian Gardiner joined the [British Antarctic Survey] (BAS) in 1967. Posted to the Antarctic, he spent two years working in the atmospheric physics and meteorological programmes before returning to the UK in 1970. Arranging special ozone observing programmes to coincide with satellite activity, he and his team provided critical 'ground truth' observations for the satellites. In 1975 he was appointed Head of the Radiation and Ozone Section at BAS. Since 1989 Brian has been Principal Scientific Officer at BAS and continues his research into the ozone hole and related issues. He has recently been heavily involved in EU ozone measurement projects [4].

$ This year scientists at British Antarctic Survey (BAS) commemorate their discovery of the Antarctic 'ozone hole' 20 years ago and commend the historic international agreement (the Montreal Protocol 1987) that will lead to its eventual recovery.

Jonathan Shanklin, one of the researchers who made the discovery says,

> The… hole is larger and deeper than the holes that formed when the discovery was made but the situation would be much worse if the Montreal Protocol had not come into force. This agreement shows us that global action by governments to stop the release of ozone depleting chemicals really can help society to successfully mitigate a global environmental problem. We are still experiencing large losses of Antarctic ozone each spring because CFCs and other chemicals live for a long time in our atmosphere. However, the ban ensures that we will see an improvement in the future. We now need to take similar actions to control greenhouse gasses, otherwise we will bequeath future generations a significantly different climate from that of today.…

Members of the British Antarctic Survey's Meteorological and Ozone Monitoring Unit… carry out ozone observations at Halley and Rothera Research Stations. Ozone has been monitored at BAS research stations for nearly 50 years – the longest record of ozone measurements in the Antarctic. There was no ozone hole until the late 1970s. Joe Farman, Brian Gardiner and Jonathan Shanklin first announced the discovery of the annual depletion of ozone above the Antarctic in… *Nature* in May 1985. Later, NASA scientists re-analysed their satellite data and found that the whole of the Antarctic was affected.…

[BAS] is a world leader in research into global issues in an Antarctic context. It is the UK's national operator and is a component of the Natural Environment Research Council. It has an annual budget of around £40 million, runs eight research programmes and operates five research stations, two Royal Research Ships and five aircraft in and around Antarctica. More information about the work of the Survey can be found at: www.antarctica.ac.uk [5].

Truly Non-Cooperative Games: A Unified Theory

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05. April 2010

Fig. 1. – *A Conversation with Willard Boyle* (1)[$]

A DISSERTATION
Presented to the Faculty of The University of Malta,
in Candidacy for the Degree of Doctor of Philosophy.[£]

Matt Funk, FLS

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For my son, William.

$ [A] Canadian… won a Nobel Prize Tuesday. But physicist Willard Boyle had to move to the U.S. to do his cutting-edge work.

Dr Boyle… warned that managers need to give scientists leeway to come up with the kinds of transformative inventions that are too often stifled by paperwork and red tape.

What scientists face today is 'almost disgraceful. Do you think… George Smith and I ever wrote a business plan [or "ethics review board" requests, or wasted time slaving over academic journal formalisms]?… You don't have time to do that kind of baloney.'

Early in his career, Dr Boyle got a job at Bell Laboratories, a private research lab in New Jersey where he was given free rein to pursue his interests. He and Dr Smith, who is American, came up with their invention while sketching possibilities on a blackboard in October, 1969.

'There was something about that institution,' Dr Boyle told *The Chronicle-Herald* in Halifax…

'I guess it was the management and the style and the general environment of the place….' [read: *freedom*].

Dr Boyle… said policy-makers should look at the practices of think tanks that produce Nobel Prize-winners…, instead of 'pouring money randomly into [things], expecting the same results.'

'Usually… management people or… politicians haven't got the foggiest idea of what science is all about.' What is needed is 'an appreciation for the free will, free spirit of scientists. Give them a chance to do the things they want to do' (2 ; *cf* 3 ; §3).

£ The writer's object in putting forward his views in the present imperfect manner is to submit them to the test of other minds, and to be made aware of all the facts supposed to be inconsistent with them. As his hypothesis is one which claims acceptance solely as explaining and connecting facts which exist in nature, he expects facts alone to be brought to disprove it; not *à-priori* arguments against its probability (4).

ABSTRACT

This brief communique offers an introduction and broad overview of *Truly Non-cooperative Games,* axioms and complimentary negotiation models developed to analyse the human *Struggle for Life* (*cf* 5-10), which yield *The Principle of Relative Insularity*, a unified theory of value which unites economics, astrophysics, and biology. In brief, we discover that value is a derivative function of relative insularity.[$]

§1. INTRODUCTION[£]

It appears Aristotle may have been amongst the first to search for a theory of value (13), and this quest has kept problem-solvers awake at night ever since:

> In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued (14).

And thus it remains impossible to analyse a myriad of related mission-critical issues, including the problem of sustainable economic development, global warming, warfighting, asteroids, supervolcanoes, reserve currencies, monetary policy, and value at risk (VaR). Indeed, "insufficient consideration of [these] circumstances lie at the root of [our present] difficulties" (15).

§2. HYPOTHESIS

Nash developed fruitful equilibrium points (16 ; *cf* 17) and non-cooperative games (18), emphasizing the existence of

> situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness [making] the situation truly non-cooperative (18).

Our theory (19-23), in contradistinction, highlights the truly non-cooperative nature of *every situation in the universe*. Thus our realistic, asymmetric games (24) share attributes with games against nature (25 ; *cf* 26),

> but as the exposition of the entire group of considerations would be rather difficult to follow, only a few quite elementary reflexions will be given…, from which the reader will readily be able to inform himself [*i.e.*, 19-23] as to the suppositions of the theory and its line of thought (27).

Axioms (19-20) offer an indirect proof, *ruductio ad absurdum*, (20) for our unified theory of value, and, in short, we find that *The Struggle for Life* (5-10) is, in essence, an endless drive toward insularity; and thus, that economic and evolutionary *Value* (V) is a *derivative function* (f') of *relative insularity* (I_R).

$\Rightarrow V = f'(I_R)$.

We refer to this as *The Principle of Relative Insularity,* a postulate which informs evolutionarily stable strategy (*cf* 28) for all politico-economic players in the game of life of earth.

In brief, rational game-play (20) reveals that long-term human survival requires splitting resources and efforts between two inherently conflicting objectives (ecological preservation and economic development), and thus the great difficulty lies within the fact that we can not nor will ever be sufficiently informed to understand how much or how many inherently 'ecologically degrading' economic activities are required in our never-ending quest for human survival (*cf* 19-23), but, perhaps to our surprise, our theory does indeed inform evolutionarily stable strategy. Alas, however, "nothing seems less wanted than a simple solution to an age-old… problem" (29); thus we shall emphasize and contextualize: Ulam once challenged Samuelson to name a social theory which was nontrivial and true; Samuelson countered with Ricardo's theory of comparative advantage:

> That it is logically true need not be argued before a mathematician; that it is not trivial is attested by the thousands of … men who have never been able to grasp the doctrine for themselves or to believe it after it was explained to them (30).

$ Value is the essence of things in economics. Its laws are to political economy what the law of gravity is to mechanics. Every great system of political economy up till now has formulated its own peculiar view on value as the ultimate foundation in theory of its applications to practical life, and no new effort at reform can have laid an adequate foundation for these applications if it cannot support them on a new and more perfect theory of value (11).

£ When we propose a theory… we also propose, or try to understand, its logical implications; that is, all those statements which follow from it. But this… is a hopeless task: there is an infinity of unforeseeable nontrivial statements belonging to the informative content of any theory, and an exactly corresponding infinity of statements belonging to its logical content. We can therefore never know or understand all the implications of any theory, or its full significance.

…Understanding a theory is always an infinite task, and… theories can in principle be understood better and better. …If we wish to understand a theory better, what we have to do first is to discover its logical relation to those existing problems and existing theories which constitute what we may call the 'problem situation'.

Admittedly, we also try to look ahead: we try to discover new problems raised by our theory. But the task is infinite, and can never be completed (12).

Indeed, this may be true, as innumerable intelligent islanders around the world appear unable to grasp this doctrine (21), but a stronger rebuttal to Ulam's challenge presently requires our immediate and undivided attention: *On the Origin of Mass Extinctions: Darwin's nontrivial error* (22).

Furthermore, the denaturalization of economics (31), logic of war (32), derivative nature economic power (33), Hardin's error (34), and Popper's solution to *The Problem of Induction* (35) require careful consideration as well. Indeed, investing in these arguments (31-35) may help clearly explain why in-communicative (36) and thus truly uncooperative "prisoners" (*cf* 37) – *the unknown and unknowable future* (20) – beg us to reconsider many fashionable theories, plead for international cooperation (*cf* 22), and even implore us to consider a revolutionary approach to science.[$]

§3. A NOTE ON METHOD

> Gutenberg's invention was a piece of technology that made printing… simple and inexpensive. His first [book] was a bible. Venture capitalists, if there were such a thing in fifteenth-century Germany, might have looked at Gutenberg's… invention and seen a way to make cheaper bibles. 'Let's pour some money into Gutenberg's printing press and in a few years we can take over the whole Bible business,' they might… have concluded. If they had done so, however, they would have missed the entire point… The printing press was not about cheaper bibles, it was a technological revolution that made it possible for anyone with an idea to publish anything. [It] changed our world. It led to an explosion of knowledge, of learning, of ideas. It brought down Medieval Europe…, crushed the Power of Kings, and gave rise to the middle class, manufacturing, and trade. It set off the Enlightenment and created… the world we inhabit today. We are, in effect, the direct descendents of the Gutenberg Revolution. The US Constitution is a written, printed document. It enumerates our rights and how our country is supposed to work. Yet the very first Amendment…, the very core of the Bill of Rights does not say 'You have the right to vote' or 'You have the right to be free.' Instead, it says, 'Congress Shall Make No Law Abridging a Free Press', …because… the primary bulwark of a free society is a free press (39).

The internet represents a technological advance of equal wonder. It has spawned revolutions of equal significance. Indeed, this world-wide-web has linked and liberated true problem-solvers, thereby helping to deliver (*i.e.*, 19-23 ; 33-34 ; APPENDIX) this revolutionary theory of value to you.[£]

Fellow sailor George Smith was recently commended for his 3-page PhD thesis (42); this compliment intrigued me.

But profound truths (2) uttered by another noble sailor intrigued me even more; in fact, they inspired me to chart a course for Halifax, because scientific method (43-45 ; *cf* 2, 9, 12, 20-23, 29, 35, 41) is another affair I actively explore. And, although we did indeed discuss this profound truth at length (1), I'll merely pass along a single bit of wisdom:

> It's always a bad sign when people come into meetings with stacks under their arms and start handing you piles to read. I hired Smith because he was able to communicate something very complex and very important in just three pages (1).

And with these sage words in mind, we'll bring this 3-page dissertation to a close with a parting reflexion on economics: Since economics was created to promote national interests (46), it should come of no surprise that real problems (*e.g.*, 2-29 ; 31-47) remain largely outside this non-existent realm, and thus "economics" (and the "social sciences") remain unable to analyze and inform strategy regarding mission-critical global threats. And that is problematic, to say the least, because planetary and cosmic inputs (19-20 ; 22) are the most nontrivial "economic" inputs in the universe, and, to this salient point, the "subtle differences between… species that [die] and those that [survive is] crucial (47).[†]

And that's exactly why we're not really playing games here, afterall.[‡]

$ One can argue that all environments are hostile, and that death and extinction are probable events, while survival is improbable…. In my opinion, this problem may well be used as the framework on which to build the teaching of [science] (38).

£ Internet publishing reduces the stifling impact of the refereeing process on the papers accepted and submitted to journals. …Scholars are less bound to devote a large part of their time and effort on formalisms. They have more leeway to concentrate on matters of content…. The dominance of orthodoxy is reduced (40 ; *cf* 41).

† The earth heaves and no one but is aware of the rumblings. There is not just a matter of… '[economic] troubles'; but of life and death, of starvation and existence (48).

‡ Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not… worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability to calmly ignore the sneers of, and the isolation imposed by academic contemporaries, was his conviction that the survival of mankind depends on the development and dissemination of… economics….

Economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race (45).

"This sketch is most imperfect; but in so short a space cannot make it better. Your imagination must fill up very wide blanks" (49). But for those interested in exploring this hypothesis in exhaustive detail, a 1,354 page treatise is readily and freely available to all, thanks to our friends at The Lifeboat Foundation: *The Principles of Economics & Evolution: A Survival Guide for the Inhabitants of Small Islands, including the Inhabitants of the Small Island of Earth* (50).

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On the Origin of Mass Extinctions: Darwin's Nontrivial Error

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On the Origin of Mass Extinctions: Darwin's Nontrivial Error

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ABSTRACT

Darwin's *Origin* launched evolution into theoretical orbit and it continues to influence its course. This *magnum opus* detailed a tenable solution to the most fundamental problem of human existence, and although this Promethean vision contains a few minor errors, there is one nontrivial error which misguides several crucial developments – not only in the evolving structure of evolutionary theory, but across the entire spectrum of science, including politico-economics. This problem has led theorists to mistakenly favour earth-based inputs over cosmic inputs, to over-emphasize biological evolution, and to under-emphasize stellar evolution. These perceptive, methodological, and logical errors have, in turn, emphasized the significance of the *individual* "struggle against competitors" over the *cooperative* "struggle against inclement environments", and thus fashionable theories relating to *Global Warming, The Problem of Sustainable Economic Development,* and *The Tragedy of the Commons* have been erected upon false and sandy foundations and suggest evolutionarily unstable solutions. And to this point, in light of the discoveries presented here, we conclude that largely redirected global threat mitigation efforts will require unprecedented levels of international cooperation if long-term human survival is to be achieved.

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§1. INTRODUCTION

On the Origin of Species by Means of Natural Selection, or the Preservation of the Favoured Nations in the Struggle for Life (1) was published 150 years ago, on November 24th of 1859, and – with *De Re Militari* (2), *On the Revolutions of Heavenly Spheres* (3), *Mathematical Principles of Natural Philosophy* (4), *A Treatise of Human Nature* (5), *An Inquiry into the Nature and Causes of the Wealth of Nations* (6), *Common Sense* (7), *An Essay on the Principle of Population* (8), *Two Lectures on the Checks to Population* (9), *Personal Narrative* (10), *Cosmos* (11), *On the Law which has Regulated The Introduction of New Species* (12), *The Gettysburg Address* (*cf* 13), *A Dynamical Theory of the Electromagnetic Field* (14), *Sailing Alone Around the World* (15),£ ten *Annalen der Physik* briefs (16-25), *The Winning of the West* (26), *The Economic Consequences of the Peace* (27), *Theory of Games and Economic Behaviour* (28), *The Second World War* (29) *Non-Cooperative Games* (30), *The Logic of Scientific Discovery* (31), *Molecular Structure of Nucleic Acids* (32), *Island Biology* (33), *The Pretense of Knowledge* (34), *The Constitution of Liberty* (35), *The Mustique Co. Development Plan* of 1968 (*cf* 36), a 1985 letter to *Nature* (37), a 1987 interview in *Woman's Own* (38), *The Process and Progress of Economics* (39), *Evolution and the Theory of Games* (40), *The Structure of Evolutionary Theory* (41), *What Makes Biology Unique* (42), *War and Peace* (43), a secret message (44), and *Failure is Not an Option* (45)$ – glimmers amongst our most brilliant illuminations, most valuable problem-solving tools, and most informative sources for long-term human survival strategies.

As a Fellow of the biological society (46 ; *cf* 36) where Darwin and Wallace devoted much of their efforts and announced their revolutionary discovery (47 ; *cf* 48), it may come of little surprise that I hold the *Origin* in high regard (*cf* 36). Furthermore, I concur that the *Origin*

> exceeds all other scientific 'classics' of past centuries in immediate and continued relevance to the basic theoretical formulation and debates of current practitioners. Careful exegesis of Darwin's logic and intentions, through textual analysis of the *Origin*, therefore assumes unusual importance for the contemporary practice of science (41, p 58).

Which is exactly why it is so critical that I must presently bring the grave nature of the *Origin's* most significant error to light. This task would not be so difficult if it were not for the fact that so much that has "been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright"(49, vol II, p 9), but I will try.

£ Joshua Slocum was the first man to sail around the world in a small boat with none but himself as captain, mate and crew. Other men may repeat the feat. No other man can be the first.... He wrote of his ship and his voyage, and it never occurred to him that in doing so he was forging a bond between the English whose blood was in his veins and the Americans under whose flag he was proud to circumnavigate the world....

Captain Slocum was born in Nova Scotia in 1844.... He was eight years old when his family moved to Briar's Island and he left school and was put to work on the farm. At the age of twelve he was caught making a ship model in the cellar where he should have been grading potatoes, was given a beating, saw his model smashed and ran away from home. For the next few years he earned a living for himself, as cook, ship's boy and what not, among the fishermen on the Bay of Fundy. At the age of sixteen he and a friend sailed before the mast in a full-rigged ship from St. John's [*sic*], New Brunswick, to Dublin. We next hear of him as an ordinary seaman in a British ship, sailing from England to China. He went down with fever and was left in a hospital at Batavia. There he made a very good friend in Captain Airy of the *S.S. Soushay.* He left Batavia in the *Soushay*, and in that vessel voyaged at many far-eastern ports. He can have lost no opportunity of educating himself, for at eighteen he was promoted to second mate. He twice rounded the Horn in British ships (15, pp 21-22).

$ We had not anticipated what happened back then, on Earth.... In fact, it would be hours before we really understood what had happened.... [But] what we could not accomplish through technology, or procedures and operating manuals, we might be able to manage by drawing on a priceless fund of experience, accumulated over almost a decade of sending men into places far beyond the envelope of Earth's protective, nurturing atmosphere.... These three astronauts were beyond our physical reach. But not beyond the reach of human imagination, inventiveness, and a creed that we all lived by: 'Failure is not an option' (45, p 12).

And it seems this effort must include rough sketches of three intellectual obstacles which effectively block the doorway to these illusive truths. Presently, we'll merely consider the most menacing gargoyle: *teleology*.

Several methodological issues make it rather difficult to ascertain how little or much to say about this big problem, so I will merely offer a brief definition ["any processes that 'persist toward an end point under varying conditions' or in which 'the end state of the process is determined by its properties at the beginning'" (42, p 49)], refer the curious to a more thorough contextualization (*cf* 42, pp 39- 41), and restrict focus to aspects most relevant to the problem at hand:

> Natural selection does not guarantee the power of adaptation in all circumstances, and if environments change rapidly and profoundly enough, these alterations may exceed the power of adaptation by natural selection, with extinction of most forms as the expected result, even in the most strictly Darwinian of circumstances…
>
> Darwin's hostility to catastrophic mass extinction does not arise primarily from threats posed to the mechanism of natural selection itself, but more from the challenges raised by the prospect of sudden global change to the key… assumption that observable processes at work in modern populations can, given the amplitude of geological time, render the full panoply of macroevolutionary results by prolonged accretion and accumulation.
>
> The problem of mass extinction became acute for Darwin because geological paroxysm threatened something quite particular, vitally important, and therefore of much greater immediate pith and moment than his general methodological preference for locating all causality in the palpable observation of microevolution… Global catastrophe could undermine the ecological argument that Darwin had so carefully devised… to validate something more particular but no less important: *his culture's central belief in progress…*
>
> To explain the general pattern of life's history, Darwin sought to extrapolate the results of competition ordained by the immediacies of natural selection in ecological moments. In particular…, to argue that most competition, in a world chock full of species, unfolds in the biotic mode of direct battle for limited resources, *mano a mano* so to speak, and not in the abiotic mode of struggle to survive in difficult physical conditions. If struggle by… battle (which favors mental and biomechanical improvement) trumps struggle against inclement environment (which often favors cooperation rather than battle…), then a broad vector of progress should pervade the history of life (41, pp 1298-1299).

But of course the fossil record has clearly demonstrated that this is not the case; and thus Darwin's need to cater to the teleological worldview of the Victorian era has generated grave and, alas, very long-lasting consequences.

This seemingly minor flaw in this magnificent foundational work has spawned grave and unintended consequences, namely, the gross underestimation of the global, national, and familial threats presented by cosmic (and a few planetary) inputs. Perhaps most significantly, it has almost completely obscured our dire need for cooperation (planetary threat mitigation efforts) at the global level.

> These crucial points were recently synthesized,unified, and contextualize in a brief communiqué (50) and then sailed the Gulf Stream in a rather long message-in-a-bottle (36),
>
> but as the exposition of the entire group of considerations would be rather difficult to follow, only a few quite elementary reflexions will be given in the following pages, from which the reader will readily be able to inform himself as to the suppositions of the theory and its line of thought (24, p 898).

§2. ON DARWIN'S NONTRIVIAL ERROR

The 150th anniversary of the *Origin* and the 200th celebration of Darwin's birth have generated both praise and critical reassessments of Darwin's works and methodology. To date, criticisms appear to have largely recounted trivial errors (*e.g.*, 51).

However, in order "to enhance the implausibility of truly catastrophic mass dying, Darwin holds that 'the complete extinction of the species of a group is generally a slower process than their production" (1, p 318, as cited in 41, p 1300). Darwin confessed, "Scarcely any… discovery is more striking than the fact, that the forms of life change almost simultaneously throughout the world" (1, p 322). And in pages 317-318 he had falsely concluded that

> this impression must be an artefact produced by the markedly incomplete preservation of more gradual and continuous change in a woefully imperfect geological record… 'The old notion of all the inhabitants of the earth having been swept away at successive periods by catastrophes is very generally given up, even by those geologists… whose general views would naturally lead them to this conclusion. On the contrary, we have every reason to believe, from the study of the tertiary formations, that species and groups of species gradually disappear, one after the other, first from one spot, then from another, and finally from the world.' (1, p 302, as cited in 41, p 1301).

This nontrivial error leaves us increasingly vulnerable to mass extinction by continuing to misguide science and pop-culture alike:

> In particular, these… assumptions about the extended duration of apparent mass extinctions led geologists and palaeontologists to favour earth-based rather than cosmic physical inputs…, and to focus upon telluric influences (like changing climates and sea levels) that could most easily be rendered as gradualistic in style. So strongly entrenched did this prejudice remain, even spilling over into popular culture as well, that a few years after Alvarez *et al.* published their plausible, and by then increasingly well affirmed, scenario of extraterrestrial impact as a catastrophic trigger for the Cretaceous-Tertiary event, the *New York Times* even ridiculed the idea in their editorial pages, proclaiming… that 'terrestrial events, like volcanic activity or changes in climate or sea level, are the most immediate possible cause of mass extinctions. Astronomers should leave to astrologers the task of seeking the cause of earthly events in the stars' (41, p 1303).

If the problem at hand is not clear by now, please consider an extraordinary new book: *The Cosmic Connection: How Astronomical Events Impact Life on Earth* (52):

> Our ascendancy as a species is usually credited to Darwinian processes, such as passing along traits from one generation to the next, genetic mutations that improve an organism's chances of survival, successful adaptations of organisms to different regions or environments, and the flourishing of one species of another. Nevertheless, evolution is not enough to explain the ascension of the human race on this amazing planet. In its most sweeping terms, life also results from conditions not of our world but of our universe (52, p 10).

Indeed, social and biological sciences place undue emphasis upon very recent events – the social sciences find a great deal of significant data in the past few centuries, and the biological sciences find a great deal of significant data over evolutionary time, but, in reality, the Earth has experienced almost *no* significant cosmic events (and thus we find almost no truly useful data) in the course of Hominid evolution.

For example the "asteroid the size of Mount Everest" (52, p 12) that splashed down along the coast of the Yucatán peninsula, resulting in the complete extinction of 70% of terrestrial life (including 100% of the dinosaurs) and 96% of all marine life, does, to be certain, represent one of the most significant events in natural history and therefore one of the most valuable pieces data on

Earth – but neither economics, contemporary theorists, politicians, nations, nor popular culture are much concerned with this 'outlier'. And, once again, this is problematic, to say the least because

> knowing how astronomical influences have shaped our world and enabled the human race to evolve and flourish gives us a unique perspective on the nature and direction of life on Earth and the possibility of life on other planets (52, p 13).

"Mass extinctions are more frequent, more rapid, more intense, and more different in their effects than… Darwinian biology could permit" (41, p 1312-1313), and this has had profound effects upon all sciences and politico-economic development strategies. To paraphrase J.B.S. Haldane (53), one does not have to be a profound realist to realise that consistently underestimating the probability of mass extinction finds favour with those clinging to teleological comforts, and creates serious problems for those who endeavour to develop and deploy evolutionarily stable strategies.

And to make matters worse, those able-minded theorists who possess the courage and take the time to patiently offer these unfashionable perspectives are invariably ignored or ridiculed. One such individual, Milutin Milankovitch, quietly pointed out that the Earth's axis is not fixed, but rather oscillates over a 41,000 year cycle, an oscillation which appears to have been (and*continues* to be) the greatest long-term influence of climate change (52). And, like many misunderstood visionaries, "Milankovitch was certainly on to something when practically everyone else thought he was not" (52, p 38).

How was it that he was able to see something so clearly which so many others could not? By simply adopting the universal worldview necessary to grasp the discovery illuminated here:

> Milankovitch did not merely see the Earth and its sediments; he saw the Earth in space and in motion around the Sun over the course of millions of years. It took uncanny vision to step off the Earth and look back from a distance of 100 million miles and watch cogs turn, then forge a… connection… It was the same kind of vision possessed by people like Agassiz, Adhemar, Croll, and Wegener, some of whom paid a high price to see worlds, possibilities, and connections that others could, or would, not (52, p 28).

Although it is true that "nothing makes sense in biology except in the light of evolution" (54, p 449), that nothing *on Earth* (or elsewhere in the universe) makes sense except in the light of galactic, stellar, and planetary evolution is a *more* significant truth:

> Look anywhere beyond our little nook of Galaxy and you will see a universe that is not only dispassionate, but dangerous and random. Comets plough into planets. Stars explode without regard to what clinging forms of life may be in the vicinity. Black holes suck up space and time at will (52, p 63).

At least one writer (55) has suggested we will never accomplish interstellar travel; but as an optimistic£ problem-solver focused upon human survival, your author has hope that where there is a will, there is a way.

Furthermore, in essence, this pessimistic prophecy has already been falsified:*we have, essentially, been travelling in such a manner for the past≈13 billion years*: Our planet – along with the rest of our solar system – is speeding through interstellar space at 12 miles per second "in the direction of the constellation Hercules, southwest of the bright star Vega and just north of the billowy clouds of the summer Milky Way" (52, p 162).

£ Yes, despite all this I remain an optimist toward the world. It is one's duty to be an optimist. Only from this point of view can one be active and do what one can. If you are a pessimist, you have given up. We must remain optimists, we have to look at the world from the point of view of how beautiful it is, and to try to do what we can to make it better (56, p 48).

§3. DISCUSSION

What logical implications follow from these profound and illusive truths? What are the implications for the advancement of science? National security? International Cooperation? Human survival?

In general, we may wish to start thinking more clearly about the road ahead, being mindful of obstacles we may wish to try to avoid or prepare to meet.

But this would require – amongst a myriad of inter-connected issues – the complete recognition and wide adoption of Sir Karl Popper's remarkable solution (31) to David Hume's *Problem of Induction* (5). I've written on this topic at length (*e.g.*, 50 ; 36 ; 13) and brilliant thinkers from Hayek (34-35) to Hawking (57) have testified as well, but there's little to indicate we're willing to relinquish our "intense desire for assured knowledge" (58, p 22) and teleological fairytales; it seems our disdain for realism and affection for the *Pretense of Knowledge* (34) remains so strong that we'd rather be *Fooled by Randomness* (59) and commit ourselves to near-certain extinction than face these difficult and disquieting truths (extinction would remain a high probability even if we were thinking clearly, strategizing, and acting accordingly). Clear thinking about this problem would also require the wide recognition of a key deduction by a gifted problem-solver "regularly credited with being one of the two most important logicians of the twentieth century" (60): Economic power is derivative, not primary (61 ; *cf* 13, 2, 6, 26, 29, 44).

But, like the perverse effect of the welfare state (62), this is yet another unfashionable truth which most would prefer not to acknowledge. Indeed, the inter-related problems which stem from Darwin's Nontrivial Error are incredibly far-reaching, yet we must confine ourselves to brief examples. Consider, for example, that growing legions of ideological environmentalists and an entire 'school' of economics (so-called 'ecological economics') have failed to recognize the *existence*, much less the *significance*, of cosmic inputs. In fact, a very heavy game-theoretical wrecking-ball (50) topples so many widely-held and wildly popular theories (*e.g.,* 63-64) that it will likely face fierce resistance,[£] and, as Edward De Bono once conjectured, it is possible that these unfashionable ideas "can only be expressed in book form" (65, p 31); thus, Fortune willing, a very big book with a very simple, straight-forward message – *one long argument* – is on the way (*cf* 36, pp 66-68).

But for now let's consider the manner in which theoretical wrecking-ball (50) falsifies the central thesis of 'ecological economics' (and hip-checks ideological environmentalism to the boards) – a refutation which is quite unnecessary – for it is quite unnecessary to falsify a 'subject' which does not exist (*cf* 36, pp 80 -81), yet some readers may insist.

So, consider the flimsy central thesis, as postulated by Herman E. Daly:

> The facts are plain and *uncontestable*: the biosphere is finite, nongrowing, *closed* (except for the constant input of solar energy), and constrained by the laws of thermodynamics. Any subsystem, such as the economy, must at some point cease growing and adapt itself to a dynamic equilibrium, something like a steady state (66, p 101).

But are the *facts plain* and *uncontestable?*

Is the biosphere *closed?*

Is solar energy a *constant* input? (*cf* 52).

Is solar energy the *sole* 'cosmic input' to consider?

£ I suppose the process of acceptance will pass through the usual four stages:
1. This is worthless nonsense,
2. This is an interesting, but perverse, point of view,
3. This is true, but quite unimportant,
4. I always said so (53, p 464).

I'm afraid school is officially in session for Professor Daly and his fashionable friends because the existence of a wide variety of cosmic and planetary inputs illuminates the false foundation upon which the central thesis of ecological economics is lightly tethered (50). Alas, the Earth has not, nor ever will be in a steady state, as the problem of induction renders this state indeterminable (31 ; 50).

But problems associated with the errors at hand are certainly not limited to this popular branch of economics. In fact, sampling the most influential scientific journals (67) at random testifies to near-universal error. For example, a review of *Science's* 'top articles of last month' reveals that, yet-again, Garret Hardin's 1968 *Tragedy of the Commons* (68) remains at the top, and very little literature review is required to conclude that this paper remains amongst the most influential papers in science. However, setting aside the fact that the citation itself, "Hardin 1968" (68) is incorrect (69), logical implications which follow from the truths presented here falsify this highly influential theory; although this discourse is restricted to elementary reflexions, exhaustive indirect proofs (50 ; 36) and *On the Travesty of the Tragedy of the Commons: Hardin's Nontrivial Error* (69) clarify this conjecture; further reflexions on this refutation yield a bountiful harvest of related revelations, including the falsification of the findings of a 2009 *Sveriges Riksbank Prize* winner. Although detailed considerations remain outside the scope of this discourse, a review of collected works (70-80) reveals systemic errors, faulty perceptions, and false conclusions. And this is, in large part, due to the fact that these faulty perceptions and methodological errors are the norm, not the exception:

> When we look at the world around us we see (if we are attentive enough) what is actually there, even if what is actually there is not the same as what we expected to see there. When we turn our attention from the world around us to the world of possibilities that we can imagine with our minds, however, perception does not work nearly so well. We often fail to see the obvious until it is too late or until somebody else sees it and points it out to us. And very often something that we think is the case is not the case at all (81, p xiii).

Ostrom's potpourri of apocrypha (70-80) were derived through the inductive analysis of data relating to incomplete perceptions of various 'commons' problems around the world[£] and inherently flawed by an inability to imagine the serious possibilities presented by cosmic inputs. But, to be fair, our prizewinner is certainly not alone, it seems the implications which follow from this problem remain largely unknown to all but your author.

Indeed, the fashionable empirical methods in economics invariably leave us with little more than legerdemain (*i.e.,* 63-64 ; 66 ; 68 ; 70-80), and these errors remain wholly uncorrected (*e.g.*, 82):

> We have… depended on analysis not only to solve problems but also for our source of new ideas. Most people in education, science, business and economics still believe that the analysis of data will give us all the new ideas that we need. Unfortunately, this is not so. The mind can see only what it is prepared to see. That is why after a breakthrough in science we look back and find that all the needed evidence was available a long time before but could be seen only through the old idea (65, p 23).

£ Ostrom… has challenged the conventional wisdom that common property is poorly managed and should be completely privatized or regulated by central authorities. Based on numerous studies of user-managed fish stocks, pastures, woods, lakes, and groundwater basins, Ostrom concluded that the outcomes are often better than predicted by standard theories. The perspective of these theories was too static to capture the sophisticated institutions for decisionmaking and rule enforcement that have emerged to handle conflicts of interest in user-managed common pools around the world. By turning to more recent theories that take dynamics into account, Ostrom found that some of the observed institutions could be well understood as equilibrium outcomes of repeated games. However, other rules and types of behavior are difficult to reconcile with this theory, at least under the common assumption that players are selfish materialists who only punish others when it is their own interest. In field studies and laboratory experiments individuals' willingness to punish defectors appears greater than predicted by such a model (82, pp 1-2).

Indeed, almost all of the truths presented here were known to us *prior* to the publication of Darwin's *Origin* in November of 1859 (1), but alas, this is the process and progress of science (39).

Why is the process and progress so slow and misguided? This is, alas, a long and sad story (34), because, once again, things have "been so thoroughly muddled by Plato and Aristotle" (49, p 9). And, as previously noted, we find very, very little useful empirical data on Earth. Refer back to the footnote on the previous page, note that Ostrom's researches are "based on numerous studies". Note how many times the Swedish Royal Academy has referred to her "observations". Or better yet, consider spending a few moments listening to Ostrom infer validity for her findings by rattling-off the numbers of her studies which support her untenable conjectures (83). An excerpt from some recent correspondence may help contextualize this important point:

> -------- *Original Message* --------
> *Subject: Nontrivial indeed*
> *Date:* *Tue, 1 Dec 2009*
> *From:* *Jeff Kanipe*
> *To:* *Matt Funk, FLS*
> Hello Matt,
>
> I must say I'm very impressed by your paper on Darwin's nontrivial error. Will this eventually be published? I certainly hope so, as you raise some fascinating points that I'm sure would spur further discussion.
>
> I especially appreciate your generous direct reference to my book [52] in the text.…
>
> What was interesting for me was to see how you applied my points to yours, although they are ones that I'm embarrassed to say I didn't fully consider at the time! It leaves me feeling I accomplished something greater than what I first set out to do!
>
> For example, Gould's statement on page [3], concerning how competition in a world teeming with species unfolds in one of two ways, either as a 'struggle by battle' or a 'struggle against an inclement environment,' made me reflect back to my chapter on asteroids and asteroid mitigation…; [and]… Gould's remarks, coupled with the two points you make in the following paragraph, clearly indicate that civilization is facing an imminent crossroads at which we either choose the path of global cooperation and the hope for continued existence, or stick with Darwinian processes and risk not surviving as a species.…
>
> Said another way, if we are to survive as a species-as Earthlings-we must now take the high road, whereby we cooperatively struggle against the 'inclement environment' of our planet in space, rather than just localized inclement environments on Earth. Natural selection, *per se*, takes a back seat to global extinction events; in fact, it may not even be in the car (84).

Yes, Kanipe is quite right, Natural selection may not even be on the same roadway. Furthermore – and to this salient point – outside of pure physics, empiricism invariably takes back seat to pure theory. For example, consider one of the most brilliant illuminations, most valuable problem-solving tools, and most informative sources for long-term human survival strategies noted in §1:

> In the last of his 1905 papers, entitled *On the Electrodynamics of Moving Bodies* [19], Einstein presented what became known as the special theory of relativity. The paper reads more like an essay than a scientific communication. Entirely theoretical, it contains no notes or bibliographic citations. Einstein wrote this 9,000-word treatise in just five weeks, yet historians of science consider it every bit as comprehensive and revolutionary as Isaac Newton's *Principia* [4] (85).

Alas, however, not only does the thoroughly embarrassing academic infatuation with history invariably put empiricism in the front of the car – *it puts it in the driver's seat*.[£] And the *Poverty of Historicism* (86), which happens to be inextricably intertwined with that menace known as teleology, is an impoverished and depauperated state which no species can survive for long. It may be interesting to speculate how many journals would pass on publication of *On the Electrodynamics of Moving Bodies* (19) today. Afterall, the Swedish Academy did not have confidence in this essay, thus they awarded Einstein the 1921 prize in physics for a much less significant contribution (18 ; *cf* 85).

Yes, our planet is a precious resource which we must endeavour to protect – but it is also a *depreciating asset* which we must *eagerly* and *voraciously* consume in order to survive, and, in light of cosmology and the problem of induction (50), we must assume a depreciation schedule of ≈50,000 years. In brief, our struggle to protect this asset must be balanced with a recognition that we have rightly been consuming (and must continue to consume) this resource in our resource-intensive quests for threat mitigation technologies (fission, fusion, spacecraft, weapons, telescopes, asteroid tugboats, alternative food sources, deep underground/undersea human habitats, *etc.*) to help extend the shelf-life of the Earth and the life-span of the human species, and, moreover, to ultimately facilitate our search for another world (ultra long-distance dispersal, *cf* 50 ; 87).

This new concept – *ultra-long distance dispersal* (ULDD) – happens to represent another intellectual obstacle which threatens to thwart our efforts here because, to date, it has not been recognized as the ultimate measurement of Darwinian fitness. Although Hawking champions ULDD (87), few others second this motion. This may in part be due to the fact that, given Darwin's Error, with the notable exception of a few key revolutionary insights (*cf* 33 ; 88-90), contemporary evolutionary theorists have also largely failed to recognized the crucial role long-distance and inter-continental dispersal have played in human evolution (*i.e.*, getting "Out of Africa"). But a brief thought experiment reveals that, *reductio ad adsurdum*, ULDD, is the ultimate measure of fitness, because, eventually, *resource holding power* (40) will ultimately be determined by ULDD.

And this lamentable failure to recognize the unity of nature brings us to a brief reflexion on the third obstacle which threatens to obliterate our *truly* inconvenient truth from the light of day: the manifold and intrenched problems associated with *specialization:*

> The specialization of science is an inevitable accompaniment of progress; yet it is full of dangers, and it is cruelly wasteful, since so much that is beautiful and enlightening is cut off from most of the world. Thus it is proper to the role of the scientist that he not merely find new truths and communicate it to his fellows, but that he teach, that he try to bring the most honest and intelligible account of new knowledge to all who will try to learn (91, pp 138-139 ; *cf* 50).

And thus we have reached the crux of this difficult climb. Oppenheimer estimated that scientists may make up about "one one-hundredth of a percent" of the human population (91, p 94), and, to make matters worse, as Dawkins often notes, many scientists *think* they understand evolutionary theory – yet it seems very few truly do.

Furthermore, previous commitments (religious commitments), stir many able-minded scientists to reject evolutionary theory outright, and, just when it seems the intellectual climate could be no worse, it turns out a 150 year-old nontrivial error in the foundational base of evolutionary theory has generated countless and unquantifiable errors throughout the scientific and political worlds.

£ There is an obsession with history. History is there and increasing in quantity, both because we are learning more about it and because we create it every day. We can get the 'teeth' of our minds into it. History is attractive because it is always possible to find a niche and there is always a reward for effort – in contrast to many subjects in which years of endeavour may produce nothing. It is attractive to minds with a preference for analysis… It may also, sometimes, be a refuge for minds that would not achieve much elsewhere (65, p 24).

> We prefer to put our trust in evolution. This is because evolution is gradual and allows the pressure of needs, values, reactions and events to mould ideas. It allows the shaping force of criticism. Bad ideas will die. Good ideas will survive and become even better. We really like the method of evolution because it fits our traditional thinking habits. Change has its own energy and we can modify and control this by the use of our critical faculties because criticism is the basis of our thinking tradition….
>
> In spite of these excellent reasons for preferring and trusting evolution, there is a serious flaw in… evolutionary [theory] (65, p 19).

If this communique is intelligible to <.01% of the world, what are our true prospects for survival? 99.99% of all species that have ever inhabited the Earth are extinct; the average species lifespan is 2 Myr. How do we communicate the logical implications and profound truths which follow from these findings in our fossil record? How many will grasp that evolutionary stable global threat mitigation efforts require a fundamental redirection of contemporary politico-economic development strategies and unprecedented levels of international cooperation? "Studies of mass extinctions tend to emphasize the sheer scope of the carnage. But the subtle differences between the species that died and those that survived can be crucial" (92, p 122). With this thought in mind, I will sign off with the closing remark from a talk given at Princeton in 1953:

> Research is action; and the question I want to leave in a very raw and uncomfortable form with you is how to communicate this sense of action to our fellow men who are not destined to devote their lives to the professional pursuit of new knowledge (91, p 129).

Mustique, November, 2009[£]

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£ The writer's object in putting forward his views in the present imperfect manner is to submit them to the test of other minds, and to be made aware of all the facts supposed to be inconsistent with them. As his hypothesis is one which claims acceptance solely as explaining and connecting facts which exist in nature, he expects facts alone to be brought to disprove it; not *à-priori* arguments against its probability (12, p 191).

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On the Truly Noncooperative Game of Life on Earth: Darwin, Hardin, & Ostrom's Nontrivial Errors

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§ 1. ABSTRACT

THIS PAPER introduces a game-theoretical framework for *The Problem of Sustainable Economic Development*, axioms and a complimentary negotiation model which help clarify the problem itself, and, *reductio ad absurdum*, falsify many widely-held economic, evolutionary, and ecological principles. This brief communiqué lays the foundation for evolutionary stable economic development and survival strategies – strategies which foster international cooperation, global threat mitigation, food & energy security, long-distance dispersibility, and thus, ultimately, the long-term survival of the human species.

§ 2. INTRODUCTION

THE THEORY presented here was developed to address core aspects of *The Problem of Sustainable Economic Development* as they relate to the problem of long-term human survival on Earth (and beyond, for that matter). As noted in "one of the best abstracts" UK economist Rob Elliot has "read for many a month" (1), *Darwin's On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (2)

> launched evolution into theoretical orbit and it continues to influence its course. This *magnum opus* detailed a tenable solution to the most fundamental problem of human existence, and although this Promethean vision contains a few minor errors, there is one nontrivial error which misguides several crucial developments – not only in the evolving structure of evolutionary theory, but across the entire spectrum of science, including politico-economics. This problem has led theorists to mistakenly favour earth-based inputs over cosmic inputs, to over- emphasize biological evolution, and to under-emphasize stellar evolution. These perceptive, methodological, and logical errors have, in turn, emphasized the significance of the individual "struggle against competitors" over the cooperative "struggle against inclement environments", and thus fashionable theories relating to *Global Warming*, *The Problem of Sustainable Economic Development, and The Tragedy of the Commons* have been erected upon false and sandy foundations and suggest evolutionarily unstable solutions (3).

Indeed, these fashionable yet entirely false theoretical developments - - especially those pertaining to *The Tragedy of the Commons* - - have been tabled by popular and influential theorists from Garret Hardin (4) to Elinor Ostrom (3).

The following game-theoretical framework is an effort to correct these errors.

§ 3. THESIS

SUSTAINABLE DEVELOPMENT has long been pursued from bases as diverse as geography and geochemistry, ecology and economics, or physics and political science. Increasingly, however, a core sustainability science research program that transcends the concerns of its foundational disciplines and focuses instead on understanding the complex dynamics that arise from interactions between human and environmental systems…. How can those dynamic interactions be better incorporated into emerging models and conceptualizations that integrate the Earth system, social development, and sustainability? How are long-term trends in environment and development reshaping nature-society? What factors determine the limits of resilience and sources of vulnerability for such interactive systems? What systems of incentive structures can most effectively improve social capacity to guide interactions between nature and society toward more sustainable trajectories? How can science and technology be more effectively harnessed to address sustainability? (5, p 1737).

We will begin to answer these questions and several others, and in light of this ambitious undertaking, we must hit the ground running: *How can these dynamic interactions be better incorporated into a model for sustainability?*

> One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. [Our] two approaches to the problem, via the negotiation model [and] via the axioms, are complementary; each helps…justify and clarify the other (6, p 129).

§ 4. AXIOMS

Axiom I – Survival Certainty Premise. Our first axiom is often referred to as *The Ground Zero Premise* or simply *The Will to Survive*. Darwin called it *The Struggle for Life* (1), the elementary evolutionary truth which simply stipulates that survival is the object of the game (*cf* 7, p *vii-viii*). Many evolutionary theorists have puzzled over the fact that this axiom eludes many (*e.g.*, 8-9).

Axiom II – Resource Uncertainty Premise. Global natural resource consumption is estimated at rates ranging from 20% to 300% of earthly replenishing rates; however, in light of *Axiom V* and *Axiom VI*, this figure is ultimately indeterminable, as future demand (as altered by future, stochastic events) is unknowable (see *Axiom VI*).

Axiom III – Ecological Uncertainty Premise. *Axiom II* poses uncertain and unquantifiable threats (negative externalities) to *Axiom I* and *Axiom IV.* However, scientific and technological advances derived through inter-dependent linkages associated with *Axiom II* also ultimately yield uncertain and unquantifiable *positive externalities* toward the mitigation of *Axioms IV-VI*.

Axiom IV – Political Uncertainty Premise (10-14).

> Survival…is the basic, continuing, inescapable problem for all living organisms [*e.g., Axiom I*]… It follows that survival is the… 'problem' for [nations] as well; it is a prerequisite for any other… objectives…. Our economic and social life…, [and] the actions of… governments… [is] directly or indirectly related to… meeting… survival needs (13, *abstract*).

The most significant logical implication which follows from this axiom is that economic power is derivative (15).

Axiom V – Planetary Uncertainty Premise. Even *if* we are able to mitigate threats posed by *Axiom II* and *Axiom IV* (*i.e. Warfighting*), in light of *Axiom I* and *Axiom IV*, planetary uncertainty mandates that an inhabitable planet *must* be discovered, and the ultimate feat in long-distance dispersal *must* be achieved within an unknown and unknowable time-frame, ≈50,000 years from present (14).

Although details pertaining to risk factors outlined below represent a considerable discourse in of itself, an useful survey (14) highlights and ranks many *known* risks.

However, *any and all known and unknown* risks are theoretically included: the object is not to provide an exhaustive list of global risks, but rather highlight the hereto unrecognized nature of the dilemma astrophysical and planetary phænomena present to *The Problem of Sustainable Economic Development. The Cosmic Connection: How Astronomical Events Impact Life on Earth* (16) offers an excellent overview. It may also be of interest to note, however, thatglobal warming is ranked 9th (ranked 8th in 14), and only three are anthropogenic. Risks are presented in an order of approximate relevance, but these risk factors ultimately lie well-beyond the reach of probability theory:

(*i*) *The Problem of Meteorites* (*cf* 14; 16-17)
(*ii*) *The Problem of Super-Eruptions* (*cf* 14 ; 18)
(*iii*) *The Problem of Supermassive Star Collapse* (*cf* 16 ; 19)
(*iv*) *The Problem of Chaotic Behaviour* (*cf* 16 ; 19)
(*v*) *The Problem of Solar Flux* (*cf* 14; 16)
(*vi*) *The Problem of Ohmic Decay* (*cf* 16 ; 20)
(*vii*) *The Problem of Industrial Agricultural* (*cf* 21-22)
(*viii*) *The Problem of Landrace & Richness Loss* (23)
(*ix*) *The Problem of Global Warming* (*cf.* 14 ; 24)
(*x*) *The Problem of Ice Ages* (*cf.* 14 ; 16)

Axiom VI – Universal Uncertainty Premise. This may represent the least understood, simple truth on Earth (*cf.* 25-26). *Do we have ample reason to believe the sun will rise tomorrow?* Many conclude that, *yes*, based upon 5,292.5 billion affirmative inferences (365 days X 14.5 Byr), the sun *will* rise tomorrow. However, *Axiom V* highlights phænomena which *eventually will* falsify this inference. "Man has an intense desire for assured knowledge. That is why Hume's clear message was crushing" (27, p 22).

§ 5. DISCUSSION

WE DO indeed discover that our axioms do determine a solution, as the true nature of countless widely-held – *though obviously false* – theories immediately come to light. Again, in our endeavour to avoid impossibilities, we will highlight several with a simplified version (temporarily setting *Axiom IV* aside) of *The Truly Noncooperative Game of Life on Earth*:

WHAT ARE THE RULES OF THE GAME?
Axioms I – III, Axioms V – VI

WHAT IS THE NATURE OF THE GAME?
Homo sapiens (P_1) *vs. Universe* (P_2).

WHAT IS THE OBJECT OF THE GAME?
P_1 = *Survival.*
P_2 = *?*

The Dilemma. As we strategize, a dilemma becomes apparent before play even begins: In light of the fact that P_2's objective = unknown, P_1 faces the dilemma presented by universal uncertainty (*Axiom VI*): P_1 survival requires defending *relative insularity* (of which, more to follow), but this defense must be split between *two essentially contradictory strategies*: S_1: defending *Ecological Insularity* (*Axioms I-III*), and S_2: defending *Planetary Insularity* (*Axioms IV-V*).

In other words, all quests for long-term human survival require splitting resources and efforts between two conflicting and counter-productive objectives, but *Axiom VI* renders it impossible to determine how much to allocate to each over time. The impassable difficulty lies within the observation that we can not nor will ever be sufficiently informed to understand how much or how many relatively 'ecologically degrading' economic activities have been and always will be required in our necessarily never-ending race to formulate and develop solutions relating to S_2.

Indeed, this highlights the disquieting nature of *The Prisoner's Dilemma* (28).

But all hope is not lost; this dilemma does not negate the existence of *Evolutionary Stable Strategy* (29). As several problem-solvers noted regarding an otherwise gloomy outlook for African food security, "the range of possible

human outcomes is large and depends primarily upon the choices that we make" (30, p 11086); although we are certainly in the hands of Nature, much depends upon our hands as well: To this point, recall that "the laws of nature are approximate…: we first find the 'wrong' ones, and then we find the 'right' ones" (31, p 2); indeed, our *Axioms* enable us to hone in on the 'right' ones through a sweeping process of elimination. Several implications which follow from our theoretical framework falsify a wide-range of theories—including the canons of a number of influential contemporary ideologies.

Let's explore a few logical implications and highlight several glaring errors.

Brundtland's Error. *Sustainable Development in Small Island Development States: Issues and Challenges* notes the 'seminal' *Brundtland Report* defined sustainability as:

> Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (32, p 1).

A review of the vast body of related literature reveals that this definition is almost universally accepted, but we trust that we have begun to demonstrate that this definition is theoretically untenable. Yet countless theorists have fallen and continue to stumble into this trap:

> Population growth, rising per capita consumption and the use of environmentally malign technologies are steadily eroding [ecological] services…. A major problem is to determine how to allocate resources in various ways to solve the human predicament. Scientists have much of the information necessary for making those decisions, so the biggest problem is in the purview of social scientists. They must help to determine how best to move society from knowledge to action (33:*abstract*).

But our *Axioms* demonstrate that 'scientists' do not nor ever will have the "necessary information" for making these decisions.

How remarkable that this conclusion was derived without the aid of our indirect proof in that revolutionary year of 1776 (10). Innumerable and inevitable 'altered circumstances,' which an equal number of ecologists, economists, biologists, sociologists, and sundry social theorists have failed to recognize, will present themselves in due course and – *quite literally* – pound their conjectures to dust.

On Truly Noncooperative Games. Chapter one of *FM 21-76*, 'The Will to Survive,' begins: "Two things that you can do now to help you prepare are train for survival in different environments and learn about the area where you are going" (34, p *1-1*), but in light of *Axiom VI,* we remain forever unable to *learn about the area where we are going* because 'we' are 'going' into the unknown and unknowable *future*, and thus we must emphasize an important section of a revolutionary thesis (35):

> There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness [makes] the situation truly non-cooperative (36, p 23).

Indeed, there have always been inescapable situations and there always will be inescapable situations which make the situation truly non-cooperative. In reality, any and all games are truly noncooperative games. Ironically, however, our relentless quest for human survival happens to hinge upon unprecedented levels of international cooperation.

On the Law of Superabundance.

> How much is enough?… What are the minimum conditions for the long-term persistence and adaptation of a species or population in a given place? This is one of the most difficult and challenging intellectual problems in conservation biology. Arguably, it is the quintessential issue in population biology (37, p 1-2).

If our answer to this question is not already implicitly clear, we shall render it explicitly: *this problem is also insoluble*. A half-century prior to two of the most significant explorers in this arena (38), a path-breaking, preliminary exploration began as follows:

> I think I may fairly make two postulata.
>
> First, That food is necessary to the existence of man.
>
> Secondly, That the passion between the sexes is necessary and will remain nearly in its present state (39, p 4).

These 'postulata,' Darwin's 'Malthusian Insight' of 1838, demonstrated an intuitive grasp of *The Law of Super-abundance*, and, in light of our *Axioms*, we discover that *real solutions* are neither 'population control' (40-41), nor "[increasing] global food and timber supply to accommodate a world growing to 10 billion or more" (42, p 19679), because we're unable to pursue either strategy with any justifiable conviction since *The Law of Super-abundance* stipulates, "the effort towards population …[is] always greater than the means to support it" (39, p 12). And of course nature knows best, because populations may be decimated (or be wiped-out entirely) at any point in time; we have outlined scenarios whereby, "even if death doesn't get you right away, you're unlikely to have much spare energy for sex" (43, p 124).

On the True Nature of Economic Organization.

> Very few of us realize… the intensively unusual, unstable, complicated, unreliable, temporary nature of the economic organization by which [we] live… We assume some of the most peculiar and temporary of our late advantages as natural, permanent, and to be depended on, and we lay our plans accordingly. On this sandy and false foundation we scheme for social improvement and dress our political platforms, pursue our animosities and particular ambitions, and feel ourselves with enough margin in hand to foster, not assuage, civil conflict….
>
> But perhaps it is only in England and America that it is possible to be so unconscious… The earth heaves and no one but is aware of the rumblings. There is not just a matter of… '[economic] troubles'; but of life and death, of starvation and existence, and of the fearful convulsions of a dying civilization (44, p 3-4).

As we have clearly illustrated, innumerable phænomena eventually *will* instantly (perhaps with little or no warning) render many, most, or all human survivors (if, that is, there are any) – from Professors to Presidents to Philosopher kings – nomads, fishermen, gatherers, warriors (mostly unarmed), and "hunters, the lowest and rudest state of society" (10, p 747). To make matters worse, it takes *years – even generations* – to become *Jägermeistern*, to acquire skills which are being rapidly lost, and of course one must have guns & ammo in order to shoot anything. Someday – possibly tonight – perhaps not for another million years, but, in all likelihood, sometime in the next 50,000 years, *millions*, perhaps even *billions* of people – *especially* the increasingly inter-dependent inhabitants of the so-called 'first-world' – will discover just how much Darwinian fitness they truly do or do not possess.

§ 6. SYNTHESIS

> **AS WORD** of Humboldt's death filtered around the world, there was an outpouring of… reverence befitting a beloved international celebrity…. *The Herald* lauded him as 'one of the greatest men of his age or of any other age…. He had a gigantic intellect, from which nothing in nature or in science appeared to be hid. He could grasp all subjects, and he appeared to know everything…. *Cosmos* is his imperishable monument, which will endure as long as the earth which it describes.' *The Tribune* averred, 'His fame belonged not only to Europe, but to the world; and in this country especially, probably no man who was known to us only through the medium of his scientific writings was held in equal reverence and admiration…. But what will ever distinguish Humboldt from the mass of physical inquirers who had preceded him, is his study of the universe as a harmonious whole, and his search for the laws of order, beauty, and majesty beneath the apparent confusion and contradictions of isolated appearances….'
>
> We may well ask, If Humboldt was so widely celebrated and so beloved during his long life…, why has he been largely forgotten in our own time?….
>
> Above all he was a generalist, intent on examining every natural process and shaping the myriad discordant data into a coherent whole, as in *Cosmos*. However, by the mid-nineteenth century, science was progressing so rapidly that it was increasingly becoming the province of specialists, as shown by the trend to replace university departments of *Natural Philosophy* with the narrower disciplines that we know today (45, p 327-330).

This trend has led to systemic failures ranging from the *Denaturalization of Economics* (46) to the *Transformative Hermeneutics of Quantum Gravity* (47). Indeed, as Hardin noted,

> it is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialties that perhaps should not have been separated in the first place?….
>
> My first attempt at interdisciplinary analysis led to an essay, *The Tragedy of the Commons*. Since it first appeared in *Science* 25 years ago, it has been included in anthologies on ecology, environmentalism, health care, economics, population studies, law, political science, philosophy, ethics, geography, psychology, and sociology. It became required reading for a generation of students and teachers seeking to meld multiple disciplines in order to come up with better ways to live in balance with the environment (48, p 682).

To this point, your Author was born in August of 1968, just after *The Tragedy of the Commons* was read before the *American Association for the Advancement of Science*, and thus I am amongst the second generation to heed Hardin's call; and "by bringing together all the phenomena and creations which the earth has to offer" (45, p 27), *perhaps I have indeed begun to meld multiple disciplines in order to come up with the best possible way to live in balance with the environment.*

"This sketch is most imperfect; but in so short a space I cannot make it better" (38, p 50). For more details, including methodological desiderata, personal intents, motivations, and full disclosure, please refer to *On the Truly Noncooperative Game of Life on Earth: In Search of the Unity of Nature & Evolutionary Stable Strategy* (49).

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Prince Edward Island, 18 December 2009

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On the Truly Noncooperative Game of Life on Earth: In Search of the Unity of Nature & Evolutionary Stable Strategy

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On the Truly Noncooperative Game of Life on Earth

In Search of the Unity of Nature

&

Evolutionary Stable Strategy

22 September 2009

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Naturae Discere Mores

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§ 1. EPIGRAPH

IF HARSH words are spoken about some of the greatest among the intellectual leaders of mankind, my motive is not, I hope, the wish to belittle them. It springs rather from my conviction that, if our civilization is to survive, we must break with the habit of deference to great men. Great men may make great mistakes ; and... some of the greatest leaders of the past supported the perennial attack on freedom and reason. Their influence, too rarely challenged, continues to mislead those on whose defence civilization depends, and to divide them. The responsibility for this tragic and possibly fatal division becomes ours if we hesitate to be outspoken in our criticism of what admittedly is a part of our intellectual heritage. By our reluctance to criticize some of it, we may help to destroy all of it.

—Sir Karl Popper, *The Open Society and Its Enemies*, 1944

§ 2. PRÉCIS

THIS PAPER tables axioms which model *The Problem of Sustainable Economic Development* (*i.e., The Tragedy of the Commons*), a theoretical framework which, *reductio ad absurdum*, falsifies many widely-held economic, evolutionary, and ecological principles, including the central thesis of 'ecological economics'. This brief communiqué lays the foundation for evolutionary stable economic development strategy, and, thus, fosters global threat mitigation, international cooperation, food security, national security, long-distance dispersibility, and thus, ultimately, the long-term survival of the human species.*

Key Terms:

Human survival, sustainable economic development, noncooperative games, natural selection, asteroid impact, global warming, warfighting, super-eruptions, solar flux, ohmic decay, industrial agriculture, land degradation, global threat mitigation, food security, national security, long-distance dispersal, evolutionary stable strategy.

* Perhaps such an effort of effectively thinking through these implications requires a combination of qualifications which nobody possesses to a sufficient degree and which the specialist who feels sure in his own field therefore hesitates to undertake. To do it adequately one would indeed have to be equally competent… as a logician and as a mathematician, and as a physicist and as a philosopher. I need scarcely say that I possess none of these qualifications. But since it is doubtful whether anybody does, and since a least nobody who possesses them as yet has tried his hand at this problem, it is perhaps inevitable that the first attempt should be made by somebody who had to try and acquire the necessary equipment as he went along (1:*vii*).

[Citations are styled as follows: reference number, colon (:), then page number in italics; thus, (1:*vii*) refers to page vii of reference number 1.]

§ 3. INTRODUCTION

THE THEORY presented here was developed to address fundamental, mission-critical, interdependent issues central to human survival on Earth,* a planet lacking central authority.† As a whole, these issues represent, in essence, *The Problem of Sustainable Economic Development,* but our 'problem situation' presents two obstacles to overcome prior to making any headway.

Shortly, we shall demonstrate that the most commonly held definition of 'sustainability' is theoretically untenable, and since it is true that "in framing an ideal we may assume what we wish, but should avoid impossibilities" (4), perhaps we should avoid problems which defy definition. And although framing our problem as *The Tragedy of the Commons* may prove more fruitful, this well-known, yet loosely defined collection of theories creates another host of problems which have been addressed at length (5:*97-108*). However, we shall sufficiently define and specify our problem for our purposes herewith.

The second obstacle to contend with relates to the notion that the theory presented here was developed to address a problem on Earth, *a planet lacking central authority*. This qualifier may puzzle some, others may presume such qualification is superfluous. However, such presumptions may be short-sighted; indeed, many – *if not most* – proposed solutions to the problem at hand have been unwittingly formulated for planets *with* central authority. Take, for example, the proposed solution of an esteemed Pellegrino University Research Professor: in a chapter entitled "The Solution", we discover that "during the past two decades, scientists and conservation professionals have put together a strategy aimed at the protection of most of the remaining ecosystems and species" (6:*160*). To begin with, remarkably, our Professor does not note who these scientists and conservation professionals are, how they were selected, nor what methods were utilized in deriving their solution.

In any case, setting this nontrivial matter aside, our esteemed Professor asserts that 'the solution' is…

- Salvage immediately the world's hotspots, those habitats that are both at the greatest risk and shelter the largest concentrations of species found nowhere else. Among the most valuable hotspots on the land, for example, are the surviving remnants of rainforest in Hawaii, the West Indies, Ecuador, Atlantic Brazil, West Africa, Madagascar, the Philippines, Indo-Burma, and India, as well a the Mediterranean-climate scrublands of South Africa, southwestern Australia, and southern California….
- Keep intact the five remaining frontier forests, which are the last true wildernesses on the land and home to an additional large fraction of Earth's biological diversity. They are the rainforests of the combined Amazon Basin and the Guianas; the Congo block of Central Africa; New Guinea; the temperate conifer forests of Russia, Finland, and Scandinavia combined.
- Cease all logging of old-growth forests everywhere…. At the same time, let secondary native forests recover (6:*160-161*).

This detailed solution runs on with nine more bullet-points, spanning three pages (6:*161-164*), but perhaps the point is already clear: Although our Professor implied otherwise, his solution was not derived for the Earth, it was derived for an *imaginary* planet, *a planet with central authority*.

Moreover, as we shall demonstrate, we may be thankful that, despite the conclusions of several of the greatest mid-century thinkers,‡ the Earth lacks central authority afterall, and that our Professor and his fellow 'scientists and conservation professionals' lack the authority to implement their insufficiently informed solution.

Yes, perhaps it is becoming increasingly apparent that

> ideological environmentalism wants to claim the mantle of objective science to justify its political programs… However, as the communists discovered, the failure of one's ideology to correspond to reality is ultimately fatal (8:*xxiv*).§

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* To discover how the extinct species have from time to time been replaced by new ones down to the very latest geological period, is the most difficult, and at the same time the most interesting problem in the natural history of the earth (2:*190*).

† With those who argue that it would be desirable to have world government, an appropriate delegation of national sovereignty, laws applicable to individuals in all nations, it would seem most difficult to differ; but with those who argue that these things are directly possible, in their full and ultimately necessary scope, it may be rather difficult for me to agree (3:*12-13*)

‡ Ideas of world government… were at their heyday during Nash's Princeton… days and permeated the 1950s… Founded after the collapse of the League of Nations in the 1930s, the one-world movement exploded into the national consciousness within a few years of the end of World War II (7:*270*).

§ Is there a greater tragedy imaginable than that, in our endeavor consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving for (9:*60*)?

§ 4. THESIS

AS NOTED, the theory presented here was developed to address fundamental aspects of the problem of long-term human survival on Earth (and beyond, for that matter).*

> Research relevant to the goals of sustainable development has long been pursued from bases as diverse as geography and geochemistry, ecology and economics, or physics and political science. Increasingly, however, a core sustainability science research program that transcends the concerns of its foundational disciplines and focuses instead on understanding the complex dynamics that arise from interactions between human and environmental systems.... How can those dynamic interactions be better incorporated into emerging models and conceptualizations that integrate the Earth system, social development, and sustainability? How are long-term trends in environment and development reshaping nature-society? What factors determine the limits of resilience and sources of vulnerability for such interactive systems? What systems of incentive structures can most effectively improve social capacity to guide interactions between nature and society toward more sustainable trajectories? How can science and technology be more effectively harnessed to address sustainability? (11:*1737*).

We will answer all of these questions and several others, and in light of this ambitious undertaking, we must postpone a more congenial introduction (*cf.* 5) and hit the ground running: *How can these dynamic interactions be better incorporated into a model for sustainability?*

> One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. [Our] two approaches to the problem, via the negotiation model [and] via the axioms, are complementary; each helps...justify and clarify the other (12:*129*).

§ 5. AXIOMS

Axiom I – Survival Certainty Premise.

> **ALL THINGS** living are in search of a better world.
>
> Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.
>
> An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements....
>
> All organisms are fully occupied with problem-solving. Their first problem is survival [underscore mine]. But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.
>
> According to this optimistic interpretation, it is through natural selection† and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche (13:*vii-viii*).

In other words, *Axiom I* simply stipulates that survival is the ultimate object of the game of life.

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* We are entering an increasingly dangerous period of our history. Our population and our use of the finite resources of planet earth are growing exponentially along with our technical ability to change the environment for good or ill.... It will be difficult enough to avoid disaster in the next hundred years, let alone the next thousand or million. Our only chance of long-term survival is not to remain inward looking on planet Earth but to spread out into space.... If we want to continue beyond the next hundred years, our future is in space (10:*finale*).

† Natural Selection is not Evolution. Yet, ever since the two words have been in common use, the theory of Natural Selection has been employed as a convenient abbreviation for the theory of Evolution by means of Natural Selection, put forward by Darwin and Wallace. This has had the unfortunate consequence that the theory of Natural Selection itself has scarcely... received separate consideration (14:*vii*).

Axiom II – Resource Uncertainty Premise. Global natural resource consumption is estimated at rates ranging from 20% to 300% of earthly replenishing rates; however, in light of *Axiom V* and *Axiom VI*, this figure is ultimately indeterminable, as future demand (as altered by future, stochastic events) is unknowable (*i.e., Axiom VI*).

Axiom III – Ecological Uncertainty Premise. *Axiom II* poses uncertain and unquantifiable threats (negative externalities) to *Axiom I* and *Axiom IV.* However, scientific and technological advances derived through inter-dependent linkages associated with *Axiom II* also ultimately yield uncertain and unquantifiable *positive externalities* toward the mitigation of *Axioms IV-VI*!

Axiom IV – Political Uncertainty Premise (15-24).

> Survival…is the basic, continuing, inescapable problem for all living organisms [*e.g., Axiom I*]… It follows that survival is the… 'problem' for [nations] as well; it is a prerequisite for any other… objectives…. Our economic and social life…, [and] the actions of… governments… [is] directly or indirectly related to… meeting… survival needs (23:*abstract*).*

Axiom V – Planetary Uncertainty Premise. Even *if* we are able to mitigate threats posed by *Axiom II* and *Axiom IV* (*i.e. Warfighting*),† in light of *Axiom I* and *Axiom IV*, planetary uncertainty mandates that an inhabitable planet *must* be discovered, and the ultimate feat in long-distance dispersal *must* be achieved within an unknown and unknowable time-frame, < ≈50,000 years from present (*cf.* 24 ; 10).

Although details pertaining to risk factors outlined below represent a considerable discourse in of itself, an useful survey (24) highlights and ranks many *known* risks.

However, *any and all known and unknown* risks are theoretically included: the object is not to provide an exhaustive list of global risks, but rather highlight the hereto unrecognized nature of the dilemma astrophysical and planetary phænomena present to *The Problem of Sustainable Economic Development*. It may be of interest to note, however, that global warming is ranked 9th (ranked 8th in 24), and only three are anthropogenic. Risks are presented in an order of approximate relevance, but these risk factors ultimately lie well-beyond the reach of probability theory:

(*i*) *The Problem of Meteorites* (*cf.* 24 ; 25)‡
(*ii*) *The Problem of Super-Eruptions* (*cf.* 24 ; 27)
(*iii*) *The Problem of Supermassive Star Collapse* (*cf.* 24)
(*iv*) *The Problem of Chaotic Behaviour* (*cf.* 28-29)§
(*v*) *The Problem of Solar Flux* (*cf.* 24)
(*vi*) *The Problem of Ohmic Decay* (*cf.* 30)
(*vii*) *The Problem of Industrial Agricultural* (*cf.* 31-33)
(*viii*) *The Problem of Landrace & Richness Loss* (34-35)**
(*ix*) *The Problem of Global Warming* (*cf.* 24 ; 36)
(*x*) *The Problem of Ice Ages* (*cf.* 24)

Axiom VI – Universal Uncertainty Premise. This may represent the least understood, simple truth on Earth (*cf.* 37-43). *Do we have ample reason to believe the sun will rise tomorrow?* Many conclude that, *yes*, based upon 5,292.5 billion affirmative inferences (365 days X 14.5 Byr), the sun *will* rise tomorrow. However, *Axiom V* highlights phænomena which *eventually will* falsify this inference. "Man has an intense desire for assured knowledge. That is why Hume's clear message was crushing" (44:*22*).††

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* The first duty of the sovereign, that of protecting the society from the violence and invasion of other independent societies, can be performed only by means of a military force (15:*747*).

† Can war be rational?… The answer is yes, it can be. In one of the greatest speeches of all time… Abraham Lincoln said: 'Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came' (17:*1705*).

‡ The Earth has a long and violent history of collisions with extraterrestrial bodies such as asteroids and comet nuclei. Several of these impacts have been large enough to produce major environmental changes, causing mass extinctions and severe alterations to weather patterns and geography. There is no reason to suppose that the likelihood of such collisions will be any less in the future and the spread of human settlement, civilization, and particularly *urbanization, makes it much more likely that a future impact, even relatively small, could result in the massive loss of human life and property.* Despite the fact that the technology exists to predict and to some extent prevent such events, there is currently no coordinated international response (26:*abstract*).

§ Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behavior also seems to be… essential… in the explanation of… the distribution of asteroids. The long-term motion of Pluto is suspicious (29:*abstract*).

** Richness and evenness are two key notions of biological diversity. Richness refers to the number of different kinds of individuals regardless of their frequencies (34:*5326*).

†† Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance… was. I am afraid that even today many people still do not fully understand this (13:*36*).

§ 6. HYPOTHESIS

WE DO indeed discover that our axioms do determine a solution, as the true nature of countless widely-held – *though obviously false* – theories immediately come to light. Again, in our endeavour to avoid impossibilities, we will highlight several with a simplified version (temporarily setting *Axiom IV* aside) of *The Truly Noncooperative Game of Life on Earth*:

WHAT ARE THE RULES OF THE GAME?
Axioms I – III, Axioms V – VI

WHAT IS THE NATURE OF THE GAME?
Homo sapiens (P_1) vs. Universe (P_2).

WHAT IS THE OBJECT OF THE GAME?
P_1 = *Survival.*
P_2 = *?*

The Dilemma. As we strategize, a dilemma becomes apparent before play even begins: In light of the fact that P_2*'s* objective = unknown, P_1 faces the dilemma presented by universal uncertainty (*Axiom VI*): P_1 survival requires defending *relative insularity* (*cf.* 5), but this defense must be split between *two essentially contradictory strategies*: S_1: defending *Ecological Insularity* (*Axioms I-III*), and S_2: defending *Planetary Insularity* (*Axioms IV-V*).

In other words, all quests for long-term human survival require splitting resources and efforts between two conflicting and counter-productive objectives (*cf.* 45:*22-23*), but *Axiom VI* renders it impossible to determine how much to allocate to each over time. The impassable difficulty lies within the observation that we can not nor will ever be sufficiently informed to understand how much or how many relatively 'ecologically degrading' economic activities have been and always will be required in our necessarily never-ending race to formulate and develop solutions relating to S_2.

Indeed, this highlights the disquieting nature of *The Prisoner's Dilemma* (46 ; See APPENDIX I).*

But all hope is not lost; this dilemma does not negate the existence of *Evolutionary Stable Strategy* (*cf.* 48). As several problem-solvers noted regarding an otherwise gloomy outlook for African food security, "the range of possible human outcomes is large and depends primarily upon the choices that we make" (49:*11086*); although we are certainly in the hands of Nature, much depends upon our hands as well: To this point, recall that "the laws of nature are approximate…: we first find the 'wrong' ones, and then we find the 'right' ones" (50:*2*); indeed, our *Axioms* enable us to hone in on the 'right' ones through a sweeping process of elimination. Several implications which follow from our theoretical framework falsify a wide-range of theories—including the central thesis of 'ecological economics' and the canons of a number of influential contemporary ideologies.

Let's explore a few logical implications and highlight several glaring errors.†

Brundtland's Error. *Sustainable Development in Small Island Development States: Issues and Challenges* notes the 'seminal' *Brundtland Report* defined sustainability as:

> Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (52:*1*).

A review of the vast body of related literature reveals that this definition is almost universally accepted, but we trust that we have begun to demonstrate that this definition is theoretically untenable. Yet countless theorists have fallen and continue to stumble into this trap:

> Population growth, rising per capita consumption and the use of environmentally malign technologies are steadily eroding [ecological] services…. A major problem is to determine how to allocate resources in various ways to solve the human predicament. Scientists have much of the information necessary for making those decisions, so the biggest problem is in the purview of social scientists. They must help to determine how best to move society from knowledge to action (53:*abstract*).

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* Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE (47:*preface*).

† When we propose a theory, or try to understand a theory, we also propose, or try to understand, its logical implications; that is, all those statements which follow from it. But this… is a hopeless task: there is an infinity of unforeseeable nontrivial statements belonging to the informative content of any theory, and an exactly corresponding infinity of statements belonging to its logical content. We can therefore never know or understand all the implications of any theory, or its full significance.

This, I think, is a surprising result as far as it concerns logical content; though for informative content it turns out to be rather natural…. It shows, among other things, that understanding a theory is always an infinite task, and that theories can in principle be understood better and better. It also shows that, if we wish to understand a theory better, what we have to do first is to discover its logical relation to those existing problems and existing theories which constitute what we may call the 'problem situation'.

Admittedly, we also try to look ahead: we try to discover new problems raised by our theory. But the task is infinite, and can never be completed (51:*26*).

But our *Axioms* demonstrate that 'scientists' do not nor ever will have the *miljoovervakingssystemer* (necessary information) for making these decisions.

How remarkable that this conclusion was derived without the aid of our indirect proof* in that revolutionary year of 1776:

> The statesman, who should attempt to direct private people in what manner they ought to employ their capitals, would not only load himself with a most unnecessary attention, but assume an authority which could safely be trusted, not only to no single person, but to no council or senate whatever, and which would nowhere be so dangerous as in the hands of a man who had folly and presumption enough to fancy himself fit to exercise it (15:*485*).

Innumerable and inevitable 'altered circumstances,' which an equal number of ecologists, economists, biologists, sociologists, and sundry social theorists have failed to recognize, will present themselves in due course and – *quite literally* – pound their conjectures to dust.

And thus we find ourselves in an increasingly unenviable position: As noted in a recent, curiously relevant comparative analysis of U.S. Healthcare strategy, "it isn't easy being right when pretty much everyone else is wrong" (55:7), and as Lord Acton observed some time ago, "few discoveries are more irritating than those which expose the pedigree of ideas" (9:*57*). Although we may prefer to leave the remainder of our remarks unsaid, Oppenheimer reminds us that we must press on.†

On Truly Noncooperative Games. Chapter one of *FM 21-76*, 'The Will to Survive,' begins: "Two things that you can do now to help you prepare are train for survival in different environments and learn about the area where you are going" (56:*1-1*), but in light of *Axiom VI,* we remain forever unable to *learn about the area where we are going* because 'we' are 'going' into the unknown and unknowable *future*, and thus we must emphasize an important section of a revolutionary thesis:

> There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness [makes] the situation truly non-cooperative (57:*23*).‡

Indeed, there have always been inescapable situations and there always will be inescapable situations which make the situation truly non-cooperative! In reality, any and all games are noncooperative games§ with incomplete information (*cf.* 60). Ironically, however, our relentless quest for human survival happens to hinge upon unprecedented levels of international cooperation. Of course this observation has been voiced and written by others:

> In the last words that he wrote, in words he did not live to speak, President Roosevelt looked to the future, to the atomic age. He looked to the past, to the days of the founding of the Republic. He wrote:
>
> > Thomas Jefferson, himself a distinguished scientist, once spoke of the 'brotherly spirit of science, which unites into one family all its votaries of whatever grade, and however widely dispersed throughout the different quarters of the globe.
> >
> > Today, science has brought all the different quarters of the globe so close together that it is impossible to isolate them one from another.
>
> Today we are faced with the pre-eminent fact that, if civilization is to survive, we must cultivate the science of human relationships—the ability of all peoples, of all kinds, to live together and work together, in the same world, at peace (3:*108*).

On the Law of Superabundance.

> How much is enough?... What are the minimum conditions for the long-term persistence and adaptation of a species or population in a given place? This is one of the most difficult and challenging intellectual problems in conservation biology. Arguably, it is the quintessential issue in population biology (61:*1-2*).

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* *Reductio ad absurdum*, which Euclid loved so much, is one of a mathematician's finest weapons (54:*19*).

† The true responsibility of a scientist, as we all know, is to the integrity and vigor of his science. And because most scientists, like all men of learning, tend in part also to be teachers, they have a responsibility for the communication of the truths they have found (3:*91*).

‡ The entire thesis is 27 typescript, very generously double-spaced. Frankly, I have always considered the most important sections to be the first 6 pages…and the last pages (from 21 to 26) on motivation, interpretation, and applications. For many years, I have accused John of padding the thesis in the middle (58:*164*).

§ The Nash equilibrium has helped to clarify a distinction sometimes still made between 'cooperative' and 'noncooperative' games… One trend in modern game theory… is to erase this distinction… so that all games can be modeled as noncooperative (59:*4000*).

If our answer to this question is not already implicitly clear, we shall render it explicitly: *this problem is also insoluble*. A half-century prior to two of the most significant explorers in this arena (*cf.* 2, 62-63), a path-breaking, preliminary exploration began as follows:

> I think I may fairly make two postulata.
>
> First, That food is necessary to the existence of man.
>
> Secondly, That the passion between the sexes is necessary and will remain nearly in its present state (64:*4*).

These 'postulata,' the essence of which catalyzed Darwin's 'Malthusian Insight' of 1838 (65:*122*) demonstrated an intuitive grasp of *The Law of Super-abundance*, and, in light of our *Axioms*, we discover that *real solutions* are neither 'population control' (66-67), nor "[increasing] global food and timber supply to accommodate a world growing to 10 billion or more" (68:*19679*), because we're unable to pursue either strategy with any justifiable conviction since *The Law of Super-abundance* stipulates, "the effort towards population …[is] always greater than the means to support it" (64:*12*).* And of course nature knows best, because populations may be decimated (or be wiped-out entirely) at any point in time; we have outlined scenarios whereby, "even if death doesn't get you right away, you're unlikely to have much spare energy for sex" (69:*124*).†

On the True Nature of Economic Organization.

> Very few of us realize… the intensively unusual, unstable, complicated, unreliable, temporary nature of the economic organization by which [we] live… We assume some of the most peculiar and temporary of our late advantages as natural, permanent, and to be depended on, and we lay our plans accordingly. On this sandy and false foundation we scheme for social improvement and dress our political platforms, pursue our animosities and particular ambitions, and feel ourselves with enough margin in hand to foster, not assuage, civil conflict….
>
> But perhaps it is only in England and America that it is possible to be so unconscious… The earth heaves and no one but is aware of the rumblings. There is not just a matter of… '[economic] troubles'; but of life and death, of starvation and existence, and of the fearful convulsions of a dying civilization (71:*3-4*).

The 1956 classic, *How to Stay Alive in the Woods*, begins: "Anyone at anytime can find himself dependent on his own resources for survival" (72:*11*), and as we have illustrated, this truth is more significant than most may recognize – innumerable phænomena eventually *will* instantly (likely without much warning) render the inhabitants of Earth *a'ohe nao 'ai i ka papa a,*‡ or, if there is something left to eat, any and all survivors – from Professors to Presidents to Philosopher kings – will suddenly find themselves fishermen, gatherers, warriors (mostly unarmed), and "hunters, the lowest and rudest state of society" (15:*747*). To make matters worse, it takes *years – even generations* – to become *Jägermeistern*, to acquire skills which are being rapidly lost, and of course one must have guns & ammo in order to shoot anything. Someday – possibly tonight – perhaps not for another million years, but, in all likelihood, sometime in the next 50,000 years, *millions*, perhaps even *billions* of people – *especially* the increasingly inter-dependent inhabitants of the so-called 'first-world' – will discover just how much Darwinian fitness they truly do or do not possess§. Meanwhile, the relatively self-sufficient inhabitants of the 'third-world' may be pleasantly surprised to discover that lack of 'cargo', despite misinformed conjecture to the contrary (*cf.* 74-75), is not necessarily an evolutionary shortcoming afterall. Furthermore, the fates of human societies have *not* been determined by guns, germs and steel, they have been determined by *relative insularity* (*cf.* 5).

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* By that law of our nature which makes food necessary to the life of man, the effects of these two unequal powers must be kept equal. This implies a strong and constantly operating check on population from the difficulty of subsistence. This difficulty must fall somewhere and must necessarily be severely felt by a large portion of mankind (64:*5*).

† One can argue that all environments are hostile, and that death and extinction are probable events, while survival is improbable. Just how life has managed to overcome this improbability is a problem which many biologists find challenging and fascinating. In my opinion, this problem may well be used as the framework on which to build the teaching of biology (70:*450*).

‡ Literally, 'nothing but burnt food to eat,' used to refer to a 'terrible situation' (73:*130*).

§ In a harsh year as far as survival factors are concerned, only the best individuals survive; all others are eliminated. In a mild year only the worst are culled and most individuals survive. At the beginning of the next breeding season, as a result of such great survival a much more diversified population is available for the action of sexual selection and for selection contingencies. The existence of this culling method was soon pointed out by Herbert Spencer when he called natural selection a 'survival of the fittest.' He should have said 'survival of the fitter.' The survivors are those left over after all the inferior individuals have been eliminated. This elimination process is not at all a 'selection of the best'. Curiously, it has never been remarked that the consequences of an elimination process may be quite different from those of a selection process (76:*135*).

§ 7. SYNTHESIS

AS WORD of Humboldt's death filtered around the world, there was an outpouring of… reverence befitting a beloved international celebrity…. *The Herald* lauded him as 'one of the greatest men of his age or of any other age…. He had a gigantic intellect, from which nothing in nature or in science appeared to be hid. He could grasp all subjects, and he appeared to know everything…. *Cosmos* is his imperishable monument, which will endure as long as the earth which it describes.' *The Tribune* averred, 'His fame belonged not only to Europe, but to the world; and in this country especially, probably no man who was known to us only through the medium of his scientific writings was held in equal reverence and admiration…. But what will ever distinguish Humboldt from the mass of physical inquirers who had preceded him, is his study of the universe as a harmonious whole, and his search for the laws of order, beauty, and majesty beneath the apparent confusion and contradictions of isolated appearances….'

We may well ask, If Humboldt was so widely celebrated and so beloved during his long life…, why has he been largely forgotten in our own time?….

Above all he was a generalist, intent on examining every natural process and shaping the myriad discordant data into a coherent whole, as in *Cosmos*. However, by the mid-nineteenth century, science was progressing so rapidly that it was increasingly becoming the province of specialists, as shown by the trend to replace university departments of *Natural Philosophy* with the narrower disciplines that we know today (77:*327-330*).

This trend has led to systemic failures ranging from the *Denaturalization of Economics* (78) to the *Transformative Hermeneutics of Quantum Gravity* (*cf.* 79-83). Indeed, methodological errors which have become so deeply entrenched in our universities – as a result of bad advice from Plato* to Condorcet† – may render it impossible for many 'specialists' to grasp the significance of *Axiom VI,*‡ let alone the interdependent, interdisciplinary nature of *Axioms I – VI*, because "no man can be a pure specialist without being in the strict sense an idiot" (84:*In 41*). Although searchers from Popper to Hayek (85) to Soros and Taleb§ have fought to correct these errors,

> it is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialties that perhaps should not have been separated in the first place?….
>
> My first attempt at interdisciplinary analysis led to an essay, *The Tragedy of the Commons*. Since it first appeared in *Science* 25 years ago, it has been included in anthologies on ecology, environmentalism, health care, economics, population studies, law, political science, philosophy, ethics, geography, psychology, and sociology. It became required reading for a generation of students and teachers seeking to meld multiple disciplines in order to come up with better ways to live in balance with the environment (87:*682*).

To this point, I** was born in August of 1968, just after *The Tragedy of the Commons* was read before the *American Association for the Advancement of Science*, and thus I am amongst the second generation to heed Hardin's call; and "by bringing together all the phenomena and creations which the earth has to offer" (77:*27*), *perhaps I have indeed begun to meld multiple disciplines in order to come up with the best possible way to live in balance with the environment*.

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* The development of thought since Aristotle could… be summed up by saying that every discipline, as long as it used the Aristotelian method…, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which the various sciences have been able to make any progress depended on the degree to which they have been able to get rid of [it] (this is why so much of our 'social science' still belongs to the Middle Ages.)… The problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright (41:*9*).

† The term *social science* was coined only in the 1780s, by Condorcet… The factors that led to the emergent field of social science were part and parcel of the process by which economics detached itself from natural philosophy (78:*5*).

‡ Nothing seems less wanted than a simple solution to an age-old philosophical problem (40:*73*).

§ I remember exactly the spot at Barnes and Noble on 18th Street and Fifth Avenue where in 1987, inspired by Soros, I read fifty pages of *The Open Society* and feverishly bought all the Popper titles I could get my hands on lest they run out of stock (86).

** I do not believe that dryness of language adds to scholarly quality… or that… "I" should be banned…. Here I have chosen a more personal style, one that retains ample emphasis on scholarship yet will be accessible to a variety of readers (88:*xv*).

In Search of the Unity of Nature. We have come to far to leave this synthesis to chance – sensory order (1) is far to unpredictable for that.* Therefore we'll break down the fourth wall and reveal *deus ex machina,* our utilization of an old Hollywood adage: (*i*) Tell the people what they're going to see, (*ii*) show it to them, then (*iii*) tell them what they saw. We heard (*i*) in §'s 1-5, saw (*ii*) in § 6, and now we're bring it all together (*iii*) in § 7 – the third and final act of this high-stakes drama – and endeavouring to insure that the giraffe was not missed amongst the many trees.

On several occasions we have drawn attention to the fact that the theory presented here is a theoretical *exploration* of fundamental global issues; however, it was derived during the course of a very long and very *literal exploration* of our wonderful world of islands. Several key voyages have been chronicled, contextualized, and annotated with methodological desiderata (*cf.* 5); but we will offer a brief overview of our uncommon approach: Although much has been written upon the travels, trials, travails, circumnavigation, and island-hopping explorations of the two famed Linnean Fellows who, on July 1st,1858, tabled a theory (*cf.* 62) 'to which all theories, all hypothesis, all systems must bow and satisfy in order to be thinkable and true, a light which illuminates all facts' (of which, more to follow), much less has been offered regarding their mentor, the lone guide and bright, shining star who had inspired their interdisciplinary ways:†

> For Humboldt, 'the unity of nature' meant the interrelation of all…sciences….
>
> Instead of trying to pigeonhole the natural world into prescribed classifications, Kant had argued, scientists should work to discover the underlying scientific principles at work, since only those general tenets could fully explain the myriad natural phenomena…. Humboldt agreed with Kant that a different approach to science was needed, one that could account for the harmony of nature… The scientific community, despite prodigious discoveries, seemed to have forgotten the Greek vision of nature as an integrated whole…. 'Rather than discover new, isolated facts I preferred linking already known ones together,' Humboldt later wrote. Science could only advance 'by bringing together all the phenomena and creations which the earth has to offer. In this great sequence of cause and effect, nothing can be considered in isolation.' It is in this underlying connectedness that the genuine mysteries of nature would be found.
>
> This was the deeper truth that Humboldt planned to lay bare… For only through travel, despite its accompanying risks, could a naturalist make the diverse observations necessary to advance science beyond dogma and conjecture. Although nature operated as a cohesive system, the world was also organized into distinct regions whose unique character was the result of all the interlocking forces at work in that particular place. To uncover the unity of nature, one must study the various regions of the world, comparing and contrasting the natural processes at work in each.
>
> The scientist, in other words, must become an explorer (77:*23-27*).

Yes, despite glorious victories, it seems we have forgotten the Greek vision of nature. Scattered about like seeds without soil – countless 'specialists' focused upon quasi-global, yet inherently singular 'issues', champion their narrow and inevitably misguided agendas: world peace, ecological preservation, economic prosperity, equal opportunity, biodiversity, disarmament, water purity, food security, freedom of speech, income/resource redistribution, marine mammal protection, affirmative action, the right to bear arms, *etc.*—without stopping to consider how or if their proposed solutions might conflict with a host of interconnected and invariably interdependent problems/solutions: As exemplified in our introduction, a strong call for the redirection (and thus redistribution) of much of our natural resources was tabled without weighing what may be lost or rendered improbable by doing so, or how and to what extent other global threat (*i.e., Axioms IV-V*) mitigation missions might be compromised.

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* Since his death in 1992, Hayek's scholarship has become the subject of an extensive reappraisal…. A previously neglected work—*The Sensory Order*—has crucial importance (89:*abstract*).

† In the vast army of those who felt Humboldt's impact, perhaps one stands out above the others. He was a young dreamy British naturalist who was so moved by Humboldt's accounts of his journey that he committed whole passages to memory and longed to make a similar voyage one day. When he was offered a post onboard a ship of scientific discovery in 1831, the young man quickly accepted, packing his copy of Humboldt's *Personal Narrative*. The ship was the *Beagle*, the young man Charles Darwin. Throughout his own epic voyage, Humboldt's text was his constant companion and guide. In *The Voyage of the Beagle*, Darwin cited Humboldt no fewer than seventeen times….

Humboldt… inspired him to devote his life to science. In his autobiography, Darwin wrote, 'During my last year at Cambridge, I read with care and profound interest Humboldt's *Personal Narrative*. This work and Sir J. Herschel's *Introduction to the Study of Natural History* stirred up in me a burning zeal to add even the most humble contribution to the noble structure of Natural Science. No one or a dozen other books influenced me nearly so much as these two' (77:*xx*).

Meanwhile, of course, much of the Western world (including U.S. President Obama, apparently) – besieged with often contradictory distress calls which thunder upon all shores in endless sets of media maydays – surrenders focus and critical thinking capacity in an Orwellian nightmare by watching Kanye West throw a hissy-fit at the MTV Video Music Awards (90).*

But the most glaring issues are impossible to ignore: perhaps at the pinnacle of public perception is *The Problem of Global Warming*. Indeed, amongst *Global Issues* students at The University of Prince Edward Island, this is by far the most commonly cited issue. And why wouldn't it be? On the cover of *Vanity Fair* they find Leonardo DiCaprio (looking rather awkward in crampons and a bit thin for a polar explorer),† and they have seen and been inspired by the Academy Awarded and Nobel Prized *Inconvenient Truth*. Articles like *Eco-celebrity A-list; who are the real green players?* adorn the web, and Eco-idols, Eco-Entrepreneurs, and the IPCC insist we halt 'global warming' immediately. The UN's Climate Summit, being held this very week in Copenhagen, yields today's headlines: *Hugh Jackman Turns Eco-Hero For Climate Week NYC:*

> 'I hope to be a voice for the billion people in developing countries who will be the hardest hit by changing weather patterns, by the droughts and floods that destroy their crops and threaten their food security,' said Jackman. 'Climate Week NYC provides an ideal forum to help underscore the urgency for world leaders to secure and fund an ambitious global climate change deal in Copenhagen that is effective, fair and binding' (93).

But is it possible that this 'ideal forum' has the unsavoury effect of horse-blinders? Is it possible that our Eco-Hero's have unwittingly become our enemies instead? Has 'global warming' been sufficiently defined? What lost opportunities are associated with their proposed solutions? Could these solutions compromise our ability to mitigate other, potentially greater global threats (*i.e., Axioms IV-V*)? DiCaprio is a good looking guy with a hot girlfriend and a highschool education, but perhaps Hawking's clear message (10) is more credible?‡

Jarvis, Fowler, and others (including myself) also note that one of our greatest threats may actually be *mass starvation*, and thus *in situ* landrace production (*cf.* 95),§ *ex situ* conservation, and the evolutionary stability of artisnal subsistence methods** must be balanced here on earth while Hawking's search for a better world must persist in space.

On the Open Society & Its Enemies. Our introduction closed with a note on dangerous ideologies,†† thus perhaps we should book-end this argument with a more in-depth exploration of this illusive point.

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* What is becoming a scarce resource is any sense of the significance of this welter of information. We are losing the sense of what matters, of the habits of mind that can be traced to a loss of context (91:*13*).

† Knut, [a polar bear cub born in captivity at the Berlin Zoo] has become a powerful… symbol of what this planet has to lose to global warming. Such ecological concerns are familiar to actor and environmental activist Leonardo DiCaprio, so it seemed natural to pair [them] on Annie Leibovitz's cover for this year's Green Issue. …Leibovitz… captured… DiCaprio at the Jökulsárlón glacier lagoon, in southeast Iceland (92).

‡ Stephen Hawking is considered the most brilliant theoretical physicist since Einstein. He has also done much to popularize science. His book A Brief History of Time, sold more than 10 million copies in 40 languages, achieving a kind of success almost unheard of in the history of science writing….

He studied physics at University College, Oxford, received his Ph.D. in Cosmology at Cambridge and since 1979, has held the post of Lucasian Professor of Mathematics. The chair was founded in 1663 with money left in the will of the Reverend Henry Lucas, who had been the Member of Parliament of the University. It was first held by Isaac Barrow, and then in 1669 by Isaac Newton. It is reserved for those individuals considered the most brilliant thinkers of their time.

Professor Hawking has worked on the basic laws that govern the universe. With Roger Penrose, he showed that Einstein's General Theory of Relativity implied space and time would have a beginning in the Big Bang and end in black holes. The results indicated it was necessary to unify General Relativity with Quantum Theory, the other great scientific development of the first half of the twentieth century. (94:*1266*).

§ Of the two hundred and fifty thousand known plant species in the world, only about two hundred are cultivated for food, and the vast majority of the world's food comes from just twenty crops, in eight plant families (35:*2*).

** Artisinal subsistence skills are my emphasis – though I believe Jarvis, Fowler, Russell Fielding, and others may echo this point. I will also add that the 2nd Amendment offers ESS which ever-few seem able to comprehend. Vegetius noted this long ago (*cf.* 18).

†† Every period in the history of civilized man was dominated by a definite set of ideas or ideologies. This is as true for the ancient Greeks as for Christianity, the Renaissance, the Scientific Revolution, the Enlightenment, and our modern times. It is a challenging question to ask what the source is of the dominating ideas of our present era. One can ask this question also in different terms. For instance, which books have had the greatest impact on current thinking? Inevitably, the *Bible* would have to be mentioned in the first place. Up to 1989, when the bankruptcy of Marxism was declared, Karl Marx's *Das Kapital* would clearly have been in second place, and it is still the dominating influence in many parts of the world (96:*488*).

The chaotic aftermath of *WWI* drew Popper (a young boy at the time) and many other Austrians into Marxist theory, which at the time, was being taught as *scientific socialism*. However, over time, Popper began to notice logical inconsistencies; he began to wonder if 'socialism' was a science or if it was merely a dangerous ideology in disguise:

> I had accepted a dangerous creed uncritically, dogmatically. The reaction made me… a sceptic.… By the time I was seventeen… I realized the dogmatic character of the creed, and its incredible intellectual arrogance. It was a terrible thing to arrogate to oneself a kind of knowledge which made it a duty to risk the lives of other people for an uncritically accepted dogma, or for a dream which might turn out not to be realizable. It was particularly bad for an intellectual, for one who could read and think. It was awfully depressing to have fallen into such a trap.
>
> Once I had looked at it critically, the gaps and loopholes and inconsistencies in the Marxist theory became obvious.…
>
> It took me some years of study before I felt with any confidence that I had grasped the heart of the Marxian argument.… Even then I had no intention of publishing my criticism of Marx, for anti-Marxism in Austria was a worse thing than Marxism.… It was not till sixteen years later, in 1935, that I began to write about Marxism with the intention of publishing what I wrote. As a consequence, two books emerged between 1935 and 1943 – *The Poverty of Historicism* and *The Open Society and Its Enemies*.…
>
> Later, in my *Logik der Forschung* [38], I dealt with this problem very fully (51:*34-43*).

Yes, Popper did fully deal with this problem: In his 1974 *Sveriges Riksbank Prize Lecture,* his fellow Austrian and intellectual brother offered testimony for his solution to an incredibly global issue (*Axiom VI*):

> If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not – a test which I am sure some doctrines now widely accepted as scientific would not pass (85:*126*).

Alas, the rise of ideological environmentalism suggests that Popper's test has not been employed and Hayek's warning has not been well heeded. Tragically, environmentalism may actually pose a great *threat* to the human race:

> The environmentalist diagnosis of the problems facing humanity is that modern societies are destroying the Earth and thus imperilling humanity. The cure they recommend is a series of sweeping policies that would radically reshape how the world works (8:*xxi*).*

Yes, our *Axioms* illustrate that the environmentalists' drive to *reshape* how the world works was launched without sufficiently understanding of *how* it works.

Our second example speaks to this very point. The following tale of an earnest problem-solver who learned this difficult lesson in the manner in which all such lessons must ultimately be learned—with great difficulty.

The story is told of a young surfer-poet who had unwittingly accepted the environmentalists' creed. As days, months, years and endless waves rolled by beneath the southern California sun, he became increasingly concerned – *and increasingly and singularly focused upon – The Problem of*

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* The past is secure. It is unalterable. The seal of eternity is upon it. The wisdom, which it has displayed, and the blessings, which it has bestowed, cannot be obscured; neither can they be debased by human folly, or by human infirmity. The future, is that, which may well awaken the most earnest solicitude, both for the virtue and the permanence of our Republic. The fate of other republics, their rise, their progress, their decline, and their fall, are written but too legibly on the pages of history, if indeed, they were not continually before us in the startling fragments of their ruins.

Those republics have perished; and have perished by their own hands. Prosperity has enervated them; corruption has debased them; and a venal populace has consummated their destruction… They have disregarded the warning voice of their best statesmen; and have persecuted and driven from office their truest friends. They have listened to the councils of fawning sycophants, or base calumniators of the wise and the good… They have surrendered to faction, what belongs to the common interests and common rights of the country. Patronage and party, the triumph of an artful popular leader, and the discontents of a day, have outweighed, in their view, all solid principles and institutions of government. Such are the melancholy lessons of the past history of republics down to our own.…

In theory, a government may promise the most perfect harmony of operations in all its various combinations. In practice, the whole machinery may be perpetually retarded, or thrown out of order by accidental maladjustments.… Every change discomposes for a while the whole arrangements of the system. What is safe, is not always expedient; what it new, is often pregnant with unforeseen evils, or attracts only by imaginary good (97:*325*).

Global Warming. He began to read, he began to think, and in doing so, he grew progressively anxious about the fate of the West Antarctic Ice Sheet, the polluted waters in which he surfed, and the plight of the many majestic marine mammals with whom he shared the waves along the Pacific coast—from the Ventura county line to Punta de Mita, Mexico. Thus he decided to do something about it: he endeavoured to write a novel—*a poignant parable with a clear message which would compel his fellow man to take drastic actions*. He dedicated a year of research at the Kewalo Basin Marine Mammal Intelligence Laboratory to inspire his first novel, *The Song of the Dragonfly* (98), the journey of David Everett, a reluctant hero who runs the gauntlet all heroes must run, aligns himself with a lyrical blue whale, sacrifices himself, and saves the world while he's at it.

Curiously, though perhaps no coincidence, our surfer-poet was inspired by the writings of the esteemed – *though hopelessly confused* – Professor we encountered in our introduction. As our would-be novelist concluded on the final page of his *Afterword*:

> In *Biophilia*—arguably one of the most important pieces of twentieth century nonfiction, E.O. Wilson suggests that every man, woman, child, dolphin, grain of wheat, humming-bird, turtle, flower, and treefrog is bound in an indispensable and inexplicable tapestry, woven from the celestial loom of a Mysterious Weaver.
>
> The ultimate design is unknowable. Which—if any—golden strands of thread can be snipped without unraveling this luxurious fabric of existence? Dependency of this sort—interdependence—is therefore incalculable, forever unknowable, and thus of unquantifiable value. The omission (extinction) of any one of these diverse, seemingly unrelated links could be enough to yield devastating results, consequences beyond prediction or comprehension. Who knows what small plant nestled in the undergrowth of a distant African savanna, or what fungi dusting the leaves of a Brazilian rainforest treetop canopy hold the antidote to a coming plague? And who knows what creature holds the key to unlock the mysteries of your own soul, the words to your dragonfly song? This level of protection—effectively granting rights to all living things—may sound extreme, but there was a time when the idea of granting rights to women seemed extreme to some, and there was a time when the idea of granting rights to African-Americans seemed extreme to others.
>
> In 1900 there were 100,000 tigers living in the wild, mostly along the Siberian border with China. Today there are less than 5,000. Our children's children will never see a wild tiger. The great cat's fate is inevitable—the domino is falling and the angle of incident is past the point of no return—this fierce hunter will pass silently into the night which never ends. What other dominos will fall with the tiger? Daisaku Ikeda suggested that a great revolution of character in just a single man or woman could help achieve a change in the destiny of a nation and further, would cause a change in the destiny of all mankind. Perhaps this is true. Perhaps this was the case with David Everett. And perhaps this holds true for you (98:*236-237*).

But did our well-meaning but self-righteous scribe fail to take into account that perhaps he – *not his intended audience* – was the one most in need of a personal transformation? That his desire to reshape how the world works was founded upon a false understanding of *how* the real world actually works?

In any case, our surfer-poet met decisive defeat and – *thankfully* – failed (at this stage in the game, anyway) to change the world.

But he did not let his fire go out.*

He reconsidered the course he was on, charted a new one, and set sail on an search for truth and an exploration of the philosophical foundations of science, including three of the most illusive and dimly seen problems in economics: *The Problem of Induction* (*cf. Axiom VI*), *The Problem of Axiology,*† and *The Problem of Economic Power* (*cf.* 5).‡

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* Do not let your fire go out, spark by irreplaceable spark, in the hopeless swamps of the approximate, the not-quite, the not-yet, the not-at-all. Do not let the hero in your soul perish, in lonely frustration for the life you deserved, but have never been able to reach. Check your road and the nature of your battle. The world you desired can be won, it exists, it is real, it is possible, it's yours (99:*1069*).

† In economics the most fundamental… central problem is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money (100:*61*).

‡ Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war….

Apart from the economic power of labour, all other economic

Midway along the long road he traveled alone, he discovered that "economics teaches us that things are not always as they appear" (17:*17075*), and was thus bestowed with one of the greatest gifts such a search has to offer. He pressed on, where, twice blessed, he received one of the most valuable gems of evolutionary wisdom as well: "Nothing makes sense in biology except in the light of evolution" (70:*449*). Though well-warranted attention has been devoted to this observation (102), the extraordinary reach of its far-reaching light escapes most yet today, because nothing *on earth* makes sense except in the light of evolution.

> Is evolution a theory, a system, or a hypothesis? It is much more, it is a general postulate to which all theories, all hypothesis, all systems must henceforward bow and which they must satisfy in order to be thinkable and true. Evolution is a light which illuminates all facts, a trajectory which all lines of thought must follow, this is what evolution is (103:*129*).

Is it indeed true that all systems – all theories – must bow to this postulate in order to be thinkable and true?

Absolutely.

For example, next month I plan to attend the 7th *Annual Global ARC* in Boston. My desire to attend was sparked by a reflection of this profound truth in their brochure:

> Structurally, the market turbulence of 2007 and 2008 has profoundly shaken confidence in traditional physics based approaches to modelling financial structures. Rather than merely tweak existing physics models, Andrew Haldane of the Bank of England, Professor Lord Robert May, Baron of Oxford and Fellow of Oxford University and Professor George Sugihara of UC San Diego will argue that a more radical shift may be required: a full scale migration to biology based financial models (104:*2*).

Not only are we arguing this very point, the implications which follow from our *Axioms* testify to the truth of this conjecture. A recent letter to Kenneth Griffin (with the theory presented here enclosed therein) attempted to illustrate the magnitude and dire consequences of this point as well (105).

On Political Agendas & Correction-Of-Error.

Before parting ways, perhaps it may also prove wise to anticipate an argument and fully emphasize the most critical and fundamental aspect of the problem-solving process.

First, in light of the fact that your Author may be unknown to you, Dear Reader, there may be some concern that the theory presented here was constructed in order to support *political beliefs*. Perhaps the thought has crossed a few minds that I am not the *naturalist* I claim to be, but rather an (*i*) Indiana-borne, (*ii*) Chevy truck driving, (*iii*) NRA card-carrying, (*iv*) member of the G.O.P.—and therefore (*v*) this discourse represents *a conflict of interest,* a thinly veiled effort to forward a *political agenda*.

Many writers would face great difficulty fending off such suspicions, as a meaningful defense may depend upon producing convincing evidence that such suspicions are unfounded. However, *My Error* (see APPENDIX II) offers unimpeachable testimony for the integrity of this scholarship. Indeed, Dear Reader, although (*i-iv*) may be true, they were not *always* true, and they did not influence (*v*); *rather, it was quite the other way around*—the theory presented here represents the *scientific discovery* which informed (*i-iv*), because, once upon a time not long ago, your Author was none other than that confused and misguided surfer-poet who had failed to recognize the 'unity of nature,' fallen into an intellectual trap, and unwittingly accepted the dangerous creed of ideological environmentalism.

Thus, not only was the theory presented herewith developed from neutral ground, it was in fact developed from a pre-existing bias which held the exact opposite of this discovery to be true. But, thankfully, in time, your Author came to recognize his error, and thus recognize that *The Problem of Global Warming* is not actually 'the' problem; rather, it is merely one aspect of the larger, more complex *Problem of Sustainable Economic Development*.

Some may question the wisdom of drawing attention to – perhaps even celebrating – one's errors (especially an error as humiliating as the foolish nonsense noted above), but Sir John Eccles once contextualized the relevance of this *modus operandi,* and emphasized its crucial in the problem-solving process, and the development of science:

> Until 1945 I held the following conventional ideas about scientific research – first, that hypothesis grow out of the careful and methodical collection of experimental data. This is the inductive idea of science deriving from Bacon and Mill. Most scientists and philosophers still believe that this is the scientific method....

power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it (101:*95*).

> That was my trouble. I had long espoused an hypothesis which I came to realize was likely to have to be scrapped, and I was extremely depressed about it....
>
> At that time I learnt from Popper that it was not scientifically disgraceful to have one's hypothesis falsified. That was the best news I had had for a long time. I was persuaded by Popper, in fact, to formulate my electrical hypothesis of excitatory and inhibitory synaptic transmission so precisely and rigorously that they invited falsification – and, in fact, that is what happened to them a few years later... Thanks to my tutelage by Popper, I was able to accept joyfully this death of the brain-child which I had nurtured for nearly two decades...
>
> I had experienced the last great liberating power of Popper's teachings on scientific method (39:*12-13*).

Popper also once reflected upon the significance of Eccles' intellectual breakthrough,

> In his Nobel Prize biography, Eccles writes: 'Now I can even rejoice in the falsification of a hypothesis I have cherished as my brain-child, for such falsification is a scientific success.'
>
> This last point is extremely important. We are always learning a whole host of things through falsification. We learn not only *that* a theory is wrong; we learn *why* it is wrong. Above all else, we gain a *new and more sharply focused problem*; and a new problem, as we already know, is the real starting point for a new development in science (39:*13*).

On the Problem of Global Issues. University of Prince Edward Island *Global Issues 151* students handed in their first assignments last week, addressing: *What global issue requires the most urgent action and what role can you play in helping to address it?* One of my students began his essay as follows:

> In an age with an international AIDS epidemic, wars, countless human-rights abuses, and poverty, it is often difficult to determine a method for classifying global issues, and to decide which ones are most important, and which ones should be left out of our discussions" (106:*1*).

What method should we use? Has anyone synthesized our most mission-critical threats, conflicts, and evolutionary objectives within a unified theory? Who is searching *real* solutions?

I am.

And that was our feature presentation.

In Search of a Better World. In closing, perhaps now that we're feeling anxious to set sail over perilous seas* in search of solutions, I'll suggest the long way. Although this may appear to present a tedious and unwanted detour,

> in this age, which believes that there is a short cut to everything, the greatest lesson to be learned is that the most difficult way is, in the long run, the easiest (108:*12* ; *cf.* 109).

Thus, taking time for that proper introduction (*cf.* 5), may save time and confusion, since the solution to *The Island Survival Game*† informs the solution to the problem of human survival on the island of Earth as well.‡ Moreover, we'll need to solve the most fundamental central problem in economics by recognizing that *The Struggle for Life* is, in essence, an endless drive toward *insularity* (*cf.* 5), and thus, furthermore, discovering that economic and evolutionary *Value* (V) is a *derivative function* (f') of *relative insularity* (I_R) $\Rightarrow V = f'(I_R)$.

"This sketch is most imperfect; but in so short a space I cannot make it better. Your imagination must fill up very wide blanks" (110:*50* ; *cf.* 111).§

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* There are 'perilous seas' in the world of thought, which can only be sailed by those who are willing to face their own physical powerlessness (107:*22*).

† *The Island Survival Game* is an asymmetric, noncooperative sub-game of the *Earth Island Survival Game;* it is a bounded delay game which models economic development on islands and *Relatively Insular States*. Darwinian fitness is measured by *Resource Holding Power* (RHP), the ability to sustain economic development and hold territory, thus vanquishing *The Tragedy of the Commons* (*cf.* 5).

‡ *The Earth Island Survival Game* is an asymmetric, non-cooperative, bounded (≈50,000 Yr) delay (87 Yr) supergame which models *Homo sapiens'* struggle for life; our *Axioms* provide the 'rules of the game'. Our 'gameboard' includes a single element, Earth: $\{I_1\}$. 'Players' – bio-geo-politico-economic territories distinguishable by relative insularity (sovereign islands, continental nations, and EEZ's) – are, based upon RHP, classified as *Relatively Insular States* (RIS) or *Globalized Economic Military Superpowers* (GEMS). These 'player' compete, cooperate, and struggle for survival: RIS $\{i_1, i_2, i_{3,\ldots}i_n\}$ ∪ GEMS $\{g_1, g_2, g_{3,\ldots}g_n\}$ fight for survival within $\{I_1\}$.

§ Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels.... And... there's no better glimpse into [Einstein's] offbeat creativity than the way he puzzled out the special theory of relativity.... Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern.... Other scientists had come close to his insight, but they were too confined by the dogmas of the day. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics... 'Imagination is more important than knowledge,' Einstein... said. Indeed, if we [seek] a unified theory... we should carve that proclamation above all of our blackboards (112:*35-36*).

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APPENDIX I

A TWO*PERSON DILEMMA

Two men, charged with a joint violation of law, are held separately by the police. Each is told that

(1) if one confesses and the other does not, the former will be given a reward of one unit and the latter will be fined two units,

(2) if both confess, each will be fined one unit.

At the same time each has good reason to believe that

(3) if neither confesses, both will go clear.

This situation gives rise to a simple symmetric two-person game (not zero-sum) with the following table of payoffs, in which each ordered pair represents the payoffs to I and II, in that order:

		II	
		confess	not confess
I	confess	(-1, -1)	(1, -2)
	not confess	(-2, 1)	(0, 0)

Clearly, for each man the pure strategy "confess" dominates the pure strategy "not confess." Hence, there is a unique equilibrium point* given by the two pure strategies "confess." In contrast with this non-cooperative solution one sees that both men would profit if they could form a coalition binding each other to "not confess."

The game becomes zero-sum three-person by introducing the State as a third player. The State exercises no choice (that is, has a single pure strategy) but receives payoffs as follows:

		II	
		confess	not confess
I	confess	2	1
	not confess	1	0

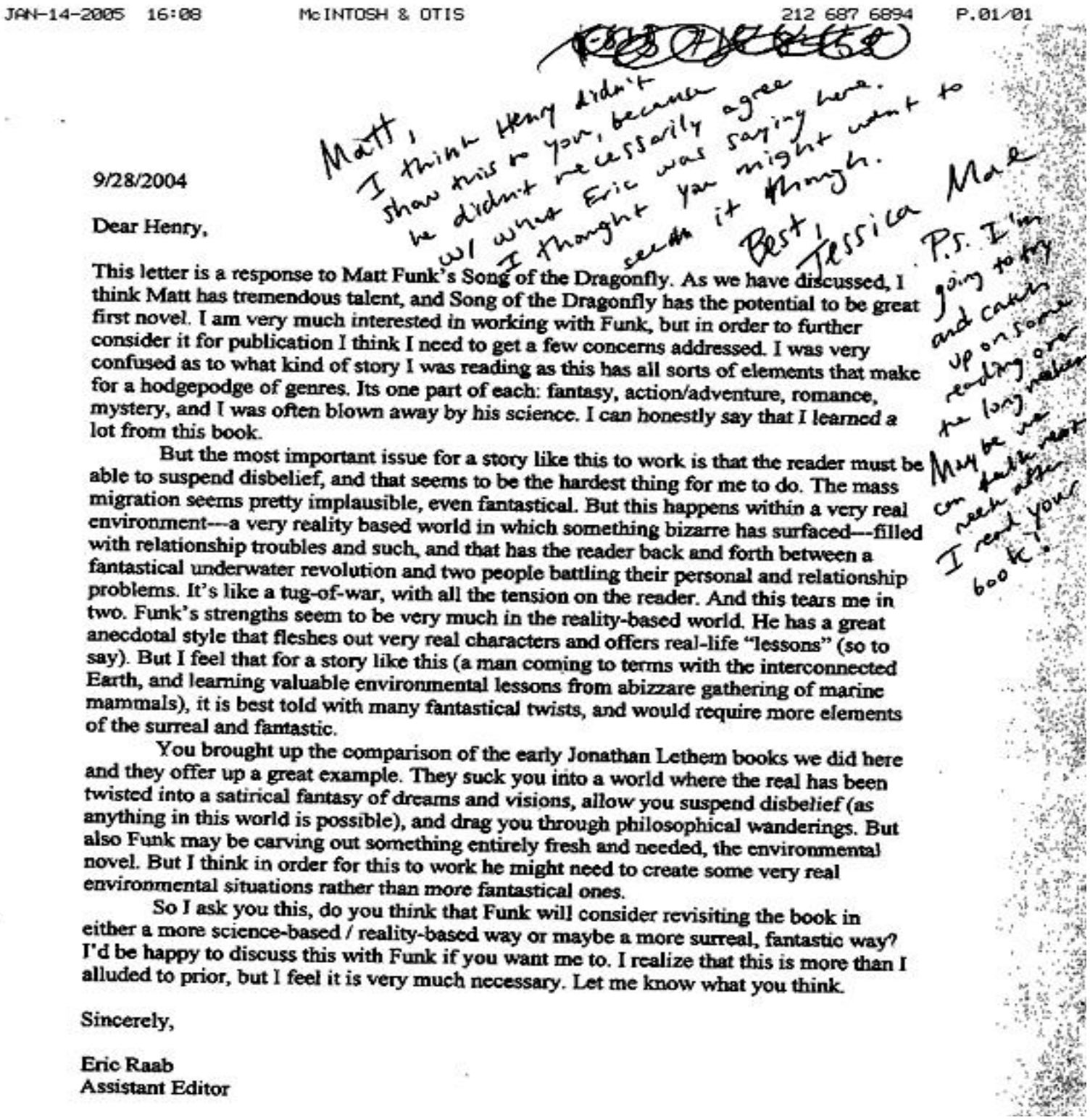
*see J. Nash, PROC. NAT. ACAD. SCI. 36 (1950) 48-49.

Stanford, May 1950 A. W. Tucker

Tucker A (1950) *A Two*Person Dilemma* (Public Domain).

APPENDIX II

MY ERROR



JAN-14-2005 16:08 McINTOSH & OTIS 212 687 6894 P.01/01

Matt,
I think Henry didn't show this to you, because he didn't necessarily agree w/ what Eric was saying here. I thought you might want to see it though.
Best, Jessica Mae

9/28/2004

Dear Henry,

This letter is a response to Matt Funk's Song of the Dragonfly. As we have discussed, I think Matt has tremendous talent, and Song of the Dragonfly has the potential to be great first novel. I am very much interested in working with Funk, but in order to further consider it for publication I think I need to get a few concerns addressed. I was very confused as to what kind of story I was reading as this has all sorts of elements that make for a hodgepodge of genres. Its one part of each: fantasy, action/adventure, romance, mystery, and I was often blown away by his science. I can honestly say that I learned a lot from this book.

But the most important issue for a story like this to work is that the reader must be able to suspend disbelief, and that seems to be the hardest thing for me to do. The mass migration seems pretty implausible, even fantastical. But this happens within a very real environment---a very reality based world in which something bizarre has surfaced---filled with relationship troubles and such, and that has the reader back and forth between a fantastical underwater revolution and two people battling their personal and relationship problems. It's like a tug-of-war, with all the tension on the reader. And this tears me in two. Funk's strengths seem to be very much in the reality-based world. He has a great anecdotal style that fleshes out very real characters and offers real-life "lessons" (so to say). But I feel that for a story like this (a man coming to terms with the interconnected Earth, and learning valuable environmental lessons from abizzare gathering of marine mammals), it is best told with many fantastical twists, and would require more elements of the surreal and fantastic.

You brought up the comparison of the early Jonathan Lethem books we did here and they offer up a great example. They suck you into a world where the real has been twisted into a satirical fantasy of dreams and visions, allow you suspend disbelief (as anything in this world is possible), and drag you through philosophical wanderings. But also Funk may be carving out something entirely fresh and needed, the environmental novel. But I think in order for this to work he might need to create some very real environmental situations rather than more fantastical ones.

So I ask you this, do you think that Funk will consider revisiting the book in either a more science-based / reality-based way or maybe a more surreal, fantastic way? I'd be happy to discuss this with Funk if you want me to. I realize that this is more than I alluded to prior, but I feel it is very much necessary. Let me know what you think.

Sincerely,

Eric Raab
Assistant Editor

P.S. I'm going to try and catch up on some reading over the long weekend. Maybe we can talk next week after I read your book.

Cf. Funk M (2005) *The Song of the Dragonfly*. Unpubl. Novel:1-238. http://files.me.com/mattfunk/z53g1t

* The author would like to thank Eric Raab, Henry Williams, and Jessica Mae Pavlas for permission to publish this correspondence.

On the Truly Noncooperative Game of Island Life: Introducing a Unified Theory of Value & Evolutionarily Stable Island Economic Development Strategy

Funk, Matt
The Linnean Society of London

04. July 2009

On the Truly Noncooperative Game of Island Life:

Introducing a Unified Theory of Value

&

Evolutionary Stable Economic Development Strategy

4 July 2009

Independence Day[*]

Author:

Matt Funk,[‡§] Fellow

The Linnean Society of London[**]

Naturae Discere Mores

---

* I liked America from the first, perhaps because I had been somewhat prejudiced against it. There was in 1950 a feeling of freedom, of personal independence, which did not exist in Europe and which, I thought, was even stronger than in New Zealand, the freest country I knew. These were the early days of McCarthyism… but judging by the general atmosphere I thought that this movement, which was thriving on fear, would in the end defeat itself. On my return to England I had an argument about this with Bertrand Russell….

The greatest and most lasting impact of our visit was made by Einstein. I had been invited to Princeton, and read in a seminar a paper on [quantum and classical physics]… In the discussion Einstein said a few words of agreement, and Bohr spoke at length….

I learned to my surprise that Einstein thought my suggestions concerning simplicity… had been universally accepted, so that everybody now knew that the simpler theory was preferable because of its greater power of excluding possible states of affairs; that is, its better testability….

It is difficult to convey the impression made by Einstein's personality. Perhaps it may be described by saying that one felt immediately at home with him, his good sense, his wisdom, and his almost childlike simplicity. *It says something for our world, and for America, that so unworldly a man not only survived, but was appreciated and so greatly honoured.*

—Sir Karl Popper, *Unended Quest*, 1992

‡ I only know that he who forms a tie is lost. The germ of corruption has entered into his soul.

—Joseph Conrad, *Victory: An Island Tale*, 1915

⇒ The Author declares no conflict of interest.

§ Correspondence: matt@funkisland.org

** Burlington House, Piccadilly, London W1J 0BF, United Kingdom

DEDICATION

For Benjamin Joseph Funk Jr.

Born in London, England, on this very day, the 4th of July, 2009.

A remarkable feat of long-distance dispersal to an island:

from the former Union of Soviet Socialist Republics (♀$_1$)

and the United States of America (♂$_1$)

to the United Kingdom (♀$_1$ + ♂$_1$ + ♂$_2$).

Joshua Slocum was the first man to sail around the world in a small boat with none but himself as captain, mate and crew. Other men may repeat the feat. No other man can be the first.... He wrote of his ship and his voyage, and it never occurred to him that in doing so he was forging a bond between the English whose blood was in his veins and the Americans under whose flag he was proud to circumnavigate the world....

Captain Joshua Slocum was born in Nova Scotia in 1844. His father was a farmer, but for many generations his had been a seafaring family and, like most small boys along that coast, he spent every minute of his holidays in and out of small boats, though like many other sailors he never learned to swim. He was eight years old when his family moved to Briar's Island and he left school and was put to work on the farm. At the age of twelve he was caught making a ship model in the cellar where he should have been grading potatoes, was given a beating, saw his model smashed and ran away from home. For the next few years he earned a living for himself, as cook, ship's boy and what not, among the fishermen on the Bay of Fundy. At the age of sixteen he and a friend sailed before the mast in a full-rigged ship from St. John's [*sic*], New Brunswick, to Dublin. We next hear of him as an ordinary seaman in a British ship, sailing from England to China. He went down with fever and was left in a hospital at Batavia. There he made a very good friend in Captain Airy of the S.S. *Soushay*. He left Batavia in the *Soushay*, and in that vessel voyaged at many far-eastern ports. He can have lost no opportunity of educating himself, for at eighteen he was promoted to second mate. He twice rounded the Horn in British ships.

—Arthur Ransome, July 1947

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APPENDICES

TABLE

MAP

PRÉCIS

This discourse offers a solution to *The Problem of Sustainable Economic Development* on islands. This hypothesis offers a foundational, sub-game solution to *The Island Survival Game,* a counter-intuitive, dominant economic development strategy for 'islands' (and relatively insular states). This discourse also tables conceptual building blocks, prerequisite analytical tools, and a guiding principle for *The Earth Island Survival Game*, a bounded delay supergame which models *The Problem of Sustainable Economic Development* at the global level. We begin our exploration with an introduction to *The Principle of Relative Insularity*, a postulate which informs ESS for 'island' and 'continental' players alike. Next, we model 'island' economic development with two bio-geo-politico-economic models and respective strategies: *The Mustique Co. Development Plan*, and *The Prince Edward Island Federal-Provincial Program for Social and Economic Advancement.* These diametrically opposed strategies offer an extraordinary comparative study. One island serves as a highly descriptive model for *The Problem of Sustainable Economic Development;* the other model informs ESS. *The Earth Island Survival Game* serves as a remarkable learning tool, offering lessons which promote islander survival, resource holding power, cooperative behaviour, and independence by illuminating the illusive path toward sustainable economic development.

Key Terms:

Non-cooperative games, evolutionary game theory, relative insularity, islands, tragedy of the commons, sustainable economic development, theory of value, resource holding power, evolutionary stable strategy, natural selection, long-distance dispersal

Matt Funk – 465 University Avenue – No. 21021– Charlottetown – Prince Edward Island – Canada – C1A-9H6

Nothing is easier than to admit in words the truth of the universal S*truggle for Life*, or more difficult—at least I have found it so—than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.

—Charles Darwin, Esq., FLS, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life,* 1859

The Linnean Society of London
Burlington House
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12 February 2009*

RE: *On the Problem of Sustainable Economic Development, Human Survival,*† *& Fellowship*

Dear Fellows:

I find myself caught in an unenviable dilemma—caught between the obligation to disclose the vastness of my ignorance,‡ and my responsibility to bring a great discovery to your attention.§

Therefore, perhaps I should state clearly from the outset that…

---

* Two hundred years ago [today], two of the most influential men of all time were born…, one in a three-story country mansion in Shrewsbury, in Shropshire, England, and the other in a one-room, dirt-floor frontier cabin in Kentucky.

Many believe English biologist Charles Darwin and American statesman Abraham Lincoln did more to change the world than any other figures in 19th Century history. Historians credit the pair with guiding the world into modernity.

Darwin did it by piecing together the theory of evolution, which… so thoroughly blew apart conventional scientific, religious and social thought and theory that 150 years later the dust still hasn't settled.

When Lincoln became president in 1861, much of the world still regarded the American ideal of democracy as a shaky, unstable experiment on the verge of failing.

Lincoln lived and validated the American dream… He saved the American experiment in its severest test, and validated the nation's founding documents by ridding us of slavery (1:*1*).

† The modern hero, the modern individual who dares to heed the call and seek the mansion of that presence with whom it is our whole destiny to be atoned, cannot, indeed must not, wait for his community to cast off its slough of pride, fear, rationalized avarice, and sanctioned misunderstanding. 'Live,' Nietzsche says, 'as though the day were here.' It is not society that is to guide and save the creative hero, but precisely the reverse (2:*391, cf. APPENDIX I: GLOSSARY – Human Survival*).

‡ All the great natural scientists were intellectually modest; and Newton speaks for them all when he says: 'I do not know what I may appear to the world, but to myself I seem to have been only a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.'

Moreover, all the great scientists realized that every solution to a scientific problem raises many new and unsolved problems. Our knowledge of our ignorance becomes increasingly conscious, detailed and precise, the more we learn about the world. Scientific research is the best method we have for obtaining information about ourselves and about our ignorance. It leads us to the important insight that there may be great differences between us with regard to minor details of what we may perhaps know, yet we are all equal in our infinite ignorance (3:*40*).

§ The true responsibility of a scientist, as we all know, is to the integrity and vigor of his science. And because most scientists, like all men of learning, tend in part also to be teachers, they have a responsibility for the communication of the truths they have found (4:*91*).

I have never fancied my mind to be in any respect more perfect than those of the generality; on the contrary, I have often wished that I were equal to some others in promptitude of thought, or in clearness and distinctness of imagination, or in fullness and readiness of memory....

I will not hesitate, however, to avow my belief that it has been my singular good fortune to have very early in life fallen in with certain tracks which have conducted me to considerations and maxims, of which I have formed a Method that gives me the means, as I think, of gradually augmenting my knowledge, and of raising it by little and little to the highest point which the mediocrity of my talents and the brief duration of my life will permit me to reach. For I have already reaped from it such fruits, that, although I have been accustomed to think lowly enough of myself, and although when I look with the eye of a philosopher at the varied courses and pursuits of mankind at large, I find scarcely one which does not appear vain and useless, I nevertheless derive the highest satisfaction from the progress I conceive myself to have already made in the search after truth, and cannot help entertaining such expectations of the future as to believe that if, among the occupations of men as men, there is any one really excellent and important, it is that which I have chosen.

After all, it is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves....

This Tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favor with all (5:*preface*).

On Sleepless Nights

With this disclosure in mind, I will relate that I have been a gifted sleeper all of my life, but for the past three years,

something has been keeping me awake at night (*cf.* 6); it has also made many otherwise trivial pursuits far more wearisome.

Consider the following communiqués I mailed last week...

-------- Original Message --------
Subject: RE: The Principle of Relative Insularity
From: Matt Funk <matt@funkisland.org>
Date: Fri, 06 Feb 2009 12:23:29 -0400
To: priya@linnean.org, leonie@linnean.org, biolj@soton.ac.uk, library@linnean.org

Greetings from Prince Edward Island!

As I echoed in the copied email I sent just a moment ago, I am writing to report a discovery.

As I noted, I'm about to board a flight, and whenever I do so, the thought of the loss of this solution becomes a bit unnerving!

I hope this rough abstract [*cf.* 6] outlines my discovery in sufficient light.

Fortune* willing, I'll send along a refinement and more details when time permits.

Bidding you Godspeed,

Matt Funk

* She was to be found on the back of many Roman coins, holding a cornucopia in one hand and a rudder in the other. She was beautiful and usually wore a light tunic and a coy smile. Her name was Fortune. She had originated as a fertility goddess, the firstborn of Jupiter, and was honoured with a festival on the 25th of May and with temples throughout Italy, visited by the barren and farmers in search of rain. But gradually her remit had widened, she had become associated with money, advancement, love and health. The cornucopia was a symbol of her power to bestow favours, the rudder's course, maintaining an imperturbable smile as she watched us choke to death on a fishbone or disappear in a landslide.

Because we are injured most by what we do not expect, and because we must expect everything ('There is nothing which Fortune does not dare'), we must, proposed Seneca, hold the possibility of disaster in mind at all times (7:*87*).

-------- *Original Message* --------

Subject: Re: The Principle of Relative Insularity
Date: Fri, 06 Feb 2009 11:53:55 -0400
From: Matt Funk <matt@funkisland.org>
To: manastasio@lanl.gov

Sir:

First and foremost, I am writing to report a discovery which informs ESS for 'individuals' and 'individual nations' alike. This counter-intuitive, game-theoretical framework models the complex inter-dependencies which relate to your most central mission,* and, to this point, offers tenable solutions which foster national security, international cooperation, and global threat mitigation.

Secondly, please note that I most sincerely want to join your team at Los Alamos—but this matter is quite secondary to the urgency of my first point.

I am sorry that I did not have time to review or edit the first draft of the paper enclosed herewith [6], but I am boarding a plane for Chicago in an hour, and I wanted to send you this work-in-progress before tempting fate.

If you would like to meet with me, my near-term schedule is:

Tonight through Sunday: *The Union League Club of Chicago* (312.427.7800)†
16-17 February: Los Angeles: *The Los Angeles Athletic Club* (213.625.2211)
17 February - 5 March: *Waimea, Hawai'i* (808.885.1275)

On 6 March 2009 I will return to Prince Edward Island to finalize my *Researches into the Natural History of Hawai'i*, then my schedule remains quite open.

Yours very truly....Matt Funk

Upon my safe arrival in Chicago, however, I was horrified to discover the following reply:

-------- *Original Message* --------

Subject: Mail System Error - Returned Mail
Date: Fri, 6 Feb 2009 11:34:22 -0500
From: Mail Administrator
To: matt@funkisland.org

Your message is larger than the destination computer is willing to accept, so it was returned. The error message below indicates the size of your message and the maximum size allowed by the receiving E-mail system. The following recipients did not receive this message:

<priya@linnean.org> <leonie@linnean.org> <library@linnean.org> <biolj@soton.ac.uk>

Of course I should have known better: after delivering a paper in the Åland Islands last summer—under this

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* For more than six decades, the United States has trusted Los Alamos National Laboratory with its most formidable national security challenges. Perhaps the greatest threats facing the nation today are climate change and the related challenge of securing a sustainable… future. The nation's investment in the Laboratory's defense mission has fostered a host of unique scientific and technical capabilities that are also used to… mitigate the impacts of climate change, clean up conventional energy sources, and develop renewable sources and the energy storage technologies…

….For two decades, the Laboratory has also modeled energy, water, economics, and other elements of our national infrastructure with a focus on their complex interdependencies (8:*1*).

† Union College, the Union League Club. These and thousands of other familiar US landmarks, along with more than six hundred towns and cities bearing the name, testify to a once vital theme in American popular discourse. Few of those who today pass through, disembark at, or otherwise inhabit these places are likely to recognize the Union appellation as meaningful, much less as stating a profound aspiration to political unity. But from the late colonial period to the early Gilded Age, American leaders and ordinary citizens constantly expressed—in everyday talk and grand administrative planning, as well as in place names and architecture—their dreams of a 'more perfect' national union.

Beginning in the mid-1880's Americans' references to union declined sharply. So did the public testaments they left behind: of the eight states admitted since 1890, and the four lands that remain US territories today, just two included a (single) Union town or county, each established well before statehood. In succeeding years the practice was in fact reversed, as former Union cities, streets, and so forth were renamed or dismantled (9:*ix*).

menacing duress which I have been unable to escape—I had attempted to transmit a likewise ill-fated communiqué:*

> -------- *Original Message* --------
> *Subject: Re: Greetings from Stockholm!*
> *From: Matt Funk <matt@funkisland.org>*
> *Date: Tue, 17 Jun 2008 01:11:16 +0000*
> *To: "Godfrey Baldacchino" gbaldacchino@upei.ca*
>
> Here's a copy of a very rough draft of a very big book - if Fortune should twist her hand and dash my efforts to reach the shores of North America again, please do your best to clarify it all, write an introduction, find a publisher, send a third of the proceeds to my son, a third to my wife, and keep a third for yourself.
>
> Cheers! Matt

On the Difficult Art of Explaining†

In any case, I suspect that—at the very least—you may see that something heavy has been weighing on my mind, and, perhaps even recognize that, essentially, I am an illiterate American burdened by a very big idea. Although I had set out in search of a tenable economic theory of value – a solution to the most fundamental, open-problem in economics§ – after much *sturm und drang*, I recognized only a unified theory of economic *and* evolutionary value would suffice. Thus, in the end, my journey has taken me into perilous seas of thought I was ill-equipped to sail: Although I am a fairly competent mathematician, able-minded theorist, learned logician, bold speculator, and a patient, detail-orientated, relentless problem-solver**—I stumble in literary darkness, groping clumsily for words and narrative order which, more often than not, elude me. A great editor once told me that all great writing is a slow form of seduction, and, indeed, two of your brightest stars††‡‡ had the uncanny ability to seduce the human race, to spool out just the right amount of Ariadne's thread to lead the

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* *The original message was received at Mon, 16 Jun 2008 21:11:23 -0400 from ns-omr2.mgt.netsol.com [10.49.6.65]*
The following addresses had permanent fatal errors : <gbaldacchino@upei.ca> (reason: 552 Error: message too large).

† Explaining is a difficult art. You can explain something so that your reader understands the words; and you can explain something so that the reader feels it in the marrow of his bones. To do the latter, it sometimes isn't enough to lay the evidence before the reader in a dispassionate way. You have to become an advocate and use the tricks of the advocate's trade (10:*xiv*).

§ In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money (11:*61*).

** THE desire of knowledge is first stimulated in us when remarkable phenomenon attract our attention. In order that this attention be continued, it is necessary that we should feel some interest in exercising it, and thus by degrees we become better acquainted with the object of our curiosity. During this process of observation we remark at first only a vast variety which presses indiscriminately on our view; we are forced to separate, to distinguish, and again to combine; by which means at last a certain order arises which admits of being surveyed with more or less satisfaction.

To accomplish this, only in a certain degree, in any department, requires an unremitting and close application; and we find, for this reason, that men prefer substituting a general theoretical view, or some system of explanation, for the facts themselves, instead of taking the trouble to make themselves first acquainted with cases in detail and then constructing a whole (12:*xxxvii*).

†† Charles Darwin was elected a Fellow of the Linnean Society of London on 7th March 1854.... He remained an active Fellow throughout his life, using the Library as a resource and reviewing papers submitted to the Society. We also received from him copies of his publications which now are a treasured part of the Library. He died on 19th April 1882 and is buried in Westminster Abbey (13).

‡‡ Alfred Russel Wallace was elected to Fellowship of the Society somewhat later, on 18th January 1871 and remained a Fellow until his death on 7th November 1913.... By that time he was well established figure in natural history. The Society is lucky to hold a number of his manuscripts, as

unbearably shy, somnambulant human psyche through a long and tricky maze; they possessed an extraordinary range of talents—they were keen observers, deep, analytical, and consilient thinkers, *and* they also happened to be gifted with the rare ability to wax rhapsodic of beauty and grandeur, standing shoulder-to-shoulder with the greatest of your romantic prose stylists.* Alas, poetry flows not from my pen. Though I have toiled long into the night and struggled to convey the 'unity of nature' which I see so clearly in my mind's-eye, my talents are more akin to Shiro (15) than Darwin or Wallace. Although I was once even foolish enough to believe that the logical content of this letter might suffice to move a province, island nation, or more—I have reluctantly surrendered and accepted the fact that I must continue to search for the appropriate words for each and every audience, and patiently relate my elegant *theory* (*cf. GLOSSARY*) with—so it seems more likely than not—a fairly large number of simple, straight-forward words (16). I have also had that extraordinary luxury of leisure,† do not own a television, possess a fiercely independent mind, and in light of the fact that a certain amount of bold speculation and stumbling about in the dark often proves productive,‡ perhaps there is some hope.

On the Problem of Long-Distance Dispersal

Our fossil record clearly demonstrates that 99.99% of all species that have ever inhabited the earth have fallen to extinction and, as a naturalist, I grasp the menacing shadow this record casts over the prospects for human survival,§ and although I understand why the logical implications** of this grave truth have been so dimly seen,†† I have had a tough time mustering

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well as much of his biological library, often with interesting marginal annotations (13).

* It is somewhat remarkable that a man who died in 1882 should still be influencing discussion among biologists. It is perhaps equally strange that so many biologists failed for so many decades to accept ideas that Darwin expressed in clear and beautiful English (14).

† One of Darwin's advantages was that he did not have to write grant proposals or publish 15 articles a year. He thought deeply about every detail of his theory for more than 20 years before publishing *On the Origin of Species* in 1859 [17], and for 12 years more before its sequel, *The Descent of Man* [18], which explored how his theory applied to people (13).

‡ The fascination of scientific work does not lie in the craftsmanlike utilization of the tools of a science. It is admirable for the gymnast to put his splendidly disciplined body through intricate manoeuvres, and it is no doubt equally admirable for the scientist to put his disciplined mind through a sequence of complex analytical or experimental manoeuvres. The great fascination of scientific endeavour, however, is precisely in the speculative pursuit of new ideas that will widen the horizon of our understanding of the world. This endeavour is not that of a graceful intellectual gymnast: on the contrary, the scientist is stumbling about in a jungle of ideas or facts that seem to defy… logic (11:*70*).

§ If we are the only intelligent beings in the galaxy we should make sure we survive and continue. But we are entering an increasingly dangerous period of our history. Our population and our use of the finite resources of planet earth are growing exponentially along with our technical ability to change the environment for good or ill.… It will be difficult enough to avoid disaster in the next hundred years, let alone the next thousand or million. Our only chance of long-term survival is not to remain inward looking on planet Earth but to spread out into space.… If we want to continue beyond the next hundred years, our future is in space (19:*finale*).

** Man's mind is his basic tool of survival. Life is given to him, survival is not. His body is given to him, its sustenance is not. His mind is given to him, its content is not. To remain alive, he must act, and before he can act he must know the nature and purpose of his action. He cannot obtain his food without a knowledge of food and of the way to obtain it. He cannot dig a ditch—or build a cyclotron—without a knowledge of his aim and of the means to achieve it. To remain alive, he must think (20:*1012*).

†† The hero adventures out of the land we know into darkness; there accomplishes his adventure, or again is simply lost to us.…

There must always remain, however, from the standpoint of normal waking consciousness, a certain baffling inconsistency between the wisdom brought forth from the deep, and the prudence usually found to be effective in the light world. Hence the common divorce of opportunism from virtue and the resultant degeneration of human existence (2:*188*).

the eloquence to utter these truths effectively and unapologetically[†]—to relate why—like our mythical conception of *Struthio camelus*—we choose to bury our heads in the sand[‡] and, more often than not, refuse to explore self-evident evolutionary truths as they relate to *Homo sapiens*. For example, Carlquist's revolutionary and daring advocacy of long-distance dispersal[§] (*cf. APPENDIX II*) has had a profound influence upon my theoretical development. During a recent seminar in the biology department at—we'll say for anonymity's sake—The University of Lonesome Isle, Professor 'Biogeography' postulated a positive correlation between large body-size and ease of long-distance dispersal across *Mammalia*. I politely countered that *Homo sapiens* effectively falsified this theory. Several attendees laughed, assuming that I was revealing a previously undetected sense of humour. Afterall, Professor Biogeography was by no means an amateur (*e.g., cf.* 22-25), and, furthermore, planes, trains, and automobiles, do indeed, at first glance, make this conjecture appear laughable. But it was not a joke. I was not kidding. I am not a funny man. If long-distance dispersal were as simple for relatively large-bodied humans as boarding a flight, half of the inhabitants of Sub-Saharan Africa would be living in limestone townhouses on the Upper East Side, bungalows at the Beverly Hills Hotel, and fortified country manors from Cornwall to Cumberland. As I clarified in Dr Biogeography's seminar, ≈1MM Canadian geese (*Ranta canadensis*) migrate each spring from the United States into Canada – but not one is forced to land and present a passport at the border. This anecdote may help illustrate just how illusive the 'unity of nature' may be; furthermore, *Dr Biogeography's Error* may be related to the fact that he had failed to recognize – *or was taught not to understand* – that subjects do not exist.[††]

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† Darwin… had the intellectual toughness to stick with the deeply discomfiting consequences of his theory (14).

‡ Darwin is still far from being fully accepted in sciences outside biology. 'People say natural selection is O.K. for human bodies but not for brain or behavior,' Dr. Cronin says. 'But making an exception for one species is to deny Darwin's tenet of understanding all living things. This includes almost the whole of social studies — that's quite an influential body that's still rejecting Darwinism' (14).

§ As a result of his studies of plants inhabiting oceanic islands, Sherwin Carlquist became an advocate of long-distance dispersal. Vicariance biogeography rose to dominance in the late 20th Century, overshadowing the significance of long-distance dispersal as a legitimate biological process worthy of scientific study…. From Carlquist's observations [in Hawaii]…, he formulated his theory of loss of dispersibility, which stated that island endemics, themselves descendants… that arrived via long-distance dispersal, have less dispersal capacity (21:*abstract)*.

†† As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) [or biogeography] is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists

> As word of Humboldt's death filtered around the world, there was an outpouring of… reverence befitting a beloved international celebrity…. *The Herald* lauded him as 'one of the greatest men of his age or of any other age…. He had a gigantic intellect, from which nothing in nature or in science appeared to be hid. He could grasp all subjects, and he appeared to know everything…. *Cosmos* is his imperishable monument, which will endure as long as the earth which it describes.' *The Tribune* averred, 'His fame belonged not only to Europe, but to the world; and in this country especially, probably no man who was known to us only through the medium of his scientific writings was held in equal reverence and admiration…. But what will ever distinguish Humboldt from the mass of physical inquirers who had preceded him, is his study of the universe as a harmonious whole, and his search for the laws of order, beauty, and majesty beneath the apparent confusion and contradictions of isolated appearances….'
>
> We may well ask, If Humboldt was so widely celebrated and so beloved during his long life…, why has he been largely forgotten in our own time?….
>
> Above all he was a generalist, intent on examining every natural process and shaping the myriad discordant data into a coherent whole, as in *Cosmos*. However, by the mid-nineteenth century, science… was increasingly becoming the province of specialists, as shown by the trend to replace university departments of *Natural Philosophy* with the narrower disciplines that we know today (27:*327-330*).

Indeed, this trend has led to spectacular failures and deeply entrenched problems ranging from the maladaptive contrivance of the 'social sciences' to the *Transformative Hermeneutics of Quantum Gravity* (28, *cf.* 29-32). Although Sir Karl Popper, Frederich August von Hayek, Garret Hardin, and other great problem-solvers have fought to correct these errors,

> it is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialties that perhaps should not have been separated in the first place (33:*682*)?

Our *theory of value* unifies all so-called subject matters. Perhaps most notably, this theory re-unites economic principles with the 'Unity of Nature' which had been recklessly divided following some very bad advice from Condorcet (*cf. GLOSSARY: Denaturalization of Economics*).* Although my interest in natural history was rather accidental, looking back now, it's easy to see that the evolution of this interest was quite *natural*. I had set off more than a decade ago in search of a solution to what I thought was an 'economic' problem, but, over time, I recognized that the problem was insoluble through the narrow lens of 'economics,' and, moreover, that 'economics' and the other so-called 'social sciences' were essentially, *creating* the problem I was struggling to solve (*cf. APPENDIX III: ON THE PROBLEM OF IVORY TOWERS*). Birds are a part of

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who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(i) There is no method of discovering a scientific theory.

(ii) There is no method of ascertaining the truth of a scientific hypothesis, *i.e.,* no method of verification.

(iii) There is no method of ascertaining whether a hypothesis is 'probable', or probably true (26:*5-6*).

* The term *social science* was coined only in the 1780's, by Condorcet, and did not enter the English language until the early nineteenth century… The factors that led to the emergent field of social science were part and parcel of the process by which economics detached itself from natural philosophy (34:*5*).

nature, as are the nests they construct– that is straightforward enough for most to grasp. Humans – and the houses, cars, ICBM's, *etc*. – are *also* part of nature, but this is not so readily grasped. Humans are not 'encroaching' upon nature – *we are part of it*. This has been clear since 1859. When gray wolves (*Canis lupus*) or the wild dogs of Africa (*Lycaon pictus*) fight, form packs, and hunt collectively, and claim territory with urine, we recognize this behaviour as pack-hunting, but when *Homo sapiens* fight, form packs, and hunt collectively (by waging wars and claiming territory with national boundaries, for example), the analogy eludes us more often than not.

But in any case, with these introductory remarks in mind, let's set off on our exploration of evolution, economics, and relative insularity. As Orr reflected, "What now are the major outstanding problems in speciation?.... We must (*i*) find the genes that cause reproductive isolation and (*ii*) identify the evolutionary forces that drove their divergence." (35:*10*).

I'm afraid I'm unable to shed much light upon (*i*) but I have made progress regarding (*ii*) since *The Principle of Relative Insularity* represents no less than the law which regulates *The Struggle for Life*.

Though I am a citizen of the United States of America and a member of *The American Society of Naturalists*, little deliberation was required in consideration of the appropriate audience for this letter.* The fact that two of the most significant papers in natural history were communicated to the world by Fellows of The Linnean Society of London naturally solidified this decision. Although I need not comment upon the first paper (36), I suspect the content and significance of the second may remain largely unknown. Furthermore, given that *Naturae Discere Mores* serves as your guiding light and that you 'embrace the entire sweep of natural history,' I will endeavour to bring this lost treasure and its universal relevance to your attention, and begin to relate how it charts a clear, evolutionary stable course in our never-ending *Search for a Better World*.

Last summer, I presented a paper (37-38) which sketched my findings (39), and although I have naturally refined this theory, the central thesis has remained unchanged since May of 2008…

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* The Linnean Society of London is the world's oldest active biological society. Founded in 1788, the Society takes its name from the Swedish naturalist Carl Linnaeus (1707-1778) whose botanical, zoological and library collections have been in its keeping since 1829....

The Society uniquely embraces the entire sweep of natural history. It promotes the study of all aspects of the biological sciences, with particular emphasis on evolution, taxonomy, biodiversity and sustainability (13:*3-4*).

Åland International Institute of Comparative Island Studies* 1 May 2008
Ålandsvägen 26
AX - 22 100 Mariehamn
ÅLAND†

Dear Ålanders:

I love islands. But I do not love all islands equally, I do not love all islands unconditionally, and there are in fact many islands which I don't even like, much less love.

I love Iceland, St. Helena, the Faroes, Île aux Coudres, St. Pierre, Miquelon, Newfoundland, Fogo, Chiloe, Isla Grande de Tierra del Fuego, the Falklands, Necker, Shetland, Orkney, and Manhattan—but I am not fond of Key West, the Balearics, nor Cuba.

Yes, I love some islands, don't care for others, and many of the 'islands' I love most are not typically considered so, such as Los Alamos,‡ the Fakahatchee Strand, the U.S. Constitution, Vermejo Park, the Flying D, Collon Cura, and Parker Ranches (*cf.* 43); the island-like province of Alberta, the independent states of Maine, New Hampshire (*cf.* 43:*Live Free*),§ Vermont, Alaska,** Wyoming, Montana, South Dakota, and the independent, island-like cantons of Switzerland.

I love Gibraltar, the land-locked 'islands' Austria and Andorra, the doubly land-locked island of Lichtenstein, the Gaspé and Kamchatka†† peninsulas, the Naknek (*cf.* 43:*Alaska*) and Cascapedia Rivers, Great Slave Lake,‡‡ Lake Chataqua, the Engadin valley, Zurich, Vienna, a mile-long stretch of undeveloped shoreline along Lake Gogebic (*cf.* 43), Ottawa, Katmai, Acadia, Glacier, and Joshua Tree National Parks, Baxter State Park, Norway, Finland, Estonia, the Alpine Convention Region,§§ and the pedestrian villages of Zermatt and Mackinack.

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* AICIS... is an Åland based, international and independent, research institute which explores the economic and institutional aspects of insular entities - mainly from a comparative point of view. It operates, on a network basis, in close cooperation with other island institutes and academic institutions, as well as with a variety of economic and policy milieus, all over the world. AICIS.... is an independent foundation, set up by a number of leading Ålandic companies: Åland Mutual, Alandia Corporations, Bank of Åland, and Åland Investment Ltd (40).

† Åland functions... similar to an independent state with its own legislation and administration (41:*684*).

‡ The design and development of an atomic bomb required enhanced security. Such a site needed to be safe from any chance of bombing by enemy aircraft and equally safe from curious citizens. General Leslie Groves ordered a search for such a site conducted throughout the western United States. Jemez Springs, New Mexico, met the basic requirements, but upon closer inspection in November 1942, Groves and Oppenheimer rejected the site because it was too confined by the high canyon walls and lacked a good road. Oppenheimer suggested another site, not far away, called Los Alamos. Groves approved.... Los Alamos seemed ideal. It was isolated, access to and from the site could be controlled....

At Los Alamos, they found the Los Alamos Ranch School, a residential boys' school that emphasized outdoor education for children of parents who could afford to give them the experience.

A light snow was falling, and the students and their teachers were on the playing fields in shorts. The school had a number of buildings that might be suitable for housing scientists, and generous views to the east and of the Sangre de Cristo mountains. This, Oppenheimer thought, would provide inspiration to the scientists (42).

§ The words *Live Free or Die*, written by General John Stark, July 31, 1809, shall be the official motto of the state (44, *cf.* 43:*Live Free*, *Bretton Woods*).

** Presently only Vermont and Alaska fully recognize the evolutionary stability of the Second Amendment.

†† The Kamchatka Peninsula's high insularity has provided the cradle (birthplace) for ≈70% of the Earth's salmon (*Salmonidae*), and offers a natural habitat which yields, amongst a cornucopia of biodiversity, the highest concentration of brown bears (*Ursus arcus horribilis*) on Earth.

‡‡ Great Slave Lake is massive, the 10th largest lake in the world, and forms part of the headwaters of the Mackenzie River. It lies smack in the middle of Canada's boreal forest, a 1.4 billion-acre swath of woods and waters that mantles northern America like a green crown, from Newfoundland all the way to the Yukon. 'The boreal,' as it is known, is one of the planet's last healthy and whole landscapes. It holds a quarter of the planet's intact forests and freshwater resources (45:*83*).

§§ The Federal Republic Of Germany, The French Republic, The Italian Republic, The Republic Of Slovenia, The Principality Of Liechtenstein, The Republic Of Austria, The Swiss Confederation, And The European Economic Community, AWARE that the Alps are one of the largest continuous unspoilt natural areas in Europe, which, with their outstanding unique and diverse natural habitat, culture and history, constitute an economic, cultural, recreational and living environment in the heart of Europe, shared by numerous peoples and countries, RECOGNIZING that the Alps constitute the living and economic environment for the indigenous population and are also vitally important for extra-Alpine regions, being the site of important transport routes, for example, RECOGNIZING the fact that the Alps constitute an essential habitat and last refuge for many endangered species of plants and animals AWARE of the substantial differences existing between national legal systems, natural conditions, population distribution, agriculture and forestry, the state and development of the economy, the volume of traffic and the nature and intensity of tourism, AWARE that the evergrowing pressures caused by man are increasingly threatening the Alpine region and its ecological functions, and that the damage is either irreparable or rectifiable only with great effort, at considerable cost and, as a rule, over a long period of time, CONVINCED of the need for economic interests to be reconciled with ecological requirements (46).

Some of my favourite islands happen to be islands within islands, such Bermuda's Fairmont Southampton (*cf.* 43:*Bermuda*),* Lyford Cay, The Ocean Reef Club (*cf.* 43), Katahdin Lake Wilderness Camps, Woburn Abbey, Haddon Hall, Berkeley, Lindisfarne, and Alnwick Castles, the National Park on the north shore of Prince Edward Island (*cf.* 43:*Island Life*)—and the three cottages on Hummingbird Lane, tucked within the borders of this national park—and thus, essentially, three islands within an island on an island.

But at the pinnacle, above all others, there is a very special class of islands which I love the most: the United States and the United Kingdom,‡ Mustique (*cf.* 43), Greenland, Newfoundland, Catalina Island, Skorpios, Kodiak Island, Baffin Island, the Svalbard Archipelago, Mago, Molokai, the big island of Hawaii, the diminutive Entry Island, Ile aux Coudres, Forsythe, Funk (49) the Moonsund, Roque, Vinalhaven-North Haven archipelagos, Monhegan, New Zealand,§ Waiheke, Tasmania, Kangaroo, Japan,** the Azores,†† San Marino, Lofoten, Gotland, Koster, Fårö, Ekerö, Orust,‡‡ and each and every one of the six thousand five hundred Åland Islands.

And so I thank you for the opportunity to present this paper and my forthcoming seminar at your second annual conference, *Islands of Competence – Branding Identities in a Globalized World*. It will be a great privilege and honour to visit Åland and the Baltic Sea, which, to date, I have only been able to admire from afar.

Why do I love Åland? Why do I love some islands and dislike others?

This is the story I would like to share with you....

Although time will presently not enable us to scratch the surface of the islands I love most, we will explore specific inter-dependencies relating to several, and, moreover three fundamental qualities which relate to them all: (*i*) The inhabitants of these islands have demonstrated exceptional and enduring preferences for relative insularity, (*ii*) they have maintained this preference through independence, *Darwinian fitness* (*Resource Holding Power,* 53), and (*iii*) thus these islands are *relatively valuable*.

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* Comprising over 100 acres and rising to an elevation over 100 feet above sea level, the Fairmont Southampton is the highest, driest, and largest contiguous piece of private property in Bermuda (47).

‡ When great powers are separated by large bodies of water, they usually do not have much offensive capability against each other, regardless of the relative size of their armies. Large bodies of water are formidable obstacles that cause significant power-projection problems for attacking armies. For example, the stopping power of water explains in good part why the United Kingdom and the United States... have never been invaded by another great power. It also explains why the United States has never tried to conquer territory in Europe or Northeast Asia, and why the United Kingdom has never attempted to dominate the European continent. Great powers located on the same landmass are in a much better position to attack and conquer each other. That is especially true of states that share a common border. Therefore, great powers separated by water are likely to fear each other less than great powers that can get at each other over land (48:*44*).

§ The two great islands which mainly constitute New Zealand are together about as large as the kingdom of Italy. They stretch over thirteen degrees of latitude in the warmer portion of the south-temperate zone, their extreme points corresponding to the latitudes of Vienna and Cyprus. Their climate throughout is mild and equable, their vegetation is luxuriant... The geological structure of these islands has a decidedly continental character... Gold, silver, copper, tin, iron, and coal are plentiful.... The position of New Zealand, in the great Southern Ocean, about 1,200 miles distant from the Australian continent, is very isolated (50:*434-435*).

** The Japanese Islands occupy a very similar position on the eastern shore of the great Euro-Asiatic continent to that of the British Islands on the western, except that they are about sixteen degrees further south, and having a greater extension in latitude, enjoy a more varied as well as a more temperate climate. Their outline is also much more irregular and their mountains loftier, the volcanic peak of Fusiyama being 14,177 feet high ; while their geological structure is very complex, their soil extremely fertile, and their vegetation in the highest degree varied and beautiful (50:*357*).

†† 'Not a beach destination or otherwise susceptible to mass tourism; indeed, its capricious climate probably impedes the flow of tourists. The islands' green volcanic mountains and picturesque black-and-white towns look set to remain unspoiled....'

'Remote and temperate, the Azores remain lightly touristed.... The ecosystem—from the beautiful hydrangea-covered hills of Flores to the rock-bottomed bays of Terceira—is in great shape' (51).

‡‡ The largest island on the western coast of Sweden, Orust covers a mere 45 square miles and has only about 16,000 residents. Yet the island produces more than 50 percent of Sweden's sailboat exports; roughly half of the island's tradesmen build sailboats (52).

In short, the *Struggle for Life* on the islands I love, those I do not, and the island of Earth alike, is regulated—past, present, and future—by the merciless law which has been keeping me up at night.

The principle which has regulated life on earth for the past 4.5 billion years is the very same law which regulates the survival of every living organism on earth yet today, the very same law which regulates the survival of men, women, children, dragonflies, bison, hedge funds, ranches, islands, nations, island nations, currencies, and inhabitable planets alike; this theory clearly illuminates the true nature of the nonrandom gauntlet all organisms must run, but casts an especially bright light upon *Homo sapiens* and nations ('individual' nations, that is, which neither connotes nor denotes *The Theory of Group Selection*).* *The Principle of Relative Insularity* demonstrates how *Darwinian fitness* (*cf. GLOSSARY*) is won and lost through the deployment or failure to deploy *evolutionary stable strategies*, to gain and maintain *relative insularity* with *Resource Holding Power* (*RHP*, *cf. GLOSSARY*).†

(39) offers the 'evolutionary stable strategy' (*ESS, cf. GLOSSARY*) for *The Problem of Human Survival*, a 'strategic equilibrium' (*GLOSSARY*) which informs, naturally, strategies for all derivative problems, such as *The Problem of Global Warming*, a problem which, when we apply our powers of reason, we may recognize more generally and fruitfully as one mere aspect of *The Problem of Sustainable Economic Development*.

Prior to our theoretical, comparative and quantitative exploration of 'relative insularity,' we should offer a few preliminary remarks, as this term is loaded with many preconceived – and often false – notions. Thus, please indulge a few definitive points which may help frame our discourse. The entry in my beloved and generously discounted (*cf.* 43:*Governing Idea II*) *Oxford English Dictionary* speaks volumes of this word, but the three definitions most relevant to our theory are as

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* No other potential object of selection has been as frequently the source of argument as the group. From the synthesis to the 1960s no evolutionist was a champion of group selection. It is not supported, indeed not even mentioned, by Dobzhansky (1937) or in my widely used text… It is not listed in the index of either volume. I fail to find a whole-hearted adoption of group selection in any other publication in contemporary evolutionary biology. Group selection is upheld only in some publications in behavioral biology and ecology. Konrad Lorenz frequently stated that some trait was favored by selection because it was 'for the good of the species.' The ecologists also tended to typological thinking, and one finds frequent references in the ecological literature (Allee, Emerson, Brereton, *etc.*) that amount to a support for group selection. These statements in general were ignored in the evolutionary literature. This all might well have changed when Wynne-Edwards published in 1962 a vigorous promotion of group selection. He claimed that in animals, particularly in birds, and specifically in red grouse, many life history traits had been acquired by group selection. This claim was at once, point by point, vigorously refuted by David Lack in a superb analysis (1966). Lack was not the only one to reject the group selection thesis. G. C. Williams devoted an entire book… to this purpose…. Together with Lack's refutation this was the end of Wynne-Edwards's ill-founded claims (54:*146-147*).

† Although genomic studies suggest that natural selection in humans is ongoing, the strength of selection acting on particular characteristics in human populations has rarely been measured. Positive selection on male wealth appears to be a recurrent feature of human agrarian and pastoralist societies, and there is some evidence of it in industrial populations, too…. Even the weakest selection gradients observed for male wealth in humans are as strong as or stronger than selection gradients reported from field studies of other species. Thus, selection on male wealth in contemporary humans appears to be ubiquitous and substantial in strength (55:*abstract*).

follows:

> 1. a. Of or pertaining to an island; inhabiting or situated on an island. 1611 COTGR., *Insulaire*, Insular, Iland-like; of, or belonging to, an Iland....
> *b. Phys. Geog.* Of climate: Of the moderate or temperate kind which prevails in situations surrounded and tempered by the sea. 1830 LYELL *Princ. Geol. I. 97 An alteration from what has been termed an 'insular' to an 'excessive' climate. 1880 HAUGHTON Phys. Geog. iii. 118 The term 'Insular Climate' has been always given to climates in which the annual range of temperature is small....*
> 2. Of the nature of an island; composing or forming an island.
> 3. a. *transf.* Detached or standing out by itself like an island; insulated (56).

'Insulated' is indeed our touchstone of choice, and, going forward, perhaps the most relevant conjecture to consider is that "insularity is a condition that offers a balance of advantages and disadvantages, opportunities and threats, whether applied to islands, communities, areas or economies" (57:*368*). Furthermore, insofar as sustainable economic development is concerned, we may wish to take in a bit more food for thought and plant a few seeds in the backs of our minds:

> It can be argued that development is a relative term, to be compared with other socio-economic and political contradictions, or that it is not a relative concept, but simply the name we give to structural change. However this may be, development is neither new nor old, but a fact of life. What relationships can we discern between development and insularity? How does insularity affect the development process and the development condition of a society? How can insularity be studied within a framework provided by the concept of development? What effects has insularity, viewed both as a physical and political-economic condition and as a psychological element, exerted upon the openness to innovations (57:*11*)?

Perhaps I should also offer a good example of the type of entirely false notion to which I had referred. For example, it is commonly suggested that

> insularity can be largely defined as a situation deriving from the nature of insular areas or islands, whereas islands are strictly bounded areas with specific geographical characteristics such as land discontinuity, distance from the mainland and remote location at sea. These characteristics have negative effects on the economic and social development of insular areas and constitute a basic environmental feature; isolation is generally regarded in human terms as a disadvantageous situation, and therefore development planning are often orientated towards its reduction (58:*171*).

Yes, "insularity is normally considered to be economically disadvantageous" (59:*195*). But we shall soundly refute and falsify this widely held à-priori assumption—both in terms of the principles of economics, and the syllogistic core of *Natural Selection* (*GLOSSARY*). This task it not difficult to accomplish on the evolutionary front (*cf.* 54 ; 60)– especially in light of the fact that I am preaching to the choir; thus my challenge rests with, and will thus be focused upon, the falsely

held notions of many influential economic theorists and the hecatombs of civilization under their sway.*

Although my letter to the Ålanders attempted to illustrate the dominant role relative insularity has played in the natural histories of many of the islands I love most, here I will focus upon one: a small, arid, *treasure island*—an island, ironically—amongst the 'lesser' of the lesser Antilles: *Mustique*.

Which brings us to the second priceless account of natural history to which I had referred.

(38) chronicled the unearthing of a treasure,

a paper out of the University College, London, which was accepted for publication in April of 1973 in what seems to this writer to be the single-most appropriate Journal for any such gem: The *Biological Journal of the Linnean Society.*† This paper is *The Ecologist's Role in Development for Tourism: A Case Study in the Caribbean* (62).

I opened this treasure-chest, carefully assessed the glimmering stones and nutritious minerals within, and, when I had had my fill and was about to close the lid, a faint sparkle on the final page caught my eye...

LLEWELYN-DAVIES, WEEKS, FORESTIER-WALKER & BOR, 1970. *Mustique: proposals for a development study*. Unpubl. Rep.

Well now. What was this?

I googled for hours, emailed for days, searched for months, but, alas, I could not put my hands on it. My enthusiasm faded. I tried to forget about it. But I couldn't.

Yes, I suspected it may be valuable. But I certainly did not recognize, and could not imagine that it was the very grail I had set off in search of over a decade ago.

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* Now that the Nobel Memorial Prize for economic science has been created, one can only be profoundly grateful for having been selected as one of its joint recipients, and the economists certainly have every reason for being grateful to the Swedish Riksbank for regarding their subject as worthy of this high honour.

Yet I must confess that if I had been consulted whether to establish a Nobel Prize in economics, I should have decidedly advised against it.

One reason was that I feared that such a prize, as I believe is true of the activities of some of the great scientific foundations, would tend to accentuate the swings of scientific fashion.

This apprehension the selection committee has brilliantly refuted by awarding the prize to one whose views are as unfashionable as mine are.

I do not yet feel equally reassured concerning my second cause of apprehension.

It is that the Nobel Prize confers on an individual an authority which in economics no man ought to possess.

This does not matter in the natural sciences. Here the influence exercised by an individual is chiefly an influence on his fellow experts; and they will soon cut him down to size if he exceeds his competence.

But the influence of the economist that mainly matters is an influence over laymen: politicians, journalists, civil servants and the public generally (61:*1*).

† The *Biological Journal of the Linnean Society* is a direct descendant of the oldest biological journal in the world, which published the epoch-making papers on evolution by Darwin and Wallace. The *Journal* specializes in evolution in the broadest sense and covers all taxonomic groups in all five kingdoms. It covers the whole range of techniques used to study evolution, including whole-organism, molecular, theoretical and practical.

The *Biological Journal of the Linnean Society* publishes papers concerned with the process of organic evolution in the broadest sense. It particularly welcomes contributions that illustrate some of the unifying concepts of evolutionary biology with evidence, either observational or theoretical, from the fields of genetics, systematics, biogeography, or ecology. The *Biological Journal* succeeded (in 1969) the *Proceedings of the Society*, the journal in which Darwin and Wallace published their seminal papers in 1858 (13).

On the Unity of Nature

Since 'all things living are in search of a better world' (3), and in light of the fact that the 'better world' I sought was a bio-geo-politico-economic model far more descriptive than any mathematical model could offer (*cf. GLOSSARY: Mathematics*),* a 'little world in itself' capable of modelling the 'unity of nature'† on the big island (*moku nui*) we refer to as 'Earth'; I soon recognized that I had no choice but to set sail for the torrid zone‡ (*cf. APPENDIX IV: IN SEARCH OF A BETTER WORLD*):

> For Humboldt, 'the unity of nature' meant the interrelation of all…sciences….
>
> Instead of trying to pigeonhole the natural world into prescribed classifications, Kant had argued, scientists should work to discover the underlying scientific principles at work, since only those general tenets could fully explain the myriad natural phenomena…. Humboldt agreed with Kant that a different approach to science was needed, one that could account for the harmony of nature… The scientific community, despite prodigious discoveries, seemed to have forgotten the Greek vision of nature as an integrated whole…. 'Rather than discover new, isolated facts I preferred linking already known ones together,' Humboldt later wrote. Science could only advance 'by bringing together all the phenomena and creations which the earth has to offer. In this great sequence of cause and effect, nothing can be considered in isolation.' It is in this underlying connectedness that the genuine mysteries of nature would be found.
>
> This was the deeper truth that Humboldt planned to lay bare… For only through travel, despite its accompanying risks, could a naturalist make the diverse observations necessary to advance science beyond dogma and conjecture. Although nature operated as a cohesive system, the world was also organized into distinct regions whose unique character was the result of all the interlocking forces at work in that particular place. To uncover the unity of nature, one must study the various regions of the world, comparing and contrasting the natural processes at work in each.
>
> The scientist, in other words, must become an explorer (26:*23-27*).

Yes, I did explore.** And yes, I did eventually find it (65, *cf. APPENDIX V: THE MUSTIQUE CO. DEVELOPMENT PLAN*). Moreover, as I have implied, I found much, much more.

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* Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess (63:*519-530*).

† For Humboldt, 'the unity of nature' meant the interrelation of all… sciences… which the scientist unravelled by discovering patterns in myriad, painstakingly collected data. This ambition to view nature as a whole wasn't unique to Humboldt, though. It was a quest that historians believe had begun with the ancient Greek philosopher Thales of Miletus, in the sixth century B.C. Recognized as the founder of Greek geometry, Thales also taught that all matter is ultimately composed of water. Though dead wrong, the theory was still an intellectual turning point, since it marked the first time anyone had tried to explain natural phenomena without appeal to religious dogma. It was also the first time that anyone had tried to explain the whole, divergent physical world in one grand unifying principle (26:*23-24*).

‡ I was anxious to contemplate nature…; and the hope of collecting some facts useful to the advancement of science, incessantly impelled my wishes towards the luxuriant regions spread under the torrid zone (64:*8*).

** It were erroneous to believe, that countries, because they have been already visited, are therefore known. A penetrating and capacious mind finds every where new materials for observation. The work, of which I now offer… relates to regions of which the greater part have never till now been described by a scientific and learned traveller (64:*1*).

On Nobility of Purpose in the Search for Truth Under Adverse Circumstances

Many have found the logical implications* which readily bubble to the surface from *The Principle of Relative Insularity* distasteful, disconcerting, and unacceptable. My discussions, papers, and seminars (37-38 ; 67-78) have proven rather unpopular.† But I am aware of the fact that the bulk of human beliefs are founded upon irrational grounds,‡ and that the hecatombs of human civilization are not prescient enough to understand the world in which they live.§ I have also taken refuge in the sage counsel of many great men** and women who have maintained nobility of purpose throughout the ages—

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* When we propose a theory, or try to understand a theory, we also propose, or try to understand, its logical implications; that is, all those statements which follow from it. But this... is a hopeless task: there is an infinity of unforeseeable nontrivial statements belonging to the informative content of any theory, and an exactly corresponding infinity of statements belonging to its logical content. We can therefore never know or understand all the implications of any theory, or its full significance.

This, I think, is a surprising result as far as it concerns logical content; though for informative content it turns out to be rather natural.... It shows, among other things, that understanding a theory is always an infinite task, and that theories can in principle be understood better and better. It also shows that, if we wish to understand a theory better, what we have to do first is to discover its logical relation to those existing problems and existing theories which constitute what we may call the "problem situation".

Admittedly, we also try to look ahead: we try to discover new problems raised by our theory. But the task is infinite, and can never be completed (66:*26*).

† *Sent 25 Apr 2008 at 15:13:21-0300, Subject: Your Seminar* [*cf.* 67]
Dear Matt...I received a disturbing e-mail from [your friend] in which he said that you had felt under attack for the whole of the seminar [*cf.* 67] and largely from a left-wing ideological cabal among the students. I am truly sorry that you left feeling... disheartened. You are too gifted a student, Matt, to be thrown off course in any way. And it is so undeserving. You have a remarkable thirst for learning, a rare intellectual craving, and, above all the courage to navigate difficult and uncharted waters. Your intellectual energy is apparent to all and, I would say, an inspiring example to all. I replied to [your friend] that I was not aware of how pervasive this ideological left-wing view is in the programme, but I have been aware of it from time to time on particular issues such as Cuba. I regard ideology as the enemy of critical thinking. It is usually self-righteous and conspiratorial. Because it is seamless in it connections to all questions, it is thoroughly predictable. And [your friend] is right when he complains that it is truly unsatisfying to attempt a genuine exchange with someone who is so bound by a formula. I thought your exploration of insularity was thoughtful, innovative and challenging.... I would be truly sorry if you... were to avoid these seminars in the future because they should be one of the more exciting aspects of a graduate programme. But, above all, you should not let yourself be wounded in this way. The programme owes a great debt to your contribution. You bring energy, deep reflection and, above all, insight to every class. And everyone in that room should be grateful... It was a very lively exchange. Although I am sure that you were frustrated that it seemed to go all over the map and often far from your paper which so many had not even read. There may be a case for having a moderator to ensure that the discussion stays on course. In any case, Matt, you have a truly promising future ahead of you, including success at the Ph.D. level. Of that, I could not be more confident.

‡ It is customary to suppose that the bulk of our beliefs are derived from some rational ground, and that desire is only an occasional disturbing force. The exact opposite of this would be nearer the truth: the great mass of beliefs by which we are supported in our daily life is merely the bodying forth of desire, corrected here and there, at isolated points, by the rude shock of fact. Man is essentially a dreamer, wakened sometimes for a moment by some peculiarly obtrusive element in the outer world, but lapsing again quickly into... happy somnolence (79:*14*).

§ History shows that our theories have been wrong more often than right, resulting in the demise of whole civilizations when we have misinterpreted what is happening to us....

It would be comforting to believe that humans have been prescient enough to understand what is happening to themselves and act accordingly. But... the way the mind understands the external environment—the beliefs humans construct to explain the external world are frequently incorrect, particularly if the changes are creating really novel situations. And clearly, humans have evolved environments radically different from anything that existed before (80:*1*).

** To those great men, who thus framed the Constitution, and secured the adoption of it, we owe a debt of gratitude, which can scarcely be repaid. It was not then, as it is now, looked upon, from the blessings which... it has bestowed, with general favor and affection. On the contrary, many of those pure and disinterested patriots, who stood forth, the firm advocates of its principles, did so at the expense of their existing popularity.... Many of them went to their graves, without the soothing consolation, that their services and their sacrifices were duly appreciated (81:*55*).

‡‡ 'I, Galileo, son of the late Vincenzo Galilei, Florentine, aged seventy years, arraigned personally before this tribunal, and kneeling before you, Most Eminent and Reverend Lord Cardinals, Inquisitors-General against heretical depravity throughout the entire Christian commonwealth, having before my eyes and touching with my hands, the Holy Gospels, swear that I have always believed, do believe, and by God's help will in the future believe, all that is held, preached, and taught by the Holy Catholic and Apostolic Church. But whereas -- after an injunction had been judicially intimated to me by this Holy Office, to the effect that I must altogether abandon the false opinion that the sun is the center of the world

including Galilei,[‡‡] Swift,[*] Russell, Einstein,[†] Darwin,[‡] Carlquist, Oppenheimer, Popper, Hayek, Goodall, Carson and yet another of your fellow islanders, Alfred Marshall, "who wrote: 'Students of social sciences must fear popular approval: Evil is with them when all men speak well of them'" (61:*1*).

Yes, some of you may not like what I have discovered.

But perhaps some of you—*and hopefully perhaps even two-thirds of you*[§]—may see some beauty in the truths enclosed herewith. I considered glossing over the logical implications of my discovery—but in the end, of course, I must communicate the truth, the whole truth, and nothing but the truth.

And thus what I ask of you may not be easy.

But then again, what is asked of us is never easy.

> What is asked of us is not easy. The openness of the world derives its character from the irreversibility of learning; what is once learned is part of human life. We cannot close our minds to discovery; we cannot stop our ears so that the voices of far-off and strange people can no longer reach them... Neither our integrity as men of learning nor our humanity allows that. In this open world, what is there, any man may try to learn.
>
> This is no new problem. There has always been more to know than one man could know; there have always been modes of feeling that could not move the same heart; there have always been deeply held beliefs that could not be composed into a synthetic union. Yet never before today have the diversity, the complexity, the richness so clearly defied hierarchical order and simplification; never before have we had to understand the complementary, mutually not compatible ways of life and recognize choice between them as the only course of freedom. Never before today

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and immovable, and that the earth is not the center of the world, and moves, and that I must not hold, defend, or teach in any way whatsoever, verbally or in writing, the said false doctrine, and after it had been notified to me that the said doctrine was contrary to Holy Scripture -- I wrote and printed a book in which I discuss this new doctrine already condemned, and adduce arguments of great cogency in its favor, without presenting any solution of these, and for this reason I have been pronounced by the Holy Office to be vehemently suspected of heresy, that is to say, of having held and believed that the Sun is the center of the world and immovable, and that the earth is not the center and moves:

Therefore, desiring to remove from the minds of your Eminences, and of all faithful Christians, this vehement suspicion, justly conceived against me, with sincere heart and unfeigned faith I abjure, curse, and detest the aforesaid errors and heresies, and generally every other error, heresy, and sect whatsoever contrary to the said Holy Church, and I swear that in the future I will never again say or assert, verbally or in writing, anything that might furnish occasion for a similar suspicion regarding me....

I, the said Galileo Galilei, have abjured, sworn, promised, and bound myself as above; and in witness of the truth thereof I have with my own hand subscribed the present document of my abjuration, and recited it word for word at Rome, in the Convent of Minerva, this twenty-second day of June, 1633....'

Legend has it that as Galileo rose to his feet, he said under his breath, '*Eppur si muove*'—'*And yet, it moves.*' The remark captivated scientists and scholars for centuries, as it represented defiance of obscurantism and nobility of purpose in the search for truth under the most adverse circumstances (82).

* When a true genius appears in the word, you may know him by this sign, that the dunces are all in confederacy against him (83).

† Great spirits have always encountered violent opposition from mediocre minds. The mediocre mind is incapable of understanding the man who refuses to bow blindly to conventional prejudices and chooses instead to express his opinions courageously and honestly (84)

‡ [Darwin] brought several intellectual virtues to the task at hand. Instead of brushing off objections to his theory, he thought about them obsessively until he had found a solution (14).

§ No person shall be declared to be elected a Fellow who has not received the votes of two-thirds of the number of Fellows and other eligible Members voting (85:*19*).

> has the integrity of the intimate, the detailed, the true art, the integrity of craftsmanship and the preservation of the familiar, of the humorous and the beautiful stood in more massive contrast to the vastness of life, the greatness of the globe, the otherness of people, the otherness of ways, and the all-encompassing dark.
>
> This is a world in which each of us, knowing his limitations, knowing the evils of superficiality and the terrors of fatigue, will have to cling to what is close to him, to what he knows, to what he can do, to his friends and his tradition and his love, lest he be dissolved in a universal confusion and know nothing and love nothing. It is at the same time a world in which none of us can find hieratic prescription or general sanction for any ignorance, any insensitivity, any indifference. When a friend tells us of a new discovery we may not understand, we may not be able to listen without jeopardizing the work that is ours and closer to us; but we cannot find in a book or canon—and we should not seek—grounds for hallowing our ignorance. If a man tells us that he sees differently than we, or that he finds beautiful what we find ugly, we may have to leave the room, from fatigue or trouble; but that is our weakness and our default. If we must live with a perpetual sense that the world and the men in it are greater than we and too much for us, let it be the measure of our virtue that we know this and seek no comfort. Above all, let us not proclaim that the limits of our powers correspond to some special wisdom in our choice of life, of learning, or of beauty.
>
> This balance, this perpetual, precarious, impossible balance between the infinitely open and the intimate, this time—our twentieth century—has been long in coming; but it has come. It is, I think, for us and our children, our only way.
>
> This is for all men. For the artist and for the scientist there is a special problem and a special hope, for in their extraordinarily different ways, in their lives that have increasingly divergent character, there is still a sensed bond, a sensed analogy. Both the man of science and the man of art live always at the edge of mystery, surrounded by it; both always, as the measure of their creation, have had to do with the harmonization of what is new with what is familiar, with the balance between novelty and synthesis, with the struggle to make partial order in total chaos. They can, in their work and in their lives, help themselves, help one another, and help all men. They can make the paths that connect the villages of arts and sciences with each other and with the world at large the multiple, varied, precious bonds of a true and world-wide community.
>
> This cannot be an easy life. We shall have a rugged time of it to keep our minds open and to keep them deep, to keep our sense of beauty and our ability to make it, and our occasional ability to see it in places remote and strange and unfamiliar; we shall have a rugged time of it, all of us, in keeping these gardens in our villages, in keeping open the manifold, intricate, casual paths, to keep these flourishing in a great, open, windy world; but this, as I see it, is the condition of man; and in this condition we can help, because we can love, one another (4:*143-146*).

On Method

Yes, I am going to tell you of a new discovery which some of you may not be able to hear without jeopardizing beliefs which are closer to you, but before Oppenheimer's majestic spirit of openness fades away, I must not fail to disclose that you may all love at least one aspect of the truths I have discovered, as these truths clearly suggest that one of the best ways we might all find the means to help and love one another is by adopting evolutionary worldviews. There is, afterall, a *method*, so to speak, to all of this madness, so I humbly request a little patience in seeing it through; as a fellow islander offered upon review of (38),

> yes, there is clearly a method to the madness. It will be exasperating to most readers, because you really walk the talk when it comes to dismantling disciplinary boundaries. Your treatise does range from 'astronomy' to 'zoology'.

I realize the page-count, copious and discursive footnotes, and appendices which appear in this letter of introduction and short discourse enclosed herewith may appear excessive at first glance, but I trust my fellow naturalists may recognize

that—given the scope of this vast undertaking—it is all quite necessary, and thus it would be disingenuous to offer an apology, since *every* truthful treatise *must* range from astronomy to zoology. All assumptions must be carefully defined, all positions must be meticulously developed, and nothing short of consilience and data cascades will do (*cf.* *GLOSSARY:consilience*).

I might also suggest that, if it were possible to condense this communiqué to a dozen pages, if it were possible to accurately and effectively introduce – much less communicate in a concrete fashion – a unified theory of value and tenable solution to *The Problem of Sustainable Economic Development* in an academic paper or refereed journal article, then it seems it would have been done so by now (*cf.* 86).* Furthermore, although it may take some time to read, I trust my theory is not difficult to understand, because, as noted, I am a follower of the Enlightenment,† a fellow naturalist, and I have used islands to do exactly what they do best: help simplify‡ and clarify the complex world in which we live.§

> How teach again... what has been taught correctly and incorrectly learned a thousand thousand times, throughout the milleniums of mankind's prudent folly? That is [our] difficult task....
>
> The easy thing is to commit the whole community to the devil and retire again into the heavenly rock-dwelling, close the door, and make it fast. But... [this] work... cannot be avoided (2:*218*).**

Generally speaking, we require nothing more than the method of the naturalist to accomplish this feat:

> Darwin was first and foremost a naturalist. His favourite method was also that of the naturalist. He made a series of observations and developed a conjecture from this evidence.... Actually, perhaps the closest to the truth would be to say that Darwin was a pragmatist and used whatever method he thought would bring him the best results. Darwin was a very keen observer, and there is no doubt that observation was his most productive approach (89:*488-489* ; *cf.* 90).

My analysis of what is generally regarded as 'economic' phænomena is in line with the highly unfashionable methods of Natural Philosophy, Austrian economics (*GLOSSARY*), and 18th century 'economists', naturalists, and moral philosophers,

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* If the problems of land degradation could have been solved by research and reports alone, they would have disappeared long ago. It has been [sixty] years since some of the first seminal works on environmental degradation were written..., and perhaps [twenty] to [twenty-five] since the high-water mark of environmental movements in the United States and Europe was reached (87:*xxvii*).

† Every intellectual has a very special responsibility. He has the privilege and the opportunity of studying. In return, he owes it to his fellow men (or 'to society') to represent the results of his study as simply, clearly and modestly as he can.... Anyone who cannot speak simply and clearly should say nothing and continue to work until he can do so (3:*83*).

‡ Compared with continents... [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range... their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (50:*241-242*).

§ I do not dispute that arguments should be simplified to their maximum potential; but people often confuse complex ideas that cannot be simplified into a media-friendly statement as symptomatic of a confused mind. MBAs learn the concept of clarity and simplicity—the five-minute manager take on things. The concept may apply to the business plan for a fertilizer plant, but not to highly probabilistic arguments—which is the reason I have anecdotal evidence in my business that MBAs tend to blow up in financial markets (88:*36-37*).

** Scientists... have a responsibility for the communication of the truths they have found (4:*91*).

including your namesake Carl Linnaeus,* Alexander von Humboldt, David Hume, and Adam Smith.† However, contemporary game-theory represents a considerable exception to this rule, as these popular and priceless tools for the analysis of conflict (*cf.* 91:*introduction*) prove especially useful, since economic "development is closely associated with conflict" (57:*9*).

And although (39) offers a detailed introduction to 'game theory' (*cf. GLOSSARY*), I will offer a few brief notes: Some may find it fruitful to conceptualize our games as asymmetric (*cf.* 92, 93:*107*), bounded delay supergames (*cf.* 94:*224*) with incomplete information, but "those readers who are unacquainted with [these] technicalities will find that they can manage quite well by ignoring them" (95:*129*). Our theory is founded upon a revolutionary, brief communiqué from 1950 (96, *cf.* 97) and two elegant, well-established‡ proofs (98:*177 ; cf.* 99); a few terms and concepts may be peculiar, but fluency in game theory may be acquired in short order; and although one foundational work (100) may offer an interesting historical perspective, those interested in setting off upon an introductory exploration of *The Theory of Games* may bypass this well-known treatise: As several early investigators rightfully concluded following a fruitful experiment, "it is extremely difficult to tell whether or not the observed results corroborate the von Neumann-Morgenstern theory. This is partly because it is not quite clear what the theory asserts" (101:*23*). In fact, (102) may offer a snapshot sufficient enough for this discourse.

Imagination is the sole prerequisite.

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* Linnaeus, interestingly, also cultivated an account of economic development that was rooted in the German cameralist tradition. But, in many respects, he provides us with the first full-fledged description of an economy, only it is a description of an economy that encompasses everything, including plants [and] animals… This helps underscore all the more the close links between economic thought and natural philosophy that prevailed in the eighteenth century (34:*20*).

† The two most prominent Scottish political economists [were] Hume and Smith… [and their efforts were largely] to join economics to nature. Numerous scholars have emphasized the fundamental importance of natural science in the development of moral philosophy among the Scottish Enlightenment writers.… [Emerson] points out that most of the leading professors at the Scottish universities who taught moral philosophy were also versed in natural science (34:*21*).

‡ Most economists enter this market in new ideas, let me emphasize, in order to obtain ideas and methods for the applications they are making of economics to the thousand problems with which they are occupied: these economists are not the suppliers of new ideas but only demanders. Their problem is comparable to that of the automobile buyer: to find a reliable vehicle. Indeed, they usually end up by buying a used, and therefore tested, idea.

Those economists who seek to engage in research on the new ideas of the science – to refute or confirm or develop or displace them – are in a sense both buyers and sellers of new ideas. They seek to develop new ideas and persuade the science to accept them, but they also are following clues and promises and explorations in the current or preceding ideas of the science. It is very costly to enter this market: it takes a good deal of time and thought to explore a new idea far enough to discover its promise or its lack of promise. The history of economics, and I assume of every science, is strewn with costly errors: of ideas, so to speak, that wouldn't run far or carry many passengers (11:*529-530*).

** *cf. APPENDIX IV*, 3-5 ; 11-12 ; 16-18 ; 26-32 ; 34 ; 36 ; 50 ; 54 ; 57 ; 60 ; 61-66 ; 75-76 ; 88-105; *GLOSSARY*: *Austrian Economics, Games, Game Theory, Science, Scientific Method.*

Finally, I might also note that our unified approach requires wide-ranging methodological tools,** but in light of the fact that *Scientific Method* (*GLOSSARY*) does not exist, searching for a ghost may prove uneconomical: As Hayek (103, *cf.* 104) observed long ago, *The Mind-Body Problem* does not enable us to know the method by which we come to know what we know, and therefore the probability that we might accurately recount these methods in a meaningful manner to others – with 'mind-body problems' of their own – *is less than zero*.

Thus, perhaps the most relevant remark on method was scribbled on a note in Brazil in 1952:

> First figure out why you want the [readers] to learn… and what you want them to know, and the method will result more or less by common sense (105:*xx*).

On the Problem of Survival on Earth

I will offer a brief preview of *The Earth Island Survival Game* to help set the stage (the Earth) upon which our subgame, *The Island Survival Game* takes place:

The Earth Island Survival Game consists of two classes of 'players', 'Globalized Economic Military Superpowers' (*GEMS, cf. GLOSSARY*) and 'Relatively Insular States' (*RIS, cf. GLOSSARY*); although *The Island Survival Game* is a game played by individuals (*Homo sapiens*) on a single island, we shall briefly compare and contrast both global players from the larger and more complicated game. To begin with, it may prove helpful to conceptualize these two player classes as 'Continental' (*GEMS*) and 'Island' (*RIS*) based economies. (*i*) Astrophysical uncertainty, and (*ii*) the fact that the Earth is a planet lacking central authority both further complicate *The Earth Island Survival Game*, and although we have much to discover in our forthcoming exploration (39) of these stochastic elements, for the time being we'll merely contextualize them in outline form:

WHAT IS THE NATURE OF THE GAME?

GEMS vs. GEMS
GEMS vs. RIS
RIS vs. RIS
GEMS $\cup$ *RIS vs. Universe*

WHAT IS THE OBJECT OF THE GAME?

GEMS = Survival $\rightarrow +(I_R)$
RIS = Survival $\rightarrow +(I_R)$
Universe = ?

HOW IS THE OBJECTIVE ATTAINED?

GEMS = *RHP*

RIS = *RHP*

Universe = *?*

WHAT STRATEGIES ARE AVAILABLE?

S_1: *Maximum Economic Development* (*MED*)

S_2: *Maximum Ecological Preservation* (*MEP*)

ESS?

RIS = *Maximum Ecological Preservation* (*MEP*)

GEMS = *Maximum Economic Development* (*MED*)

For the time being, please tentatively accept that survival is attained by '$\rightarrow +(I_R)$', an indirect proof of *The Principle of Relative Insularity* (and our theory of value based upon relative insularity) is detailed in (39) ; these arguments are extensive and necessarily exhaustive. However, to make a very long argument very short, (39) demonstrates that *Value* (V) is a *derivative function* (f') of *relative insularity* (I_R), $\Rightarrow V = f'(I_R)$, and this, in a nutshell is why our objective is: '$\rightarrow +(I_R)$'

When rational play unfolds, equilibrium is attained when players pursue respective rational, opposing *ESS*, offering optimal windfall: *RIS*-driven *ecological* protection and *GEMS*-driven *planetary* protection. In essence, this non-cooperative, strategic equilibrium paves the way for rational, mutually beneficial, cooperative behaviour, yields higher ecological and planetary insularities, and thus maximizes (*i*) economic value and (*ii*) *Darwinian fitness/RHP*. *RIS* maximize (*i* & *ii*) by pursuing self-interests, by struggling for *maximum ecological insularity* &*economic value* (through ecological preservation, politico-economic independence, self-sufficiency). *GEMS* maximize (*i* & *ii*) by pursuing self-interests, by fighting for *maximum economic development* (*i.e.* 'globalization'), and *planetary insularity.*[*]

Surplus value is maximized through strategic transparency: *If* (*a*) all players recognize the value of respective, opposing, and antithetical, rational strategies and employ the *ESS*, *then* (*b*) all players maximize economic value & Darwinian fitness, negotiate, struggle, fight, communicate, and cooperate more rationally, more efficiently, more peacefully, and thus (*c*) maximum sustainable economic development is achieved and human survival prospects are maximized.[†]

As introduced in (37-38), roughly sketched here, and detailed in (39), perhaps the most revelatory feature of sub-

* Global defence, extraterrestrial exploration, and extra-planetary threat mitigation, such as the finance, R&D, the deployment of Asteroid Tugboats, *SHIELDS*, and, ultimately, inter-planetary long-distance dispersal.

† When the goal is to give advice to all of the players in a game (*i.e.*, to advise each player what strategy to choose), any advice that was not an equilibrium would have the unsettling property that there would always be some player for whom the advice was bad, in the sense that, if all other players followed the parts of the advice directed to them, it would be better for some player to do differently than he was advised. If the advice is an equilibrium, however, this will not be the case, because the advice to each player is the best response to the advice given to the other players (99:*3999*).

game play is that *GEMS ESS* and *RIS ESS* are antithetical, yet in light of *The Problem of Induction,* we discover these naturally opposing – *and complementary* – strategies represent the *strategic equilibrium,* the most tenable, rational solution possible.

How is it possible that the two classes of players derive two *different*, antithetical, optimal strategies when utilizing the same theory of value?

Simply because they both happen to represent the dominant (best) strategy for each player class to achieve *greater insularity:* $\rightarrow +(I_R)$.

For example, when *RIS* employ *GEMS ESS*, as they invariably have and continue to do (*cf.* 38), given their inherent disadvantages in terms of economies of scope, scale, and location theory, through the deleterious effects of the amplification by compression of negative externalities, they destroy their ecology and, in rather short order, their economies, as well. Their trajectory, in short, becomes $\rightarrow -(I_R)$.

Although some may be willing to entertain the conjecture that *RIS ESS* = Maximum Ecological Protection (*MEP*), perhaps many may find my inherently controversial finding that *GEMS ESS* = Maximum Economic Development (*MED*) unpalatable. Again, although *The Earth Island Survival Game* (39) is not our focus here, I will briefly remark that, although *Human Survival* (*cf. GLOSSARY*) ultimately depends upon a single, unified, life-giving sphere of insularity, it must ultimately be defended on *two inherently uncertain* levels: (*i*) insularity pertaining to the biosphere (*i.e.* Ecology, the 'whole world' according to the principles of 'ecological economics'), and (*ii*) insularity pertaining to the *semi-closed* island of Earth, including stochastic political phænomena (warfighting) and stochastic planetary and extra-planetary phænomena (meteorites, volcanoes, chaotic gravitational forces, supernovas, stochastic and anthropogenic climate change, the Earth's inherently unknown and unknowable lifespan, etc.). Thus, resources must be split between two contradictory, yet complimentary objectives, but it is impossible to determine how much to allocate to each over time (6).

On the Problem of Survival on Islands

States, Microstates and Islands tables a widely held and generally accepted conjecture:

> Theoretically, an island country has two options. It can remain a small closed society… Alternatively it can… [become] integrated with the world economy through the promotion of the type of development which allows for greater and more beneficial exchange. In fact, the first is not really an option. There are few, if any, small islands which having had access to certain amenities have rejected them (106:*155*).

Although it is true that, theoretically, there are indeed just two development options for an island to pursue (*MEP* and *MED*)—the conclusion tabled above is entirely unfounded: In reality, the first option (*MEP*) is the *only* option, as the second

(*MED*) – though it may stimulate a flurry of short-term economic gains – will invariably degenerate into *The Tragedy of the Commons* (*GLOSSARY*). Furthermore, once this truly tragic and depauperative state has been reached, few options – other than political revolution are available to the island population in order to stave off ecological and (eventually) economic collapse.

Ceteris paribus, *RIS* may select only one *pure* development strategy. Once a pure strategy has been selected and put into motion, it is extraordinarily difficult to switch development strategies after the corresponding linkages – industries, institutions, and trade – develop and inter-dependencies become entrenched (which is why we play 'delay' games). This dilemma is exacerbated by the fact that most political decisions are made to maximize value on a *very* short-term basis, rarely exceeding four-year windows of politico-economic development opportunity (as in the case of a single term for U.S. Presidency), but, in many worst-case constitutional scenarios, elections may be called at virtually *any* time, such as in the case of the election of the Prime Minister's of Canada.*†

Given this constitutional arrangement, *RIS* democratic majorities invariably elect present consumption (*MED*) over future preservation (*MEP*) and, especially if the climate is right for the tourist trade (*i.e.* the Caribbean), rapidly degenerate into *The Tragedy of the Commons*.

Yes, theoretically, an island country has two options – *MED* and *MEP* – and, this is the expected payoff matrix:

RIS Strategy	*Short-Term Payoff (1-40 years)*	*Long-Term Payoff (20-30) years*
Maximum Economic Development	*$-Rich/Land-Poor*	*$-Poor/Land-Poor*
Maximum Ecological Preservation	*Land-Rich/$-Poor*	*Land Rich/$-Rich*

Table 1: *'Island' Economic Development Strategy Payoff Matrix*

* Perhaps the most haunting lines in Canada's history were written in 1858: 'It will be observed that the basis of Confederation now proposed differs from that of the United States in several important particulars. It does not profess to be derived from the people but would be the constitution provided by the imperial parliament…' These words are from a letter signed by three Fathers of Confederation, George-Etienne Cartier, Alexander Galt, and John Ross….

So deep are their current differences on fundamental questions of political justice and collective identity that Canadian may now be incapable of acting together as a sovereign people (107:*3-5*).

† Twenty years ago… I was teaching a university course on the American and Canadian constitutions. I covered the Canadian material while a colleague, Walter Berns, presented the American side. We attended classes together, each listening to and commenting on one other's account of his country's constitutional experience. One day after I had been going on for some time about Canada's constitutional debate, Walter turned to me and said, 'Peter, you Canadian have not yet constituted yourselves a people.' I have been brooding about Bern's remark ever since.

As the years rolled by and Canada's constitutional debate went on and on and on, with rising levels of intensity, I had to concede that Berns was right. The debate has continued so long without resolution because Canadian have never squarely faced the question whether they share enough in common to form a single people consenting to a common constitution (107:*ix*).

Shortly, we will explore the bio-geo-politico-economic models and the corresponding politico-economic development strategies which informed this payoff matrix; and although (106)'s observation that 'few, if any' small islands have elected *MEP* over *MED* is quite accurate, there are at least a half-dozen islands (Mustique, Molokai, and several small islands off the coast of Maine, *e.g.*) known to this author who have elected the first option.

Let's take in an overview of the structure of *The Island Survival Game* before moving on to our models:

WHAT IS THE NATURE OF THE GAME?

Islander vs. Islander
Islander vs. Invader

WHAT IS THE OBJECT OF THE GAME?

Islander = Survival $\rightarrow +(I_R)$
Invader = Survival $\rightarrow +(I_R)$

HOW IS OUR OBJECTIVE ATTAINED?

Islander = RHP
Invader = RHP

WHAT STRATEGIES ARE AVAILABLE?

S_1: *Maximum Economic Development (MED)*
S_2: *Maximum Ecological Preservation (MEP)*

ESS?

MEP: *Maximum Ecological Preservation*

The Island Survival Game is an asymmetric, bounded delay supergame.

The game is bounded by a finite duration of ≈50,000 years, and a 'delay' of 87 years transpires between moves, in other words, once a strategy has been selected, the opportunity to 'switch' strategies does not come along for another 87 years. The logic behind the 'boundedness' of our game follows from the paper enclosed herewith (*cf.* 6, *Axiom V*). "The distinction between bounded and unbounded delay supergames is theoretically important," (94:*202*); for example, the central thesis of 'ecological economics' is founded upon a false, a-priori assumption that the truly noncooperative game of life on Earth is 'unbounded'— but it is not, because "an upper bound... can be named for the survival of any economic situation," (94:*224*), and as detailed in the paper enclosed herewith, ≈50,000 years represents the logical upper limit for the survival of both the evolutionary and economic situation on Earth. The game is over – *quite literally* – in ≈50,000 years.

As far as the 'delay' is concerned, as Selten remarked, "it does not really matter exactly how long the delays are,

choosing one delay period over another is largely insignificant" (94:*202*); the purpose is merely to help illustrate the fact that, once economic development strategies are selected and the resultant inter-dependencies become entrenched, under democratic rule, it is extremely difficult to switch strategies—the delay helps conceptualize and emphasize the long-lasting effects of these strategic decisions. For example, as we shall momentarily discover, the politico-economic development strategies currently being deployed on the two islands which model our problem and solution are the same strategies which were put into play in 1970—and there is no sign that either islands intends (and, moreover, is able) to 'switch' strategies anytime in the near future. Thus, the 'delay' for these two living and evolving bio-geo-politico-economic models, is > 40 years. In any case, however, for the purpose of our analysis, it seems the most fruitful delay may be between 70 and 100 years—the somewhat arbitrary delay of 87 years was selected in-part for sentimental reasons.*

Our games are 'asymmetric' (*cf.* 92-93) because, naturally, the conflicts at hand are asymmetric: If a home is listed for sale on the island of Mustique for $50MM USD, the strategies employed for contesting for this property will not be 'mixed' – they will be informed by the readily apparent asymmetries relating to RHP ($) ; mixed (random) strategies – such as knocking on the front door and boldly proclaiming ownership, attempting to take the home by force, or writing a long, eloquent, and flattering letter to the owner, begging for this territory and shelter as a gift – are all highly unlikely to result in the legal transfer of deeded title – and thus control, of this scarce resource. Likewise, as we discover in *The Earth Island Survival Game* (39), the Seychelles, for example, would not employ a 'mixed' strategy (such as flipping a coin) when deliberating whether or not to declare war upon The United States and China for refusing to be held accountable to the Kyoto Protocol. The nature of these contests are also clearly asymmetric (in the case of *The Earth Island Survival Game, RHP = $ = military power*).†

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* Four score and seven years ago our fathers brought forth, upon this continent, a new nation, conceived in Liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation, so conceived, and so dedicated, can long endure. We are met here on a great battlefield of that war. We have come to dedicate a portion of it as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

But in a larger sense we can not dedicate -- we can not consecrate -- we can not hallow this ground. The brave men, living and dead, who struggled, here, have consecrated it far above our poor power to add or detract. The world will little note, nor long remember, what we say here, but can never forget what they did here. It is for us, the living, rather to be dedicated here to the unfinished work which they have, thus far, so nobly carried on. It is rather for us to be here dedicated to the great task remaining before us -- that from these honored dead we take increased devotion to that cause for which they here gave the last full measure of devotion -- that we here highly resolve that these dead shall not have died in vain; that this nation shall have a new birth of freedom; and that this government of the people, by the people, for the people, shall not perish from the earth (108, *cf.* 109-110).

† Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war or the threat of war....

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of

One final – yet crucial – pre-game announcement is that, *ceteris paribus*, 'islanders' wield a *natural* 'home-court' advantage over 'invaders.' (*cf.* 93).

With these introductory notes in mind, *The Island Survival Game* serves as an excellent learning tool.

Although we will not delve into specific gameplay scenarios, the game-theoretical negotiations common to all games (communication, cooperation, conflict, resolution, *etc.*) are detailed in (39), but readers may refer to (93) as a relevant resource in the meantime. If we use a bit of imagination at this juncture, however, the nature of the game, and thus gameplay, may already be clear.

Moreover, we may also recognize that, *ceteris paribus*, based upon revealed 20th & 21st century preferences, with very few notable exceptions – default *RIS* strategy (*MED*) has been sub-optimal/maladaptive. This assessment applies to nearly all of the warm-water, small island developing states* and sub-national island jurisdictions. With the exception of cold-water islands (*cf.* 112) and other extremely remote islands (*i.e.,* St. Helena, Pitcairn, Tristan da Cunha, *etc.*), *RIS* players operating in the real world have nearly all discovered and/or are in the process of discovering that "the short-term advantages of free riding may fulfil Hardin's prediction that 'freedom in the commons brings ruin to all'" (113:*2294*).

However, with one significant exception (industrial agricultural production, *cf.* 6, *Axiom V*), 20th & 21st century *GEMS* strategy has, contrary to prevailing sentiments, been optimal. In other words, in several regards, the global prognosis in not nearly as dire as many influential theorists (*e.g.,* 114) have led many to believe (though it is perhaps more dire in many regards which they have failed to detect).

On The Tragedy of the Commons

This problem remains one of the most-cited concepts because it represents the very essence of *The Problem of Sustainable Economic Development*. Yes, this problem is complex, but I hope we may have begun to demonstrate that it may be fruitfully simplified with the bio-geo-politico-economic models we refer to 'islands'. And perhaps one of the most accurate and descriptive models of our problem is Prince Edward Island.

The Development Plan for Prince Edward Island (*APPENDIX VI*), in contradistinction to *The Mustique Co. Development Plan* (*APPENDIX V*), offers an extraordinary comparative study.

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armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it (79:*95*).

* About one fifth of all politically independent countries are small island developing states. For these countries, sustainable development is not a matter of choice, it is imperative (111:*dust jacket*).

Prince Edward Island (in conjunction with *APPENDIX VI*) also happens to offer one of the most accurate, realistic, descriptive, and readily studied bio-geo-politico-economic models of *The Problem of Sustainable Economic Development*.

(115) chronicles the ten-year debate,* scientific investigations, and end-game decision‡ to construct a one billion dollar bridge§ from Prince Edward Island** to New Brunswick.††

Objections to building the bridge were many,‡‡ but perhaps the most significant objection was over the substantial empirical and theoretical evidence which indicated that building the bridge would destroy the south-shore fishery,§§ arguably the island's most valuable economic resource (38).

PEI Premier Ghiz had assured his fellow islanders throughout the ten-year process that the province would defer to

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* The machinations of the federal and provincial governments and the development consortium comprise a saga of deceit, dishonesty and undemocratic action (115:*4*).

‡ Often the insular progeny of colonizing organisms has lost the ability to migrate and has become incapable of competing with more effective continental organisms, and is thus in danger of extinction as soon as it comes into contact with such organisms, as happened to the dodo (*Raphus cucullatus*), a wingless bird related to pigeons endemic in Mauritius, rapidly destroyed at the time of the early European expansion in the Indian Ocean, not only by hunting sailors but also by feral cats and dogs (57:*33*).

§ A bridge, a stretch of tar, is a contentious subject, especially for islands and islanders. Murray… does not mince his words: the convenience of the bridge is obtained at too high a price, since it irrevocably transforms otherwise whole islands into mere parts, fractions of mainlands (116:*324 ; cf.* 117).

** Even the official motto belies its aspirations. The motto of Prince Edward Island, *Parva sub ingenti*, 'the small under the protection of the great,' is an apt metaphor for Canada's smallest province. It is also a bitterly paradoxical expression of the Island's status as a 'have not' province, largely dependent on others for its survival, first as a colony under British rule and then as a somewhat reluctant new province of Canada. As Prince Edward Island comes to the end of the 20th century, the goal of greater self-sufficiency and self-reliance remains as elusive as ever (118:*175*).

†† The Confederation Bridge, linking Prince Edward Island (PEI) to New Brunswick (NB) across the Northumberland Strait… has probably been the most keenly debated and most traumatic event in the modern history of PEI, Canada's smallest province (116:*329*).

‡‡ In *A Geography of Islands*, Royle dedicates the first photo in his book to the 14-km Confederation Bridge, linking PEI (and its 140,000 citizens) to mainland New Brunswick since 1997… To judge from the lead-up, many Islanders held high hopes from the completed structure. 'Our Island province is about to experience a transition to a new frontier of vigorous expansion and renewed community vitality,' PEI Premier Pat Binns predicted at the official opening. 'Our traditional sectors of agriculture and the fishery will be enhanced by a marked improvement in transportation infrastructure….

The decision to bridge the gap (that is, the Northumberland Strait) was by no means universally popular, however… Prominent islanders like Betty Howatt campaigned vigorously against the bridge—because she saw 'a loosening of the social fabric in the province' and claimed that 'people no longer have that sense of place that they once had…' In a January 1988 plebiscite, 40 percent of islanders voted against a fixed link. For many of these, a fixed attachment was a violation of a natural order of things; a forced and permanent alternation of an intimate and fundamental spatiality… A key perceived threat was to the impact that a bridge would have on the island's unique and distinct 'way of life.' The latter may escape definition, although Ansel Ferguson, an island fisherman, describes it as 'a little more friendliness, a little more community, a little less crime…' Critics argued that easy access to the island province would damage the tranquility, natural beauty and charm of island life. Islanders did not want the green fields and red soil to be tarnished by the hotdog stands and jukebox joints that would transform the place into another Coney Island… A fixed connection would allow New Brunswick and Nova Scotia firms to truck their products more efficiently to PEI, as well as encourage Islanders to go shopping in such places as Moncton or Halifax, undercutting the island's smaller producers and retail outlets. Fishers complained that any solid structure in the strait would affect fish stocks, shellfish beds and especially lobster (116:*329*).

§§ For an island that depends so much on its natural resources (sea, land)… [and tourism] to support its economy, it is not surprising that much concern was raised on the environmental impact of the bridge, especially in the sensitive Northumberland Strait. There are now tell tale signs of 'ecological collapse' in that stretch of water… Many are claiming that the bridge is to blame for a 'sick strait'… The Federal Environmental Assessment Review Office had concluded, in 1990, that '… in terms of the marine ecosystem of the Northumberland Strait, the risks associated with the proposed bridge concept are unacceptable' (116:*321-322*).

the guidance of the one and only official and impartial *Report of the Environmental Assessment Panel,* which was commissioned and published in August of 1990. This report,

> which resulted from over a year of study and public hearing into… [the] bridge proposal… is quite explicit and clear-cut about the proposed bridge: On two occasions the report said, in bold print, "**The Panel recommends, therefore, that the project not proceed**" (115:*6*).

And, ironically, a testament to this recommendation was nearly visible to the naked eye from PEI: across the Northumberland Straight stands the Canso causeway, a link whose history offered much to help inform the Confederation bridge strategy a half-century prior:

> In 1944, a federal committee recommended that a fixed link be constructed… During the remainder of the 1940s, Post-Record publisher H.P. Duchemin was relentless in his use of his editorial space to promote and push for a fixed link… On 28 February 1944, Duchemin wrote that lack of an alternative to the ferry crossing '…is an insurmountable hurdle to the industrial progress of the Province….'
>
> On 1 March 1944 Duchemin said there was 'great necessity for this long overdue modernizing' and quoted Nova Scotia Premier MacMillan as admitting that 'no post–war work… would take care of more men than this job'… Duchemin pointed to the 'saving of carriage costs' that would be realized by a fixed link, thereby improving the 'industrial progress' of the province…. On 10 June 1944 he stated that the crossing is long-overdue and to continue to ignore the need was to condemn Nova Scotia to 'industrial stagnation and economic inferiority' (119:*72-73*).

When the Canso Causeway was built and opened for all to see, admire, and cross, on 13 August 1955, Transport Minister George Marler said that Nova Scotians could finally

> 'look forward to the future with profitable optimism…' as the Causeway would foster trade and stimulate new industries and 'make it possible to visit, more easily than before, this inviting and friendly vacationland.' Premier Henry Hicks waxed more poetic: 'Demands of increasing population have always stirred men to overcome difficulties that have seemed barriers to progress.' (119:*76*).

But the savings did not come. The tourists did not come. The profit did not come.

But economic and ecologic decimation did.

Flashing forward, to 1990, the time that the *Report of the Environmental Assessment Panel* 'recommended, therefore, that the [Confederation Bridge] project not proceed,' fellow islanders across the Northumberland straight on Cape Breton Island had long-since began to "associate the Causeway with decimating industrial activity and, as a result, reducing populations" (119:*73*). The Causeway, ironically, had also been linked to the collapse the local fishery.

> The Canso Causeway may have tied Cape Breton to mainland Nova Scotia, but the Island's economic situation did not improve; rather, the link is one that exacerbated a culture of colonialism and dependence, where the central powers extract the resources and the best minds out of its 'most despised hinterland'… With official unemployment handing steadily at between 17 and 20 per cent, outmigration endemic, and no real changes in sight, economic prosperity is an elusive goal. Linking the Island to the mainland did not seem to improve the relationships between the entities, even after fifty years conjoined.
>
> Industry did not expand significantly, population declined… As an industrial development tool, the Canso

Causeway failed (119:*81*).

If one were to turn around and look in the other direction – to Quebec – two more enlightening lessons were to be found in the St. Lawrence. And if one were to heed von Humboldt's call to become an explorer, heading down to Florida's Gulf Coast would have offered yet three more islands. Moreover, if one looked beyond the shores of North America, to Sweden, literally *hundreds* of illustrative lessons were to be learned (of which, more to follow).

Needless to say, the same pomp and circumstance, the same political rhetoric – nearly verbatim – conspired against the islands on Prince Edward Island (115). And yes, the Confederation Bridge linking Prince Edward Island to Nova Scotia was built and stands yet today.

Within a decade after completion of the bridge, the south shore fishery, once amongst the most productive in Canada, collapsed; all commercial species on the south shore are now commercially extinct. Economic and ecologic collapse have also occurred much more rapidly and with far more destructive power than that caused by the Canso Causeway. Although this decimation has analyzed and chronicled (*cf.* 38 ; 75 ; 78), it is not surprising that several – if not most – of the aspects relating to this collapse have eluded analysis (*cf.* 115), as the same inductive methods which have been utilized to inform economic development strategy for the past century (*i.e.* methods lacking a theory of value, founded upon the inherently false and sandy inductive foundation of the 'social sciences'), have been utilized to assess the post-construction economic performance. Although I have reported upon this curious phenomena (*cf.* 75), no other economic analysis has commented upon the fact the mandate to drive monocrop potato production has worked-out fabulously well – PEI boasts the highest density potato production in North America, with acres in production nearly doubled since the completion of the Confederation Bridge – but it has come at an evolutionarily unstable price: potato blight fungicides are amongst the most toxic chemicals on Earth.*

Alas, this spectacular, Naru-esque tragedy plays on yet into the present: the industrial agricultural objective set into motion in 1970 and brought into full fruition with the construction of the Confederation Bridge has plagued PEI with the

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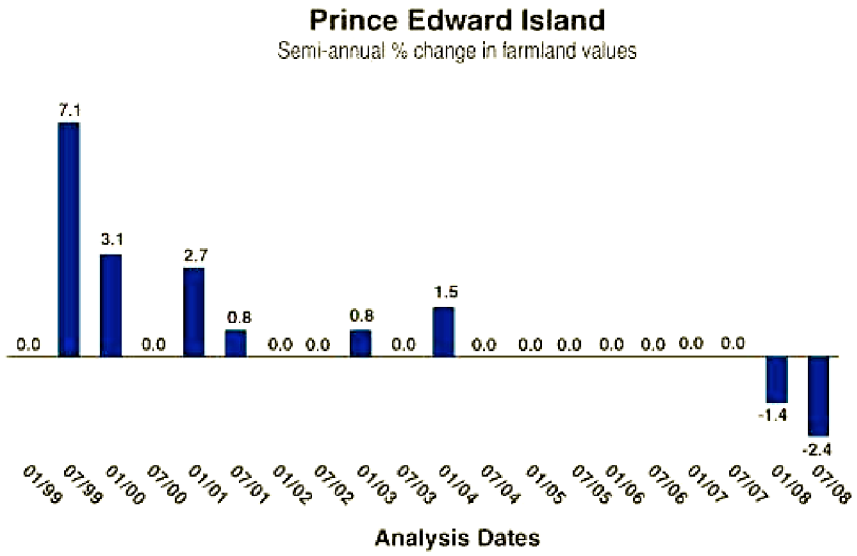
* The historical development of island peoples bears always in greater or less degree the stamp of isolation; but this isolation may lead to opposite cultural results. It may mean in one case retardation, in another accelerated development. Its geographical advantages are distinctly relative, increasing rapidly with a rising scale of civilization. Therefore in an island habitat the [human] factor may operate with or against the geographic factor in producing a desirable historical result. If the isolation is almost complete, the cultural status of the inhabitants low, and therefore their need of stimulation from without very great, the lack of it will send them deeper in barbarism than their kinsmen on the mainland (120).

poorest water quality (75),* poorest economy (38), poorest populace (38 ; 78), and highest cancer rates in Canada (75). Needless to say, PEI is suffering great losses and staggering defeats on a daily basis,† not the least of which is marketing itself as the 'green island,' or 'gentle isle.'

Although there is no need to repeat analysis I've already produced in exhaustive detail (*cf.* 75), I will offer three quick economic snapshots – two now, and the third in due course.

First, recall that the 'agricultural economic miracle' the premier promised was to commence with the completion of the Confederation Bridge in 1997:



And of course the greatest tragedy – the element which gives this drama it's tragi-comedy quality, is that industrial agriculture is untenable on PEI under the best conditions. Farmers are restricted – by law – to ownership of 3,000 acres or less. The last time I checked, the largest potato farmer in Idaho was working a little over 100,000 acres. In general, PEI farmers are unable to *produce* agricultural commodities for less than they're *selling* for on the Chicago Board of Trade. If it weren't for subsidies, perhaps they'd all be out of business (even with subsidies, many are folding). Thus, the irony is that

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* The quest for high-quality water has been an objective of human society going back to prehistoric times. Early humans gathered in locations with readily accessible sources of water and *if the water was believed to be of questionable quality, entire settlements would be abandoned* (121:*S13*).

† Sorry I haven't been able to read your many emails and get back to you since my expedition to Åland [*cf.* 37], but I've been working through a dilemma, and, alas, I've concluded: *ESS* ≠ *PEI*. I wish I had time to offer you all the considerations which were involved in arriving at this difficult conclusion, but I will note my final decision came at the end of my seminar in Åland. After detailing our rather extraordinary economic and ecological problems, at the end of my seminar, a PEI native (and UPEI 'island studies' professor, no less) said, 'I disagree with Funk's assessment, I can't explain it, but I just wanted to state that I disagree.' And that's when it occurred to me that she – and countless islanders just like her – actually don't think or aren't capable or can't handle thinking – that these problems exist! It doesn't matter how much evidence piles up, the dissonance is too painful. But this thoroughly predictable commentary was truly a gift, because, for the first time, another native islander seated in the audience – my wife – was able to see the true nature of the problem as well. I hope I'm wrong, but I'm afraid the problem won't be solved in my lifetime, as it seems (*i*) *The Tragedy of the Commons*, (*ii*) *The Canadian Constitution* [*cf.* 107 ; also *cf.* the 10th Amendment of the U.S. Constitution], (*iii*) *Religion*, and perhaps even (*iv*) *The Founder Effect* brew quite a toxic stew. Sorry I won't have the opportunity to offer further assistance with your research. Farewell and good luck—Matt.

the islanders are poisoning themselves and – to add insult to injury – losing money while they're at it. At least the Albertans are making $ from the oilsands (much of which, ironically comes back to PEI in the form of provincial transfer payments).

The second snapshot, released 22 April 2009, really says it all:

> *Corporate Knights* released the first comprehensive environmental report card today for… Canada's provinces…
>
> The Green Provincial Report Card, which considered environmental performance across ten equally weighted categories – including greenhouse gases, organic food, green energy, green jobs, water use, biodiversity and car dependency—ranked BC at the top of the class with an overall score of 69 per cent for being tops in green jobs, green buildings, organic food, and energy efficiency.
>
> Although the survey methodology adjusted for size of population and economy, Prince Edward Island pulled in at the bottom of the class due to poor energy efficiency, high car dependency, extreme paucity of protected land, and a dearth of certified green buildings (122).

PROVINCE	TOTAL	GRADE
BC	69%	C+
ON	67%	C+
NT	66%	C+
YT	57%	C-
NU	56%	C-
AB	55%	C-
NS	53%	D
SK	50%	D
QB	49%	F
MB	46%	F
NB	40%	F
NL	38%	F
PE	32%	F

Last year, a *Globe & Mail* cover-story exclaimed: *PEI'S KILLING FIELDS*:

> Every summer Islanders hear about… thousands of fish dying in our rivers and streams… Wednesday, three more sites were added to the initial list of 13 rivers and streams plagued with the stench of rotting… fish. And apparently the problem is getting worse. Environment Minister George Webster concedes that 'the trend is escalating' and 'there seem to be higher numbers' (123:*A6*).

Two weeks later, on your Author's 40th Birthday (13 August 2008), *The Guardian* asked: *Fish kills in our rivers: Are we heeding the warning?*

> The first comprehensive Atlantic salmon survey on Prince Edward Island in almost a decade has revealed an alarming trend. The report, *A Conservation Strategy for Atlantic Salmon in Prince Edward Island*, warns of disappearing… salmon.
>
> 'Eleven *PEI* rivers have lost their salmon since the early 1990s,' says Daryl Guignion, the report's author. 'Only 22 rivers presently have Atlantic salmon and stocks in seven of those are very precarious. With the current rate of loss, in a few years, Atlantic salmon will likely disappear from Prince Edward Island.'
>
> Todd Dupuis, director of regional programs for the Atlantic Salmon Federation, says the report is an eye-opener. 'We need to do something quickly if Islanders are to continue to enjoy Atlantic salmon in this province," said Dupuis. "We know that salmon stocks in Northumberland Strait rivers in New Brunswick and Nova Scotia remain relatively strong therefore it seems there is something different on *PEI* that is causing this rapid decline.'

> The recent federal-provincial report on the high levels of nitrates in provincial groundwater and surfacewater should come of no surprise.
>
> As a member of the provincial Round Table on Resource Land Use and Stewardship, I regularly heard the issue raised at public presentations. Nitrates were seen as a threat to the quality of Prince Edward Island's water and received attention in our 1997 report. Ten years later, the problem continues to get worse (124:*A7*).

Why did this come of no surprise? Why does this problem persist?

*Because the poor, alas, deviate more.**

Why was the Confederation Bridge build despite the peril which it so clearly posed?

Because it was a *one billion dollar bridge*—one billion dollars worth of jobs and infrastructure contracts for 'have not' islanders (jobs which were not even given to them in the end – but that's another long, sad story). *The Tragedy of the Commons* may be readily taken in on any given day one (reluctantly) chooses to open *The Guardian*. A few weeks ago I was invited to offer a guest-lecture (69) and as I had hoped to make this very point, I opened *The Guardian* that morning and was not surprised to find an illustrative example (see *APPENDIX VII: ON THE TRAGEDY OF THE PRINCE EDWARD ISLAND COMMONS*). The point that this article made was this: Rustico, PEI, announced in the paper that morning that they had decided to sell-off some land as a new housing development, despite the fact that they happen to have many well-known problems which should have informed otherwise, two of which are (*i*) insufficient fresh-water supplies (which, thanks to increasing salt-water intrusion, are dwindling by the day) and (*ii*) a sewage system operating well over over-capacity. Yes, they decided that a new housing development was the solution to their ills; yes, the daily news on Prince Edward Island attests (*e.g.,* 75 ; 38 ; 69 ; 111-112 ; 117-121 ; ; *APPENDIX VII*) and continues to attest, the poor deviate more.

Populations with hungry mouths to feed and little to feed them with choose economic development over ecological preservation almost every time (though the people of Molokai offer a brilliant and inspiring exception to this rule).

In *Islandness*, *PEI* islander David Weale contended that

> economically, socially, psychologically, the construction of a fixed link will reduce our insularity. It moves in the direction of peninsularity, which as the work itself expresses, is a state of being almost an island (126: *82*).

It seemed to me that Weale was on to something—that his intuition and survival instincts served him well—but that he was unable to fully express a very important message, and thus unable to make his case with sufficient conviction. It

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* A variety of sources indicate that 'the poor deviate more.' If the average person violates neoclassical assumptions, the average welfare recipient violates them to a markedly greater degree….

> Once you accept the idea that you can hurt people by giving them more choices, you cannot dismiss the idea that you can help them by taking some of their choices away. In practice, of course, the latter is much more costly and intrusive than the former (125:*503*).

appeared that Weale was struggling to describe a desirable, *evolutionary stable degree of relative insularity*: the institutions, communities, people, economies, wildlife that biogeographical *and* politico-economic insularity engender.

I began to wonder if Weale's promethean apprehension was founded upon an intuitive understanding that a drastic reduction in relative insularity represented evolutionarily unstable strategy.

In the end I concluded that Weale was right: In short, the islanders (*i*) failed to recognize that they had evolved and adapted to live within niches of high insularity (as did Dodos and Great auks), (*ii*) failed to understand the value of relative insularity, and thus (*iii*), failed to adequately assess the consequences of a dramatic reduction in relative insularity. Yes, Weale was on to something, and game theory happens to offer support for the critical point he and others* tried so desperately to make.†

Furthermore, as I pondered Weale's conundrum, I began to wonder if relative insularity could be *quantified?* What if Weale had been able to *quantify* what this loss of insularity might mean? *The Funk-Carlquist Formula* (*GLOSSARY*) represents my on-going search for a quantitative solution.

When islands chase continental economic mirages, such as the pursuit of commercial agriculture, sooner or later, they lose money *and* the benefits their island ecology once offered: through amplification-by-compression, they experience *greater* pollution-related externalities than continental counterparts, form greater trade-related interdependencies, and thus become more vulnerable to financial shock as well.

The simple solution for island development is this: Do as little as possible, disturb as little as possible, foster the healthiest environment possible, for that *is* and *almost always will* be an island's greatest asset! 'Islandness' is any island's greatest competitive advantage – insularity is perhaps the single, scarce commodity with which 'globalized economic military superpowers' simply cannot compete!

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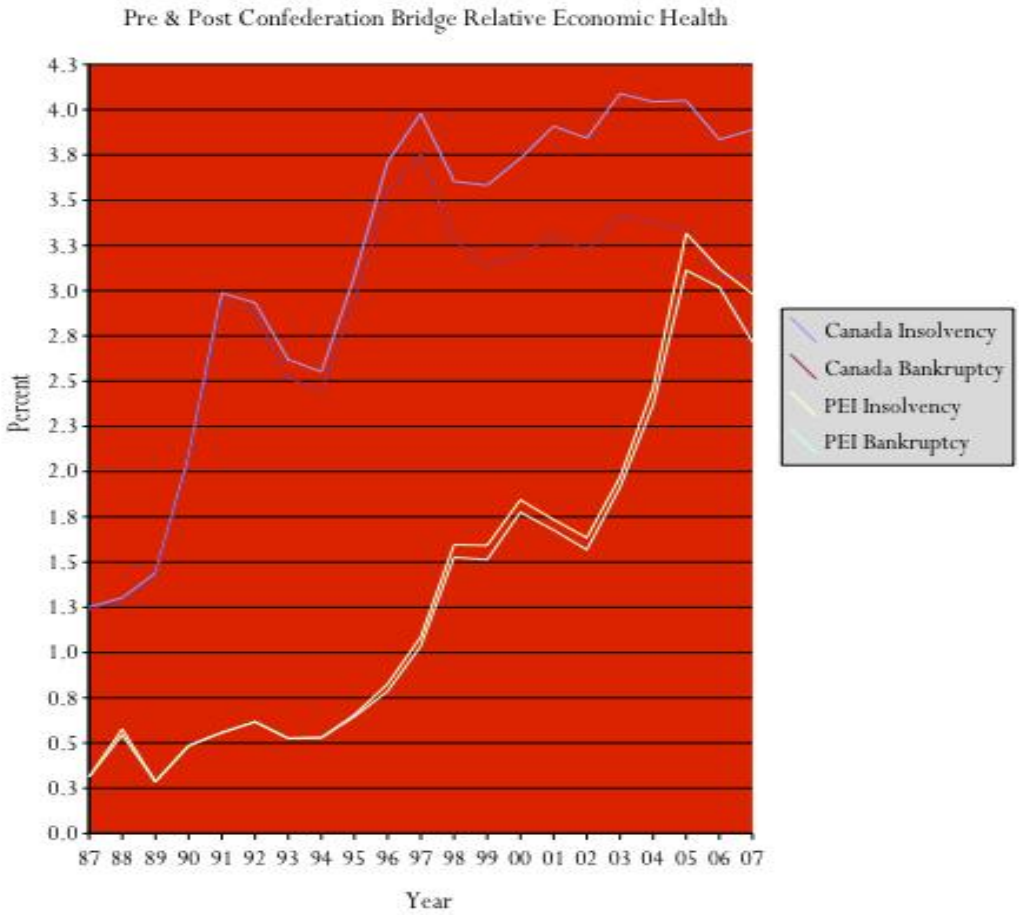
* The potential for dysfunctions were equally difficult to calculate. If a fixed link made it easier for Island exporters to penetrate Mainland markets, would it not also be easier for Mainland producers to penetrate Island markets? Was travel time and boat fare not a useful buffer against Mainland competition? Remove it and local manufacturers might be crushed under Mainland competitors' larger economies of scale. Many of these arguments were encapsulated in a submission made by Harry Baglole to the Conservative Task Force on Transportation in 1987. A fixed link, speculated Baglole, would encourage an economic centrifuge in which 'diversity and flexibility suffer and energy and resources tend to flow from the smaller and weaker toward the larger and stronger, away from the extremities and toward the centre.... Among the affected industries Baglole identified were fish processing, meat packing, and potato processing (127:*38*).

† What imitation rules [should] an individual... choose when she now and then has the opportunity to imitate another individual in the same player position but is otherwise constrained by severe restrictions on information and memory? ...If the individual wants a learning rule that leads to non decreasing expected payoffs over time in all stationary environments, then the individual should (a) always imitate (not experiment) when changing strategy, (b) never imitate an individual whose payoff realization was worse than her own, and (c) imitate individuals whose payoff realizations are better than her own with a probability that is proportional to this payoff difference (128:9).

Stewart Shepherd, one of the five economists hired (remarkably, all economists were from Europe, none had ever been to PEI) to develop and write the ill-fated plan of 1970 (*cf. APPENDIX VI*) confirmed my finding. Shepherd noted the plan was initiated because *per capita income* was lower on PEI than in the other provinces of Canada. But as Shepard remarked, *life expectancy and the standards of living were not lower*.

Moreover, standards of living may actually have been much better than the rest of Canada, relatively speaking, prior to building the bridge. In either case, however, as previously noted, per capita income data is inherently meaningless with no *Theory of Value* (11).

Perhaps some relatively useful economic data, however, is data which shines light upon *economic survival*:



As you may see, prior to the 'economic miracle' known as the Confederation Bridge, insolvency and bankruptcy was nearly unknown to Prince Edward Islanders, those thrifty sons and daughters of your highland, lowland, and island Scots (for example, my island wife's father is Campbell and her mother is a McDonald). But isn't it curious that *c.* 1997, just as insolvency and bankruptcy rates across Canada were falling and levelling-off, both took meteoric rises on PEI?

But dollars and sense are now perhaps the least of PEI's woes, as ecological destruction has rendered any and all

economic arguments moot points – relevant analysis insofar as Prince Edward Island and Prince Edward Islanders are concerned are more fruitfully directed towards how they might best migrate to greener fields elsewhere across Canada.

In the past, ecological preservation has invariably taken place by accident, not design. For example, consider the fact that

> the 17th century saw several attempts to develop the PEI fisheries through grants made by the French crown for monopoly fishing or sealing rights... *Because of PEI's remoteness, its poor north shore harbours*, and political squabbling, *none of these projects was ever realized* (129).

This 'accident' helps illustrate the self-defeating nature of employing 'continental' (*MED*) economic development strategies on islands. From an islanders economic perspective, this 'failure' was actually an *economic miracle*. The relative access to the deep water harbours on PEI's south shore have helped turn the Northumberland Strait into a lifeless sewer, but the *poor north shore harbours* have *preserved* the north shore's ecology *and* its economy. PEI's most productive fishery, most desirable tourist destinations, most desirable (valuable) real estate, *relatively* healthy water-sheds (still amongst the most polluted in Canada), are a direct result of these 'poor' north shore harbours (130).

Meanwhile, following the Gulf stream to the north-east, extraordinarily high levels of natural (biogeographic) insularity played out in an even more advantageous fashion:

> Compared to Newfoundland, Iceland's domestic fisheries remained at very low levels of effort and catches until the early 20th century... In the period 1905-1909, Icelandic groundfish landings averaged only 48.4 thousand metric tonnes, or about a quarter of those of Newfoundland (129:*101*).

As the 'accessible' Newfoundland fishery collapsed, the Icelandic cod fishery was *preserved* by it's insularity. In the years which followed, by the way, Iceland complemented biogeographical insularity by augmenting it with political insularity by waging the cod wars.

I attempted to convey the essence of this counter-intuitive finding in my conclusion to a long letter to the Ålanders:

> The fact that your per-capita income ranks so highly is admirable,* but largely irrelevant – pay as little attention to this inherently meaningless [11] figure as possible, for if it should rise to number-one, in reality you may be worse off, and if it should fall precipitously, you may in fact be better off. The best indicator of your great success is plain for all to see: *Your health*.† As the years pass, keep an eye on this benchmark, for, ideally, it should *always* be on the rise. If it should remain flat, be concerned. If it should fall, be alarmed (38).

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* In 2003, the [per capita GDP] was €34 193 (£22 556, US$44 423), the highest in the Nordic countries (41:*684*).

† Its health statistics are good. The average life expectancy is 2–3 years higher than in the rest of Finland. For women it is the highest in the Nordic countries (41:*684*).

Of course PEI is not an exceptional case, it is merely an accurate, highly descriptive, and relatively simple model of the maladaptive politico-economic development strategy that has been (and remains) employed on most islands throughout the world. Maladaptation is the norm – not the exception – amongst island nations and sub-national island jurisdictions, for *The Tragedy of the Commons* is so utterly *common* that it is extraordinarily difficult to find an exception to this rule, which is referred to regionally by various names, including *The Coney Island Effect, The Key West Effect,* and *Balaericazation*.* Even the Galapagos are 'under siege' by a 'growing flock of well-meaning ecotourists' (131:*W1*), and, furthermore (and somewhat ironically), since tourism is the number one industry in the world and, naturally #1 on most islands, islanders also have a tendency to work hard to obfuscate these truths – which, of course, ends up making the problem more difficult to solve.

There are several infamous and notorious examples – from Easter Island to Nauru – in which *The Tragedy of the Commons* plays out until the very bitter end; and islands such as Phuket, Key West, Malta, Oahu, St. Martin, Ibiza, St. Thomas, Bermuda, Jamaica, Carriacou (*cf.* 132), Barbados (of which, more to follow), and, in fact *most* Caribbean islands (*cf.* 57:*98-100*) find themselves face-to-face with the final curtain-call for the final act in this play.† The highest point on Malta – visible from all points on the island – is the summit of the central landfill. Throughout St. Vincent and the Grenadines, 'tipping' is the waste-disposal method of choice: Utilizing modified pick-up truck beds, islanders back-up to a cliff, and 'tip' their waste into the sea. This practice has been a source of particular embarrassment on St. Vincent, since the most popular tipping cliff towers above an otherwise inaccessible beach at the mouth of the harbour: As cruiseship passengers arrive daily (by the *thousands*, of course), their introduction to the splendours of St. Vincent are the rolling hills of rubbish along this beach.

The challenge, of course, is to identify a significant exception to this rule, and see what lessons it may have to offer—and I have done just that.

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* Even when agriculture, fisheries and commerce have done their best, in the various stages of civilisation, to increase the food supply, yet insular populations tend to outgrow the means of subsistence procurable from their narrow base (18:*459*).

† The specific colonial history of most islands has created an artificial economy which had meaning only within the imperial context....

Since the 1950's, in particular, there have been disturbing signs of a new crisis affecting the viability of an increasing number of islands, both those within the developed world and those colonial and ex-colonial islands mainly concentrated in tropical latitudes. This crisis is reflected in the increasingly marked tendency to use emigration as a safety-valve to reduce population pressure when it becomes incompatible with the maintenance of living standards, given local economic systems and capacities....

For many islands the post-war period brought the culmination of a long set of policies and circumstances which were inimical to long-term sustainable growth. Centuries of deforestation, erosive plantation monoculture, marine exploitation, natural disasters and policy neglect had resulted in the progressive loss of renewable resources, diminished biological productivity and diversity, and the abandonment of traditional resource husbandry. This ecological crisis was often combined with a crisis of subsistence agriculture which, after the 1950s and 1960s, no longer appealed to island populations as a viable way of life (57:*102-103*).

Though Molokai and the big island of Hawaii offer admirable exceptions with impressive sustainable economic development track-records and extraordinary relative insularity, Molokai's success is based upon *cultural cohesion*, and although this appears to have offered a solid foundation for Icelandic* ESS† for ≈1000 years, the most recent chapter in Iceland's history suggests perhaps *cultural cohesion* ≠ *ESS* afterall.

The *moku nui* of Hawaii is naturally well endowed—in fact *The Funk-Carlquist Formula* (*GLOSSARY*) suggests the big island may represent the single-most insular island on Earth. But this fortunate case is only *partly* by design (*i.e. privatization viz.* The Parker Ranch)—it is in large part due to the fact that destructive agricultural industrial enterprises and high-density housing developments are uneconomical/impractical/impossible on the summits and flanks of 13,000 foot volcanoes: *The Funk-Carlquist Formula* suggests that the big island's extraordinary *relative insularity* is attributable to interdependent factors all working in unison to foster extraordinary evolutionary & economic value: *Hegemon Military Status*,‡ vast land-area, the Pacific Basin,§ wonderful isolation,** extraordinary fresh water reserves, considerable natural resources, high elevation (and thus, an unprecedented range of ecological zones, convection rainfall, *etc.*), a high percentage of forested Land Area, considerable Land Area protected by nature preserve, relatively low industrial agriculture production, no irrigated agricultural production, great solar and wind resources, low population density, and the fact that ≈10% of the island (≈30%

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* Settled by Norwegian and Celtic… immigrants during the late 9th and 10th centuries AD, Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated… Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. Literacy, longevity… and social cohesion are first-rate (133).

† Looking back at all the different island problems, my understanding is that most of these could be best solved if the island community develops and sustains a sense of unity, which may manifest itself in civic mobilization. Iceland won the cod [*Gadus morhua*] war because all the Icelanders were prepared to fight against the British fishing fleet and thus conserve their basic resource. Had there been any disagreement on this within the Icelandic population, they would never have won (134: *337-342*).

‡ The main metrics of world power… are gross domestic product (GDP), population, defense spending, and a less precise factor that includes innovation in technology. Power is summed as a percentage of total global power: Fourteen nations hold at least a 1 percent share. The United States holds about 20 percent of global power; the European Union (considered as a unified actor) and China, about 14 percent each. India holds about 9 percent. Brazil, South Korea, and Russia hold about 2 percent each. In moving toward 2015, the United States will first gain power, then decline somewhat, ending up at about where it is now. The EU, however, will lose power, as will all non-U.S. members of the G-8. The gainers will be China and India. The assessment identifies possible alliances that could match the power of the United States acting alone or with its traditional allies. It also examines the most likely locations for future conflict. Asia is by far the most dangerous region, with six of the eight conflict-prone bilateral balances involving China (135: *abstract*).

§ Many thousands of islands, totally more than one million square miles of land area, are strewn over the third of the earth's surface that comprises the Pacific basin….

Any consideration of Pacific islands must begin with the immensity of the water area that surrounds them, the largest single earth feature, whose area is greater than all the land above sea level on the face of the globe (136:7).

** When great powers are separated by large bodies of water, they usually do not have much offensive capability against each other, regardless of the relative size of their armies. Large bodies of water are formidable obstacles that cause significant power-projection problems for attacking armies. For example, the stopping power of water explains in good part why the United Kingdom and the United States… have never been invaded by another great power. It also explains why the United States has never tried to conquer territory in Europe or Northeast Asia, and why the United Kingdom has never attempted to dominate the European continent. Great powers located on the same landmass are in a much better position to attack and conquer each other. That is especially true of states that share a common border. Therefore, great powers separated by water are likely to fear each other less than great powers that can get at each other over land (48:*44*).

of all arable land) was under the *private stewardship* of Parker Ranch from the mid-19th century until the present: *The Tragedy of the Commons* has not been able to wreak a fraction of the havoc it has wreaked upon Oahu and Maui.

But a truly descriptive model for *RIS ESS* (*MEP*) requires a smaller, far more controlled experiment; an island with a natural history guided more by the hand of human agency than by Mother nature, a politico-economic realm of insularity which evolved and is evolving from a clearly stated, politico-economic development strategy from day one, *and* had and maintains the enforcement mechanisms in place to achieve it.

Stewart Shepherd, whom I have discovered to be a truly wise economist, gentleman, and a scholar, readily concedes the PEI development plan failed to consider ecological factors. And although he was almost entirely correct when he acknowledged and defended this error by noting that there weren't any economists on Earth factoring ecological considerations in 1969, there was at least one economic development plan being drafted – at the exact same point in time – which did.

There are 34 islands in the Grenadine archipelago,* which possess very similar levels of relative insularity, almost no natural resources (many even lacking fresh water), and all fall under the same bio-geo-politico-economic umbrella of the St. Vincent and the Grenadines (*SVG*) flag.†

SVG is the second-poorest nation in the *OECS*, and "it is notable that there are currently no comprehensive policies or mechanisms that address sustainable development in St. Vincent" (139:*2*). Thus *SVG* offers one of the finest laboratory for a relatively controlled, comparative island study of sustainable economic development; furthermore, the extraordinary value of comparative island study cannot be overemphasized (*cf.* 17-18 ; 50 ; 60 ; 64 ; 78 ; 89-90 ; 92 ; 107 ; 117-118 ; 129-130 ; 135-137 ; 139-151 ; &*c*. !!!).

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* The Grenadine Islands extend between the islands of St. Vincent in the North and Grenada in the south. They lie on the Grenada Bank and belong to two countries, St. Vincent and the Grenadines and Grenada. St Vincent and the Grenadines (SVG) is an archipelago of 34 islands and islets located in the Eastern Caribbean at 13° 15 N, 61° 12 W. St. Vincent, the mainland, is 133 sq. miles, while the Grenadine islands which run for forty miles to its southwest are in total 17 sq. miles. The… islands consist of a number of private and state-owned islands with Bequia, Mustique, Canouan, Mayreau, Union and Palm Islands and Petit St. Vincent being inhabited. Four other islands make up the Tobago Cays Marine Park… The Grenadine islands of Grenada include Petit Martinique and Carriacou… The entire Grenadines are well known for their beautiful scenery, spectacular beaches and diverse marine habitats. All islands have a variety of surrounding fringing, patch and barrier reefs, and there are numerous offshore reef shoals on the bank. St. Vincent and the Grenadines is highly dependent on agriculture (mainly bananas) as a main source of income. However, growth in tourism has made that industry the current highest income generator in the country. In 2002, revenue from visitor expenditure amounted to approximately EC $219.46 million, while that from banana export amount to EC $38, 918,908.57… At present there is no integrated plan within which development and conservation will be pursued in either country. In many instances, development is taking place haphazardly and often without the input of relevant stakeholders. Both governmental and non-governmental organizations lack the capacity to develop an integrated framework for development (137:*1*).

† For a comprehensive history of SVG, *cf.* 138.

SVG lies in the *lesser* Antilles, denoted as such because they were, quite literally, worth *less* in the eyes of early European explores than the natural resource rich, greater Antilles (Cuba, Jamaica, Dominica, Puerto Rico) – unable to merit large-scale agricultural production. And Mustique is certainly one of the lesser of the lesser Antilles: 1400 desert acres, very little fresh water,* no *EEZ*, no minerals, no oil nor natural gas, heavy salt spray, no inductive rain-fall, no geothermal energy, no deep water harbours, no financial sector, no manufacturing sector, a runway too short for jets, one 16-room hotel, one 4-room B&B, one general store, two restaurants, and one bar. Furthermore, *SVG* doesn't provide waste, medical, educational, police, water, fire, power, nor infrastructure support.† Mustique is an 'outlier,' a data-set economists often 'toss out' as irrelevant.

But the case of Mustique could not be any more relevant. By the central theorems and principles of economics, Mustique's economic value could be naturally expected to be as low or lower (due to the lack of fresh water) than many sister islands in the Grenadines, and far lower than on St. Vincent, the main island which possesses nearly all of *SVG*'s natural resources and 90% of the 'human capital.'‡

But this is not what we discover on Mustique.

And this is exactly why this 1400 acre desert island models *RIS ESS* so well.

Evolutionary Stable Strategy

First and foremost, Mustique demonstrates that the foundation to any proposed plan for *RIS* successful economic development *must* commence with a medium-to-long term carrying-capacity study, *and* facilitate the means for *enforcing* the plan's strategy: Mustique has had both items in place from day-one (1970) to the present.

The Mustique Co. Development Plan is indeed truly extraordinary, and, to my knowledge, unprecedented, as it marks

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* The Grenadines are faced with several challenges. Because the islands are so small, they attract very little rainfall, have no permanent rivers or streams and due to their calciferous nature, do not support water retention.... Approximate annual rainfall on the mainland island ranges from 1700 mm on the dry coast to 7000 mm in the wet central mountains. In contrast, the Grenadines may experience as little as 460 mm per annum... Hence, there is very little surface water (137:*10*).

† The island of Mustique is well known as a privately owned island as well as a conservation area by a number of shareholders of The Mustique Company. Although Mustique is part of the Grenadines Islands and has a small population. It has it own Act that deals with matters relating to Mustique specifically. However, section 24 ensures that the laws of St. Vincent and the Grenadines apply to Mustique in the same manner that they apply to the other islands. This keeps Mustique under the ultimate jurisdiction of St. Vincent, but its individual Act allows for matters associated with a privately owned island and conservation area to be addressed adequately.

In the Act, the Mustique Company has a number of responsibilities to fulfil. Since the Mustique Company owns the entire island and it is inhabited, they also have a duty to manage, develop and maintain infrastructure and provide services that are normally the responsibility of public authorities. Infrastructure includes but is not limited to the airport, jetty, roads, and recreational as well as conservation areas (139:*89*).

‡ Insularity has significant links with conflict.... Very few well-developed islands have strong economies and societies... Most islands are not so lucky. ...Weakness has often led to economic peripherality, dependence and external aggression (57:*13*).

the only known instance of the ecologically planned development of an uninhabited island.

The Island Survival Game assists our search for *RIS ESS*, an island-based economic development strategy which cannot be 'invaded'. In other words, the 'island' – be it in the middle of the pacific or landlocked in the middle of the Alps, cannot be 'taken away' (from the 'islander's point of view, *i.e.*, those presently 'holding' the territory) – by force, purchase, or effectively lost as a result of pollution, deforestation, *etc.*

With this object in mind, consider the fact that Mustique was once held by Arawaks, taken away by the Caribbes, taken away by the French and the English,* then, remarkably, was taken and held for some time by one man with a promethean vision and considerable *RHP* – alas, however, not enough. Neither tribes nor nations nor man were able to deploy *ESS*. But the island was ultimately taken away once again, by *The Mustique Co.*, a *private* organization which *did* deploy *RIS ESS*, the *RIS* solution to the *Tragedy of the Commons,* and thus, ultimately, the solution *The Problem of Sustainable Economic Development*.

At this juncture I should also underscore that possessing an 'unbeatable' strategy ≠ *being literally* 'unbeatable,' because *ESS* is *merely theoretical*. Mustique is fairly vulnerable to 'attack' from several fronts: it has almost *no natural insularity*, and very little *political insularity*.† The only insularity it has is the insularity *it created* through privatization—by fencing off the *commons*. The good news, however, is that the only 'invaders' Mustique has to worry about are (*i*) Natural disasters, and (*ii*) political disasters (*e.g.* invasion or SVG attacking via nationalization). The greatest threat – *the commons* – has been effectively eliminated through privatization.§

But even if a hurricane, VE-2+ eruption on St. Vincent, or a military coup should wipe out the 'value' meticulously and *purposefully* created on Mustique, (65) *still* models the *theoretical solution* to our problem.

The 'founder colony' of Prince Edward Island, in contrast, is losing *The Island Survival Game*. This fact is, however, not readily apparent, because Canada's smallest province has generally achieved population growth over the past decade, but this growth is deceiving: the 'founder population' – in this case, the descendants of Scottish Islanders who were deeded this

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* Resistance by native Caribs prevented colonization on St. Vincent until 1719. Disputed between France and the United Kingdom for most of the 18th century, the island was ceded to the latter in 1783. Between 1960 and 1962, Saint Vincent and the Grenadines was a separate administrative unit of the Federation of the West Indies. Autonomy was granted in 1969 and independence in 1979 (133).

† No regular military forces; Royal Saint Vincent and the Grenadines Police Force, Coast Guard (133).

§ 90 shareholders each own their homes plus 1/90th of *The Mustique Co.*, the free-hold owner and operator of the island of Mustique. Properties average 10-20 acres, and may not be subdivided. Any proposed new development must receive a 2/3rd majority vote from the shareholders

island six generations ago – do not presently exhibited sufficient RHP to 'hold the island', and 'invaders' are rapidly taking it from them — although the founder population held steady (*naturally*) at ≈100,000 for nearly 150 years, economic development strategy founded without a *Theory of Value* is only able to prescribe endless growth – thus, despite the fact that the present population – 134,000 is well over the island's carrying-capacity, politico-economic incentive nonetheless offer 'invaders' significant incentives (Canadian citizenship) to 'invade' in order to maintain population growth! The irony, of course, is that this 'growth' actually amounts – from the islanders perspective – to 'loss.'

At least one Prince Edward islander apparently sees some value in the learning tool our game readily produces.*

I will briefly sketch two more excellent examples of widely practiced, maladaptive politico-economic development strategy: My wife and I were fortunate enough to spend a week of 2007 on the beautiful island of Bermuda—but as we rode to our hotel one night after dinner, we heard a sad story which happens to represent the rule, not the exception amongst Bermudans. Our taxi driver, dressed in a fresh-pressed suit and tie, also happened to be a certified public accountant (I asked for his business card – and his story checked out); alas, however, he confided that, at 54 years of age, *after working both jobs for the last decade, he had finally given up on the prospect of home ownership*.

Off-shore finance, often seen as a quick-fix and big dollar idea in island jurisdictions – like so many such contrivances, is prone to *The Law of Unintended Consequences*. Bermuda's insurance sector writes more than $100MMM USD in premiums per annum. The tiny capital city of Hamilton boasts over 3.5 million square feet of office space. These are indeed the kinds of numbers which get economists and politicians excited – but it doesn't get *Bermudans* excited: These dollars do not, generally speaking, benefit *Bermudans*. In fact, they often work against them in the form of dominant *RHP* ($) – those who own and come to work for the largest insurance companies in the world (primarily from the UK) have superior 'firepower', so to speak. Bermudans have unwittingly – and quite effectively – priced themselves out of their own market and are thus losing *The Island Survival Game*.

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* -------- *Original Message* --------
Sent Mon, 21 July 2008 03:22 at pm:
Hey Matt, Just finished reading....

I like... *The Island Survival Game*. Yes, the farmer would want to sustain and protect their farm for genetic survival. I never thought of it in terms of PEI's founder population decreasing, therefore it is an evolutionary unstable strategy driving the founder population extinct. (I am a member of the founder population, and yes we are going extinct!). I liked how you explained: Drastic reduction in relative insularity represents unstable evolutionary strategy, and then used the Bridge as an example. I agree Islanders evolved to live with the niches of insularity, because I feel it.... It was a great... example, explaining how the problem of the Bridge represent the universal worldwide problem. PEI should conduct a carrying capacity study. I didn't know about that point. Very interesting. I think it is great that [you discovered] Mustique..., and I am with you 100%, island ecological heath = island economic health.

The inhabitants of Barbados are losing, too, and this is rather ironic (though perhaps predictable), considering the fact that "the country enjoys one of the highest per capita incomes in the region" (133); although this counter-intuitive finding is detailed in an exhaustive (though admittedly unrefined) discourse (38). And, since a picture tells a thousand words, I have animated this illusive dilemma with 174,000 words in four minutes and 19 seconds by producing a brief overview (literally), a round-trip flight from Barbados to Mustique. This magic flight* offers a stunning visual introduction to the amplified nature of *The Tragedy of the Commons* on islands, *RIS ESS*, and a contemporary overview of the value propositions diametrically opposed economic development strategies (*MED* and *MEP*) offer. This short, silent film also introduces *The Funk Line*, the bio-geo-politico-economic equivalent of *The Wallace Line*.

The Funk Line (151) brings the human agency (politico-economics, *i.e.,* land-use policy, *etc.*) into the biogeographical evolutionary equation, clearly demonstrating that, when comparing Mustique to Barbados, St. Vincent, the other 33 islands of the Grenadine chain, the remainder of the lesser Antilles, all of the greater Antilles, and almost *every* other warm-water island on Earth,

> there is no other example on the globe of an island so closely surrounded by other islands on every side, yet preserving such a marked individuality in its forms of life;… it is, so far as yet known, absolutely unique (50:*426*).

Cold water islands – such as the Faroes and Lofoten (51:*110*) – are often applauded for their sustainability, but cold water island ecological preservation is, more often than not, a function of natural consequences (low tourist demand, few ecologically degrading industrial and agricultural opportunities to exploit, *etc.*), not human agency (though the Svalbard archipelago may represent a notable exception).

Mustique achieved and maintained *ESS* through (*i*) Colin Tennant's *privatization* and promethean vision, (*ii*) the ecological principles Tenant and Money-Coutts established by commissioning *The Mustique Co. Development Plan*, (*iii*) the prudent management and execution of this development plan —with an emphasis upon *gradualism* – by the Honourable Brian Alexander, (*iv*) the relative insularity protected, fostered, and insured by ample *RHP* ($, The Mustique Co.) and (*v*) the constitutional and contractual agreement (free-hold land title) honoured by *SVG*.

Alexander was kind enough to critique my positions regarding Mustique (*cf. APPENDIX IV*), and his most

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* If the hero in his triumph wins the blessing of the goddess or the god and is then explicitly commissioned to return to the world with some elixir for the restoration of society, the final stage [(the magic flight)] of his adventure is supported by all the powers of his supernatural patron (2:*170*).

fundamental criticism was that Mustique's success was only possible *with extraordinary capital reserves*. Others have suggested that Mustique does not model sustainability because it is not *self-sufficient*. However, as demonstrate in the short discourse enclosed herewith (6), it is theoretically *impossible* for *any* 'island' on Earth to be self-sufficient (though a relatively high degree of self-sufficiency does = ESS).

Furthermore, the object of the game – *RHP* – makes no normative assumptions regarding self-sufficiency nor any other 'traditions which satisfy the canons of rationality embraced by socialists' (of which, more to follow).

In any case, returning to our thread regarding the essence of *RIS ESS*, contrary to findings tabled across the board in neoclassical economic theory, islands are not in fact *cursed* by geography, from an '*Islands*' economic perspective, small-island societies are clearly *saved* by the *miracle* of biogeography, by the miracle of *insularity*.

Moreover, as time moves forward, the few 'islands' willing and able to embrace *The Principle of Relative Insularity* (willing and able to make an economic sacrifice in the present for economic and ecological value in the future), stand to watch the value of their evolutionary *and* politico-economic (political stability, economic insularity, *etc.*) assets (such as the increasingly rare and precious asset known as potable water) increase and become ever-more sought-after as healthy, inhabitable environments, tourist destinations, *etc*.

Why is tourism the largest industry on Earth? Because humans consistently reveal the universal preference for relative insularity.

In many—if not most—regards, *The Prince Edward Island Development Plan* was executed brilliantly – over the past forty years this "Federal-Provincial Program for Social and Economic Advancement" has achieved very near what it was formulated to do. The problem was and remains, however, that it adopted a strategy based upon economic principles which were not supported by any theory of value (11). The Mustique Co. Development Plan demonstrated an intuitive understanding of the true value of relative insularity. The PEI plan does not.

These diametrically opposed plans yielded completely opposite and unintended results.

Remarkably, *The Prince Edward Island Development Plan*, which set the path for the intense economic development of an island (relatively rich in natural resources – *i.e.* the fisheries and some of the most fertile, tillable soil in all of Canada) with no regard for the ecology. The result was short-term economic gain followed by both ecological & economic collapse, and dwindling *RHP* (the population is rapidly aging, out-migrating, fertility rates falling, caner rates rising, and population growth has only been achieved through offer incentives to 'invaders'). Despite its mounting ecological problems, rapidly

deteriorating fresh-water supply, and despite the fact that tourism now represents the largest industry (≈1MM tourist visits per year), to this date, *PEI* has never commissioned nor conducted a carrying-capacity study.

The Mustique plan, however, mandated the ecological preservation of a relatively worthless scrap of desert surround by water (the island was generally viewed uninhabitable when Tenant purchased it in the 1950's; moreover, in reality, without The Mustique Co.'s *RHP*, it would remain uninhabitable), with very little, entirely secondary emphasis upon economic development—the plan also clearly stipulates that economic success would only be achievable through extraordinary measures ecological preservation and extraordinarily strict land-use-policies.

Furthermore, you need not take my word nor the curious case of Mustique alone, for several recent investigations offer various degrees of support to my central thesis: comparative studies on Cape Breton Island (*cf.* 119), Honeymoon, Caladesi, & Anclote (*cf.* 148), Sweden,* and two curious little gems in the St. Lawrence River, Ile d'Orleans and Ile aux Coudres (150), all testify – offering various degrees of support – to the value of relative insularity, and, moreover, support this hypothesis: *RIS ESS=MEP*. Also, though this letter would could easily double itself with an illustrative exploration of Iceland, it does not seem to require much imagination to see how the Icelanders tragic plight attests to my principle of relative insularity; several colleagues have also generously offered testimony.†‡*

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* Is it good or bad for an island to be linked to the mainland? The common view in most parts of the world seems to be that it is good when it comes to 'hard' values such as economy and population growth, but perhaps bad when it comes to 'soft' values such as quality of life.

In the Swedish context, one may mention the Koster Health Project… which was initiated to investigate what characterized 'a good living environment' and 'a healthy human being.' The small and relatively isolated Koster islands, north of Gotenborg, were chosen as the main test site for this study because they were found to be amenable to a focused examination of the interplay between human beings and their environment.… The islanders seemed to have a remarkably high quality of life, in spite of illness and nonexistent social and medical facilities on the islands. Having compared the island and mainland 'state of health, [it was concluded] that the Kosterites:

> Had a more wholesome lifestyle, more modest material and economic needs, an a higher quality of life (fewer subjective symptoms of bad health than did the city dwellers. The people of Koster usually had someone's hand to hold if there was a crisis. The nuclear family was alive and well and spread security. That favoured a good quality of life.…

The Swedes were no surprised that quality of life was found to be high on the Koster islands. Sweden is a scarcely populated Nordic nation, rather peripherically situated, with inhabitants who claim they live relatively close to nature, and they love nature. For example, a traditional and common belief among the population is that most Swedes really enjoy strolling in silent, dark, and huge forests which would frighten other Europeans, while noisy and polluted European cities would scare the Swedes. It is not surprising that islands, representing nature, are still often seen as positive symbols, as areas yet unspoilt my modern civilization.…

The conflict between calm island life and exploitation is beautifully captured in the children's story *Viktor bigger en bro* (*Viktor builds a bridge),* written by Jan Loof, one of Sweden's most popular writers of children's stories. Apart from offering a Swedish solution [which, by the way, supports the solution derived herewith] (149:*254-255*).

† -------- *Original Message* --------
Subject: Re: Relative Insularity, Sent on Tue, 30 Sep 2008 07:18:55 -0300:
Yes - the events these last few days vindicate your thesis.

‡ -------- *Original Message* --------
Sent on Mon, 8 Sep 2008 09:39:49 -0300:

Hi Matt….I don't think we've ever formally met… I saw your email address in the mailing list of Godfrey's most recent mail-out and am using that to contact you. I am still working on my thesis… and am engaged in PEI economic development research… I happened upon a paper you submitted to the 2008 Åland Islands Conference and was quite intrigued with your thoughts about the value of relative insularity and approaches

And now that we have developed clear concept of *RIS ESS*, we may begin to recognize that several other 'islands' which have employed our counter-intuitive strategy in-part of in whole: Molokai, the Alpine Convention Region, many of the islands along the coast of Maine and, not surprisingly, many privately held islands, such as Lyford Cay, half of Key Largo (The Ocean Reef Club), the river systems your British Isles, Ireland, Iceland, and the Cascapedia† - which I am, thankfully, able to enjoy from time to time. In short, once again, (*i*) the inhabitants of these islands have demonstrated exceptional preferences for relative insularity, (*ii*) they have fought for, guarded, and maintained this relative insularity through privatization and fierce independence, and thus (*iii*) these islands are thus *relatively valuable*.

Most importantly, of course, we begin to recognize the manner in which we may deploy this strategy. How was ESS achieved on Mustique? By simply fencing off the 'commons'; theoretically, *The Tragedy of the Commons* can not occur on Mustique: there is no 'commons' – it has been fenced off and would require a 2/3rd's majority vote (by the shareholders of The Mustique Co.) to re-instate.

Many have suggested that this solution is impossible to achieve on islands under the control of democratic action. At first blush, it may seem that this is a valid point—but it is not. In fact, this economic development strategy is incredibly *easily* to deploy – it's just that *most* societies are unwilling to endure elect the short-term *sacrifices* necessary to achieve it. It has – and is presently, afterall, being effectively achieved on the island of Molokai, and would most highly recommend those interested in this extraordinary case to explore it thoroughly; but our exploration today is limited to the exploration of the theoretical model – not a practical applications thereof. Let's take a moment to review Table 1:

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to economic and/or sustainable development pursued by islands. Powerful stuff! In that paper, you mention that there are two more parts of this 'trilogy' of work and that you could send copies to conference-goers. I wonder if you could email me those two other parts of the work to me?... I would look forward to discussing your research some time....

I look forward to hearing from you and I wish you success.

* -------- *Original Message* --------

Sent on Thu, 6 Nov 2008 09:39:49 -0300:

Hello Matt...I read your paper today, I spent a long time on it, almost all day. I am glad I did, it's very insightful and interesting. I admire the intelligence with which you construct your argument and the unbelievable amount of reading you have done. I don't think one can argue with you... I attached my comments. I am happy to discuss further with you...

The thing you must be aware of is that this paper can't be read quickly if one wants to understand it. If one tries to read it quickly, I don't think one can understand it because the arguments are carefully constructed and need careful following.

† Many mistakes had been made since the late eighteenth century in husbanding the river systems of the eastern United States. Very little land had been reserved by the successive governments for the exclusive use by private fishing clubs with a vested interest, and many hearty salmon populations were over-harvested, and virtually wiped out by 1850. The Canadian government was increasingly aware that it was unable to provide the resources to properly supervise the many rivers and lakes within the province. On many of the better salmon rivers, a private leasing system was established by the late 1860s, offering good salmon water on over two-dozen rivers to men of means. This early 'privatization' of salmon rivers by sportsmen brought with it a spirit of enlightened self-interest, leading to self-imposed conservation measures. The private clubs that began to take hold on many rivers by the late 1880s were often the catalyst that saved the fishery of those important Canadian Rivers (152:*11* ; *cf.* 153).

RIS Strategy	*Short-Term Payoff (1-40 years)*	*Long-Term Payoff (20-30) years*
Maximum Economic Development	*$-Rich/Land-Poor*	*$-Poor/Land-Poor*
Maximum Ecological Preservation	*Land-Rich/$-Poor*	*Land Rich/$-Rich*

Table 1: *'Island' Economic Development Strategy Payoff Matrix*

Based upon my current estimates, Mustique, a small, water-less, natural resource-void island satellite of one of the most impoverished Caribbean nations, commands undeveloped (bare-land) values amongst the highest *anywhere* on Earth ($2*MM USD*/undeveloped acre and approximately $20*MM USD*/home). Their ecosystem is perhaps the healthiest in the Caribbean, standards of living are easily the highest, *and* it is the second-largest employer in *SVG* (second only to the government)!

But it did not happen by accident, it did not happen overnight, and it may come of little surprise that The Mustique Co. was cash-flow negative from 1958-1988.

MEP requires *sacrifice*, a sacrifice the homogenous inhabitants (perhaps a key trait) of Molokai have, once again – time after time – elected to endure for the sake of their children's children.

If you take a moment to review the opening of my letter to the Ålanders, you may recognized that many of the 'islands I love' have 'fenced-off' 30-75% 'commons' by designating it as nature preserve. That's all it takes!

For example, although we will not burdened ourselves with detailed strategies which are decidedly unwanted, the Prince Edward Island provincial government could, for example, simply do what they did in 1970: *buy land*. But this time around, instead of clearing all the hedgerows and forest tracts, then repackaging them as monocrop potato farms, they could simply add to the miniscule 3% of land area under protection as nature preserves, or, once again, they did throughout the 1970's, repackage the land in *smaller* package with a few strings attached (land-use policies*, i.e.,* certified organic designation) attached. The government, if effectively ruled by rational people, could simply perform the same function The Mustique Co. has provided – *protection from the commons*. Alternatively, any private citizen, corporation, or cooperative with adequate *RHP* ($) could perform the same function – that's exactly what Percival P. Baxter and several others did in the U.S. state of Maine (*cf.* 154-155), and that is exactly what Ted Turner has done with *two million rangeland acres – rangelands totalling more than twice the size of Prince Edward Island*.

Yes, the solution is simple.

But the problem is that most people would rather have a little money now (even at the expense of the environment in which they live), rather than a lot of money (and a healthy environment) later.

So the tragedy plays on. Remarkably, PEI has no comprehensive land-use policy to this very day.

But I must also emphasize that, although the Confederation Bridge has amplified innumerable, inter-connected problems for Prince Edward Islanders, it is neither the *true source* of the problem and the problem is far from insoluble. It seems that I should re-state that the bridge was merely the extension of *The Prince Edward Island Plan for Economic Development* which had commenced in earnest in 1970. As a wise Fulbright scholar recently discovered (while exploring the lack of relative insularity on Prince Edward Island and the differing insularities of three islands off the Gulf coast of Florida):

> The romance of islands is often used by marketers of tourism as an enticing characteristic of their advertised destination. According to Tom Baum, small islands are popular tourist destinations because of their remoteness, boundedness, and insularity—a combination of characteristics David Weale calls *islandness*. Royle and others comment that this concept of islandness can be diminished or lost altogether when a fixed link, such as a bridge, causeway, or tunnel is established between the island and the mainland.
>
> Ilan Kelman states that insufficient research has been done regarding the degree to which an island's insularity, or islandness, is lost when it is linked to the mainland:
>
> > In debating the construction of fixed links, fears are often expressed about the expected loss of island characteristics. Working out how much 'islandness; has been lost due to a fixed link is difficult....
> > Proponents of the link have said that it will only enhance the Island way of life. That is quite absurd. You might reasonably argue that it will enhance the economy of the province, or that it will make travelling on an off the Island more convenient, but you cannot reasonably argue that it will enhance the Islandness of our way of life. You can no more enhance the Island way of life by building a fixed link than you can enhance the forest by cutting down the trees. Economically, socially, psychologically, the construction of a fixed link will reduce our insularity.... There is nothing wrong with that, but we should not pretend that it makes no difference (*cf.* 156:*3*).

Yes, the bridge has helped reduce insularity to the nadir of evolutionary instability – but of course this bridge is a powerful lever which can be pulled in either direction: For example, as feared by many promethean islanders, the bridge has opened the gates for low-cost and pork which have decimated island farms and farmers. And, presently, the toll for a transport truck is not much more than that for a passenger vehicle ($42 CAD). Want to increase insularity for island farmers? Increase relative insularity by raise the toll for transport trucks as needed (*e.g.* $500, $1000, $5000). Want to give the islanders a competitive advantage? Wipe out their tolls entirely ($0) as demanded and received by the inhabitants of Skye. My point is that it is actually possible to increase islandness to a point in which it is actually *greater* than it was prior to the building of the bridge.

And, to close on another positive note I'll very briefly illustrate yet another sketch of one more archipelago which I love above all others: the Roque archipelago. This illustration is especially excellent, as we're able to see how recognizing

The Principle of Relative Insularity often is so close to so many, yet dangles just out-of-reach. Consider, for example, this passage from my June 2009 issue of *Blue Water Sailing*:

> Roque island is a special place… What makes it so special has to be the combination of remoteness and appearance of almost a mile of white pine-topped, craggy islands all around it (157:*39*).

Although I do agree with this author that Roque is 'a special place', this 'combination' is not what 'makes it so special'. However, a bit further down the page the author stumbled upon the truth: "The island and surrounding islands are private and have been in the same family for almost 200 years" (157:*39*).* We may also speculate that, perhaps our fellow blue water sailor was aware of this profound truth, *but was afraid to say it*. As I've noted, these truths are unpopular, and writers and publishers who want to sell popular magazines often side-step unpopular truths. Even worse yet, many writers cater to man's innate desire for fairy-tales by telling lies.

In fact, although one may presume that telling lies may be difficult – as it requires a certain amount of cunning and a straight poker-face – in reality, it may be far easier than telling the truth, because this feat requires no less than a thunderbolt for a weapon (*cf. APPENDIX VIII*), which 'the germ of corruption' may render impotent.†

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* For a long time, Roque Island has been the ultimate goal of sailors cruising Down East—perhaps because of its beautiful, mile-long white sand beach, perhaps because there is the sense of something special about this island, perhaps because it takes determination to sail east of Schoodic and Petit Manan.

Roque is the centerpiece of an archipelago that includes Great and Little Spruce, Lakeman, Marsh and Bar, Double Shot, Anguilla, and Halifax Island—all set in a body of water called Chandler Bay to the west and Englishman Bay to the east. Shaped roughly like an H, the Roque archipelago offers a delightful variety of anchorages. The great southern beach on Roque Harbor is the most familiar. Lakeman Harbor to the east, surrounded by Lakeman, Marsh, and Bar Island, provides a secure anchorage. Tiny, landlocked Bunker Cove is to the west. Another sand beach curves around Shorey Cove, on the north side of the island.

Indians were the earliest-known summer inhabitants of Roque, and numerous shell heaps have been studied here by archaeologists. Joseph Peabody acquired Roque in 1806, and for almost two centuries the island has served as a resort and retreat for his descendants, the Gardner and Monks families. The old family buildings and farmhouses, red and yellow, are on the eastern side of Squire Point, overlooking Shorey Cove. There is a private boatyard, with a dock, metal and woodworking shops, and a small fleet at the moorings. Boats are hauled by attaching a farm tractor to a great old anchor half-buried in the ground and winching them up the ways.

Roque is a working farm, and it is almost self-sufficient, with cattle, sheep, pigs, geese, chickens, pigeons, and other animals. Products of the island include milk, butter, eggs, wool, beef, pork, squab, raspberries, rhubarb, herbs, and vegetables. The caretaker and the owners take pride in both frugality and ingenuity, and the farm has some marvelous Rube Goldberg contraptions, including a continuous conveyor belt built from scrap material to cut, carry, and split firewood.

In summertime, it is not unusual to see family members traveling in a horse-drawn carriage. During the winter, the resident Clydesdales haul guests on old blue sledges. As John Peabody Monks said in his book Roque Island, Maine—A History: "The visitor to Roque forgets the urgencies of time and place."

'Perroquet' is the French word for parrot, and it seems plausible that, as Samuel Eliot Morison suggests, Roque was named by the French explorers for the puffin, or sea parrot. Or perhaps the origin was "rogue," considering the pirates who were based nearby.

When Joseph Peabody bought Roque, he made good use of it. First he built a tidal dam across Paradise Cove to power a gristmill and a sawmill. Several large vessels were built for him at a shipyard in the little bight at the mouth of Paradise Cove, just west of Point Olga. At one time, Peabody owned 63 ships and employed more than 3,000 men in his various shipping and trading enterprises.

In 1868, John and Catharine Gardner sold Roque Island for reasons unknown. Ten years later, two of their sons bought it back for double the price, and the island has been in the family ever since. Shortly thereafter, the Gardners bought Great and Little Spruce, Lakeman, Anguilla, and the little Bar Islands. Double Shot was acquired in the 1930s (158:*349*).

† I had, in a moment of inadvertence, created for myself a tie. How to define it precisely I don't know. One gets attached in a way to people one has done something for. But is that friendship? I am not sure what it was. I only know that he who forms a tie is lost. The germ of corruption has

Although we will not delve too deeply into *The Problem of Induction* at this late stage in the game, I will briefly contextualize this problem (as it relates to telling lies) by connecting the dots between 'man's crushing desire (and willingness to pay) for certainty' and those liars willing to sell it, with an excerpt – *in medias res* – from a long email I transmitted to my father in February:

> -------- *Original Message* --------
> *Date: Tue, 03 Feb 2009 14:38:52 -0400, Subject: Re: SELL*
>
> ....you may recall that, over the past years, I have offered several strong warnings concerning the soundness of Warren Buffett's strategy, the last of which was on January 9th:
>
> > -----*Original Message*-----
> > *Date: Fri, 09 Jan 2009 05:41:54*
> > "Stock prices have reached what looks like a permanently high plateau. I do not feel there will be soon if ever a 50 or 60 point break from present levels, such as they have predicted. I expect to see the stock market a good deal higher within a few months."
> > —Irving Fisher, Yale University, October 17, 1929
>
> "Today, people who hold cash equivalents feel comfortable. They shouldn't. They have opted for a terrible long-term asset, one that pays virtually nothing and is certain to depreciate in value.... Equities will almost certainly outperform cash over the next decade, probably by a substantial degree."
> —Warren Buffett, Berkshire Hathaway, October 17, 2008
>
> And...
>
> -------- *Original Message* --------
> *Subject: RE: Buffett Says Now Is the Time to Buy U.S. Equities, Date: Sat, 18 Oct 2008 02:41:46-0300,*
> *From: Matt Funk <matt@funkisland.org> To:* warren@berkshirehathaway.com
> Funk says Buffett is wrong.

I had copied several recipients with this correspondence, and I received one reply which simply remarked "Brk will be fine."

Although I didn't have the opportunity to offer a reply in return, if I had, I would have remarked:

> You *could* be right - but of course that is *The Problem of Induction,* we don't have a crystal ball, but I've suggested for over a year that that Buffet will not be fine, because it has clearly demonstrated his worldview is fundamentally flawed, and, as you've probably noted over the past few weeks, his ship may be beginning to list; here's a 25 January headline: 'Berkshire Hathaway: Failing Business Model Points to a 35% Decline'.

Of course whether or not Buffett's ship actually sinks or not is irrelevant, the problem is that his model is flawed, because he does not grasp the most fundamental, open problem in economics.* You may also come to recognize this if you have a chance to review the paper I sent several months ago. But in any case, as you are no doubt aware, Buffet's *value* investment strategy is founded upon Benjamin Graham's *The Intelligent Investor,* a *Value-based* investment strategy which has worked for Buffett so well throughout *most* of his career. The problems,

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entered into his soul (159:*215*).

* In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money (11:*61*).

however, are manifold, inter-dependent, and insurmountable—but I only need to bring one to your attention. In light of (10:*61*), it is easy to see that Buffett has absolutely no idea what he is talking about—he has no tenable theory of value, thus, despite his incessant conjectures to the contrary, he does not know if something is *under* or over *valued*. I might also note that this is the fundamental problem I have been working on for the past decade, and have indeed solved this problem, and the solution I have derived illustrates that it is theoretically impossible for anyone to ever know – at any particular point in time – if any tradable equities are 'over' or 'under' valued. But one deduction I am able to make is that, given (*i*) the inherently unstable nature of our extended economic order, and (*ii*) the fact that chaos increases as time moves forward, that (*iii*) all tradable financial instruments are, by nature, inherently *over-valued*.

The "Brk will be fine" comment also reminded me of something someone we'll refer to as 'Induction' said to me in Iceland in the summer of 20007. I brought Ben Funk a copy of Taleb's new book, *The Black Swan* (recall that I've given both of his books to you as well), and I was really excited about it because Taleb has the uncanny ability to deliver a useful, enlightening discourse on *The Problem of Induction* in a very entertaining way. In any case, as I was making a great fool of myself, gushing about the book, Induction glibly chimed in "That guy doesn't make money."

I offered neither rebuttal nor defense, because I've concluded that most people are simply incapable of following this argument. However, in brief, what was rather ironic, was the fact that Induction's error is exactly same the type of error which Taleb illustrated so well in his first book, *Fooled by Randomness:* For several years, Taleb's friend, Princeton economist Robert Shiller, author of *Irrational Exuberance* (another great book I gave to you years ago, by the way) was regularly *ridiculed* (on television, in the papers, *etc*.) for *predicting a housing bubble*. Although one could argue that he may have made a mistake by *predicting* the year in which he expected the bubble to burst, *nobody is ridiculing him anymore!*

You see, Induction's conjecture that "That guy doesn't make money" was and off-base because, not only was any time-series that Induction may have had in mind insufficient (let's say 5 or 10 years), Warren Buffett's *entire lifetime* represents a totally insufficient time-series with which to make any meaningful observations.

Thus you may begin to see dubious nature of Buffet's prophecies:

> -------- *Original Message* --------
> *Sent on Mon, 24 Nov 2008 00:40:41 -0400, To: Ben Funk <bfunk@liongatecapital.com>*
>
> Greetings Human…Recall my 18 October 2008 comment ('Funk says Buffett is wrong.') after he absurdly announced that 'Now is the time to buy U.S. equities.'
>
> Think about it: When would the biggest, most experienced player in the biggest poker-game on earth announce that he's going to *start* buying U.S. equities? If he had been telling the truth, he would have only made the announcement *after* he had already bought them!!!
>
> Sadly, so many have been fooled into believing his 'track-record' actually represents a relevant time-series.
>
> For the life of me, I can't imagine why anyone wouldn't actively be engaged in an average-out program; does anyone actually believe this market is going to run away from them?
>
> Anyway, the CDS market smells a rat, too (see *Forbes* article, attached herewith). It's curious that the man who warned the world about derivatives (2002 annual report- I sent it your way last fall) is getting hammered by them.
>
> As someone pretending to be me said long ago, "Watch out for false prophets. They come to you in sheep's clothing, but inwardly they are ferocious wolves".

I hope this may help clarify an important point I've been struggling to make for the past several years. Furthermore, in essence, Buffett's theories are founded upon making money; my theories are founded upon the dream of learning to fly, and the implications surrounding this difference are far-reaching:

> This spiral of interactions or feedback mechanisms is influenced by our developing theories and by our dreams. An example is the shaping, the creation, the invention of Leonardo's bird: of what we all know today as the aeroplane. It is important to notice that it is the dream of flying that leads to flying, and not, as the materialistic conception of history of Marx and Engles would doubtless suggest, the dream of thereby making money—Sir Karl Popper

In any case Dad, although I offer no apology for relating difficult truths, I am sorry that this news is all that I have had time to report. In a nutshell, all is quite well. I hope that you're feeling better, and hope that I might be able to see you later this week or over the weekend, as I'm coming to Chicago for William's birthday party on Saturday: Of course you're all invited! And, to leave you on a positive note, things could be worse, you could be here:

Queens County PEI, Issued at: 11.00 AM AST Tuesday 3 February 2009

Winter storm warning in effect.

Today: Cloudy. Snow beginning this afternoon. Amount 2 cm. Wind becoming north 20 km/h gusting to 40 this afternoon. Temperature falling to minus 9 this afternoon.

Tonight: Snow at times heavy and blowing snow. Amount 15 to 25 cm. Wind northeast 40 km/h gusting to 70 becoming northwest 30 gusting to 50 overnight. Low minus 9.

Wednesday: Cloudy with 60 percent chance of flurries. Becoming cloudy periods in the evening. Blowing snow in the morning.

Love…Matt

On 'Ö', the Swedish Word for Island

I offer no apology for the previous digression, as I trust you may soon recognize that it was all quite requisite for our fruitful expose of a common liar by the name of Alan AtKisson. This also offers an opportunity to clarify some disclosure which may have mystified some: Last Summer, I began a discussion by stating,

> Hello, my name is Matt Funk, I'm 39 years old, and I've only solved one problem in my entire life—but don't feel sorry for me, because I'm actually quite pleased with my success, as I've solved the most fundamental, open problem in economics.
>
> (BEAT)
>
> I don't have any big corporate clients and nobody *paid* me to be here—*and I will even suggest this may work-out in your favour*; I'm here because I want to be here, because I love islands, because I want to share a few of the things that I have learned about them, and to hear what you have to say about them as well (37).

The 'corporate sponsorship' bit received a few laughs, because the previous day AtKisson opened his keynote speech by rattling off a long list of corporate and government clients. He also said many things which made me feel sorry for the islanders who had paid him to lie to them. AtKisson recently regurgitated some nonsense from his keynote speech in a paper he circulated to conference attendees:

> In Swedish, the word for 'island' is a single letter, itself a small island: ö.
>
> When one comes upon it in reading, this little 'o' with two dots over it appears suddenly and alone in a surrounding sea of words — tiny, yet redolent with linguistic meaning and personal associations. Ö seems to long for company, and to be happily self-contained (160).

If AtKisson were a poet, perhaps a reasonable defense may be erected upon the grounds of artistic license. But the problem is that AtKisson pawns himself off as a 'sustainability expert',* charging handsome fees to islands and

* Alan AtKisson has been working at the forefront of sustainability initiatives since 1988. As an author, consultant, speaker, and musician, Alan continually seeks new ways to communicate the complex challenges facing our world, and new ways to empower the change agents who are

corporations alike (*cf.* 161) for his subjectivist BS* on this difficult, complex, inter-dependent problem:

> We can extend the concept of island almost indefinitely – and indeed, it is useful to do so. Planet Earth is, after all, an island. It floats alone in the sea of space, experiencing 'limited accessibility' to the rest of the universe (or even to its nearest neighbours), even if its location appears quite 'favorable' relative to the nearest star, our sun. And of course, it requires only a reminder – and not a lengthly explanation – that nearly all the properties of islands described above could be easily applied to our planet as a whole (160).

To the contrary, I hope that I have clearly demonstrated 'a lenghtly explanation' is exactly what was needed—and that's exactly what I've done. If it seems like I'm being a bit to harsh on AtKisson, please trust me, I'm not, because

> If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass (162).

Those familiar with this 'test' will quickly grasp the unforgivable nature of AtKisson's grift:

Near the end of his Keynote speech, AtKisson unleashed wheel-barrel full of arrogated knowledge and superficial pretense, including a flurry of inductive inferences which immediately set-off my BS (163) detector. The most memorable was a prophecy which played to a minor hysteria of the moment and thus catering to those whom paid him to be all-knowing. In light of the fact that oil was trading at an all-time high in the early June of 2008 – around $140 USD/barrel, AtKisson glibly declared that it was "headed over $150, then on to $200 and $300."

That's when I left the auditorium to get some fresh air.

The next day, after mocking AtKisson as noted in my introductory remarks (37), I offered another necessary jab at the end of my talk: I said that, Ö does not 'long for company', it longs for relative insularity, and furthermore, that it is not 'happily self-contained', but rather inextricably inter-dependent. AtKisson had also said something fruity about what he thought the two dots represented (I apologize I cannot remember), but, I may have further mystified my audience by objecting to his analysis, and wrote 'Ö' on the blackboard, stating that the two dots represented (*i*) an incoming ICBM and

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working to address them. In all his work, he blends the discipline of a researcher, the fun and creativity of an artist, and the people skills of a strategic advisor and organizational leader. As CEO and President of The AtKisson Group, Alan works with his colleagues and partners around the world to "mainstream sustainability" by empowering people to make beneficial changes in their corner of the world (161).

* One of the most salient features of our culture is that there is so much bullshit. Everyone knows this. Each of us contributes his share. But we tend to take the situation for granted. Most people are rather confident of their ability to recognize bullshit and to avoid being taken in by it. So the phenomenon has not aroused much deliberate concern, nor attracted much sustained inquiry. In consequence, we have no clear understanding of what bullshit is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory (163:*1*).

(*ii*) a keyhole asteroid instead (37). If you've had the opportunity to review (6), I trust you may recognize the problem to which I was referring. Also, nearly a year later, my thoughts flew back to the poor Ålanders who had paid a prince's ransom to be baffled by BS (163) when, at 2:33 AM on 21 April 2009 the following crossed the Associated Press wire:

> SIOUX FALLS, S.D. — Oil prices plunged to their lowest levels in more than a month Monday as investors, nervous about a week chock-full of corporate earnings reports, sought safer havens in gold and the dollar.
>
> Benchmark crude for May delivery fell $4.45 to settle at US$45.88 a barrel on the New York Mercantile Exchange. With trading on the May contract ending Tuesday, most of the trading has shifted to the June contract. Benchmark crude for June delivery dropped $3.96 to settle at $48.51 a barrel.

And, by the way, oil closed the day before yesterday (2 July 2009) at $64USD and change.

Needless to say, AtKisson doesn't know any more about *The Problem of Sustainable Economic Development* than he does about the price of oil (or the price of tea in China, for that matter)—to tackle this problem one must be willing and able to fight theoretical Ogre's which AtKisson is not well-armed enough to fight (*cf. APPENDIX VIII :A THUNDERBOLT FOR A WEAPON*). Where did AtKisson go wrong? How does my approach differ? This is a long story in of itself, but, in short,

> two roads diverged in a wood, and I—
> I took the one less travelled by,
> And that has made all the difference (164:*20*).

For those strong enough to face difficult truths, for those who have not let germs of corruption enter into their souls, the solution to *The Problem of Sustainable Economic Development*—arguably the most fundamental problem on earth—requires little more than recognizing *The Principle of Relative Insularity*, understanding and adopting the ESS which best *attains and maintains relative insularity*—by applying strategy, which has, to various degrees, been successfully deployed by many rational individuals, nations, institutions, and corporations throughout the ages in islands (such as Mustique, Molokai, Roque, and North Haven) and on continents alike (38), including Vegetius (165), King George III, Kamehameha the Great,* the

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* Kamehameha thoroughly observed the place which had been entirely farmed, which was unimaginably large (*'a'ole no I kana mai ka nui maoli no*), and he said to himself, but was heard by some of his *ali'i* who were waiting for him: 'This work of farming is really a headache, yet it is the work by which benefit is gained by the patient person....'

When Kamehameha arrived at the place where the food was prepared, the people and the chiefs murmured about the true vastness of that farm made by Kamehameha and perhaps for this reason it was called Kuahew, or vast, until this very time in which we live...

At the end of the meal Kamehameha spoke these important words to his people and his *ali'i*:

E na ali'i me a'u mau keiki [Pay heed my chiefs and children]. It is well that you have farmed and planted crops. When the time comes that our crop has matured and you begin to pull it up, or perhaps break off the sugar cane clumps, or take the bananas which we all have planted, here is my command to you: pull up the *kalo* and break of the top (*huli*) neatly, and then tuck it back into the soil rather than throw it out of the garden and let it just dry up. As to the sugar cane, the ali'i desires you who break off the sugar cane, to thrust the cutting back into the earth. Also when cutting the banana stalk to take the fruit, take care lest the shoots be trampled. If you do as I have directed you, then you will continue to consume the vegetable food, the sugar cane, and the bananas and will not die of starvation. And when you see the weeds growing up, then dig them up.

Where the garden is covered with fern leaves, cover them again with new fern leaves as these are good actions which will expel starvation from the calabashes of men. Here is another instruction, O chiefs and my children: do not oppress the women, take good care of them (166:*346-*

Vikings, Theodore Roosevelt, Winston Churchill, Margaret Thatcher, Albert Einstein (167), J. Robert Oppenheimer, The Los Alamos National Laboratory, the Allied powers of World War II, John Nash, The Mustique Company, Edw. J. Funk & Sons, Super Crost Seeds, Oracle, Fairmont Minerals,* Liongate Capital Management,† The Gordon & Betty Moore Foundation, Parker Ranch,‡ The Cascapedia Society, The Brown Company,§ Austin Corbin II,** Adam Smith,†† and perhaps America's greatest patriot and conservationist since Teddy Roosevelt and Percival P. Baxter: Ted Turner.‡‡

In all cases—be it managing a ranch, a small island's natural resources, a hedge fund, a standing army, or a half-dozen allied armies—the tools, considerations, and mechanisms are straightforward and largely the same: (*i*) *Carrying-Capacity*, (*ii*) *Gradualism*, (*iii*) *Optimum Habitat Condition* (174), and (*iv*) *RHP*.

The problematic dichotomy, however, perhaps the most counter-intuitive and surprising revelation (6) offers (explored in detail in 38), is that deploying this ESS at the *planetary* level (and thus *GEMS ESS*), that *preserving and maintaining the relative insularity* of the planet Earth, is not nearly as straight-forward as has been presumed until this 12th day of February 2009: I'm afraid many 'ecologists', 'ecological economists' and 'conservation biologists' may not like what I

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347).

* Enduring business prosperity is the result of business practices that value responsible resource management, quality of life and environmental health. When a company commits to contributing to the world's social, economic and environmental needs, it can realize greater performance in all aspects of its business (168:*2*).

† The best managers… generate profits using original ideas. Managers should have a strategy we understand…. Sustainable, good performance takes both an unwavering commitment to finding managers with a competitive investment advantage in their target market, and, additionally, a commitment to intelligent aggressive portfolio management (169:*1*).

‡ AW made early, strategic decisions that guaranteed the continued growth of the ranch. Among them, in addition to acquiring land, was the procuring of superior seed stock in dairy and beef cattle, horses, and sheep, while initiating an early and permanent preventive health program for the stock. The following is from an editorial from the *Honolulu Advisor* in 1932: 'In the history of these islands, no greater economic development of a single property through the efforts of one man has ever been accomplished (170:*181*).

§ WR Brown… studied forestry science and investigated the techniques of respected high-ranking forest officers in Germany.

Previously, loggers had clear-cut and moved on. Brown was the first executive in the timber industry to hire a professional forester…

By the 1920's, the Brown Paper Co., owned 3.75 million acres of forest in northern New England and Canada, the precise number of acres WR Brown figured he would require to meet the needs of his New Hampshire and Quebec paper mills, 'without ever cutting the forest faster than it was growing' (171:*126-127*).

** In 1888, Corbin bought… twenty-five thousand acres… to establish a wild game preserve….

In hard economic times, local residents chided such extravagance, referring to the land as 'Corbin's folly.' Despite his preservation aims, Corbin was criticized in New York newspapers for his purchase of 'a big worthless chunk of New Hampshire wilderness populated by wild animals and thickly scattered with granite boulders.' Undaunted by such criticism, Corbin hired renowned natural scientist and bird defender Ernest Harold Baynes as the naturalist for his private game preserve.

Because he had witnessed firsthand the vanishing of bison on the plains of Iowa, Corbin had his original mission the desire to save the American bison or buffalo, a species rapidly becoming extinct (171:*124-125*).

†† A state may sometimes derive some part of its public revenue from the interest of money, as well as from the profits of stock. If it has amassed a treasure, it may lend a part of that treasure, either to foreign states, or to its own subjects….

The unstable and perishable nature of stock and credit, however, render them unfit to be trusted to, as the principal funds of that sure, steady and permanent revenue, which can alone give security and dignity to government. The government of no great nation, that was advanced beyond the shepherd state, seems ever to have derived the greater part of its public revenue from such sources.

Land is a fund of a more stable and permanent nature: and the rent of public lands, accordingly, has been the principal source of the public revenue of many a great nation that was much advanced beyond the shepherd state (172:*Book V*)

‡‡ I'm often reminded of Scarlett O'Hara's father in *Gone With the Wind*, who told her, 'Why, land's the only thing in the world worth fighting for, worth dying for, because it's the only thing that lasts.' I've realized this to be true (173:*275*).

have found, because an economist or ecologist who fails to take into account military strategy and astrophysical phenomena is as lost as military strategist or astrophysicist who fails to consider the ecology. The 'Unity of Nature' may elude most, but she stands tall, shimmering, basking in the radiant beauty on Earth for those able to see, for those unencumbered by ideological blinders (*cf.* 6). Despite what many may contend,

> it is not mathematically possible to maximize for two (or more) variables at the same time. This was clearly stated by von Neumann and Morgenstern, but the principle is implicit in the theory of partial differential equations, dating back at least to D'Alembert (1717–1783). (175:*1443*).

The Problem of Induction (*cf. GLOSSARY*)* both limits our theoretical range of knowledge to a more restrictive realm than has been generally considered, *and* requires that we consider a theoretical realm rarely acknowledged and/or thoroughly misunderstood.† For example, despite my confused countryman's extremely popular – *yet wildly illogical* – closing arguments (*cf.* 177:*607*): 'We' are *not* the 'Death Star,' we are our *only* hope!

And, to this very point, all hope is far from lost, as our unified theory of value (39) does indeed inform ESS for islands and continents alike, thus offering a tenable solution to *The Problem of Sustainable Economic Development* on Earth.

The Principle of Relative Insularity (38) also offers much insight for each and every individual, as, true to it's unified nature, this powerful analytical tool is as applicable at the individual level as it is at the national level, and may be utilized to inform tactics and strategies for countless common problems, such as: (*a*) selecting insular human habitats,‡ (*b*) personal investments,§ (*c*) identifying evolutionary unstable currencies,* (*d*) selecting relatively insular vacation destinations,† (*e*)

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* It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this* (3:*36*).

† We all know that, in the pursuit of our individual aims, we are not likely to be successful unless we lay down for ourselves some general rules to which we will adhere without re-examining their justification in every particular instance. In ordering our day, in doing disagreeable but necessary tasks at once, in refraining from certain stimulants, or in suppressing certain impulses, we frequently find it necessary to make such practices an unconscious habit, because we know that without this the rational grounds which make such behavior desirable would not be sufficiently effective to balance temporary desires and to make us do what we should wish to do from a long-term point of view. Though it sounds paradoxical to say that in order to make ourselves act rationally we often find it necessary to be guided by habit rather than reflection, or to say that to prevent ourselves from making the wrong decision we must deliberately reduce the range of choice before us, we all know that this is often necessary in practice if we are to achieve our long-range aims.

The same consideration apply even more where our conduct will directly affect not ourselves but others.

The burden of choice that freedom imposes, the responsibility for one's own fate that a free society places on the individual, has under the conditions of the modern world become a main source of dissatisfaction (176).

‡ *ESS* = A relatively self-sufficient working ranch. Otherwise, the "only one thing worse than living in a gated community [is] not living in a gated community" (178:*2*).

§ USD, US Treasuries, RMB, XAU (*i.e.* 2009 US Mint ultra-high relief Double-Eagles, Krugerrands, *etc.*), Well-insulated, energy efficient homes, a bio-geo-politico-economic diversified second-home, US and Canadian rangelands and wildlife production systems west of the 100th meridian (excluding California), Argentinean, British, Swiss, Icelandic, and French certified organic farmlands, rangelands, wildlife production systems and riparian rights. Wild fish, game, and organic produce for personal consumption, Education, Healthcare, a boxed-frame SUV or ¾-ton pickup (of which, more to follow), camping, fishing, & hunting gear, especially 9mm & .30/06 ammunition (179-180, *Si vis pacem, para bellum*).

identifying unstable destinations to avoid at all costs,[‡] (*f*) choosing well-insulated personal transportation (See *APPENDIX IX: ON THE PROBLEM OF HEAD-ON COLLISIONS*), (*g*) hydration and homeostasis tactics strategy (*cf.* 121; 185-186), (*h*) identifying insulation problems that coolers, fish-boxes, and ice can't help,[§] (*i*) insular footwear considerations for unexpected situations,[**] (*j*) evolutionary stable leisure-time activities (hunting, fishing, camping, hiking, sailing), (*k*) 'rethinking island development' (189-190 ; *APPENDIX V*), and most generally, (*l*) understanding how relative insularity frames strategic decision-making under uncertainty.

A Few Heroic, Independent Islanders

In closing I'll offer one more quality which I believe you may all appreciate: Many of my heroes—the brave, fierce, and independent explorers who have influenced me the most—invariably possessed one or two additional qualities, and often both: (*i*) they were born or lived in the British Isles, or (*ii*) they loved and explored (many still loving and still exploring) the 'islands' of the world:

Charles Darwin,[††] Alfred Russel Wallace,[‡‡] J.D. Hooker (191), Charles Lyell, Alexander von Humboldt, Adam

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* EUR, CAD, NZD, AUD, JPY, and ISK.

† Vermejo Park Ranch, Hawai'i (Waimea & North Kohala in particular), Mustique, Mackinac Island, Maine, New Hampshire, Vermont, Joshua Tree National Park, Theodore Roosevelt National Park, Molokai, the Azores, Iceland, Finland, Åland, Lofoten, Skye, Isle of Man, Estonia, Bermuda, Greenland, the Apostle Islands, the Gaspe, Kamchatka, and Kenai peninsulas, Ungava and Coleur Bays, and Newfoundland.

‡ Sub-Saharan Africa, the Sahara desert, the Ivory coast, Haiti, Key West, Cuba, Jamaica, Dominican Republic, India, Thailand, Indonesia, Venezuela, Guatemala, the Seychelles, the Gulf of Aden, and Indian Ocean (also, *cf.* 181-184).

§ The most stringent recommendation, for farmed salmon from northern Europe, [is] for consumption of at most one meal every 5 months in order to not exceed an elevated risk of cancer of more than 1 in 100,000. Farmed salmon from North and South America triggered advisories of between 0.4 and one meal per month. Retail market samples, in general, reflect levels found in regionally farmed fish, although much of the US salmon comes from Chile, which had somewhat lower contaminant levels than the North American farmed samples.... The advisories are driven by the nondioxin-like PCBs and pesticides and not by dioxins/furans and coplanar PCBs. For noncancer effects for contaminants where USEPA has provided a reference dose only endrin and PCBs triggered any significant advisory. For both of these in the worst case, farmed salmon from northern Europe, the advice was not more than three meals per month (187:*abstract*).

** He instinctively yanked the wheel right. The car veered into and over the guardrail, skidded across a snowy swale, and after rotating clockwise came to a stop facing into the woods. The airbags had deployed. Dodds had banged his head, and he thought he smelled smoke....

He remembers little of what happened next....

After climbing a steep hill his legs felt wooden and he couldn't go on. He was wearing a grey fleece jacket over a dress shirt. *His khaki pants and black dress shoe (he'd lost the other) and socks were soaked*. But it was dark and cold and he had no idea where he was, or how far he'd come....

He found a hemlock tree and lay down under a bough in some leaves, and fell unconscious (188:*78*).

†† Some of the most remarkable and interesting facts in the distribution and affinities of organic forms are presented by islands in relation to each other and to the surrounding continents. The study of the productions of the Galapagos — so peculiar, and yet so decidedly related to the American continent — ...had a powerful influence in determining the direction of Mr. Darwin's researches into the origin of species (50:*10-11*).

‡‡ Islands possess many advantages for the study of the laws and phenomena of distribution. As compared with continents they have a restricted area and definite boundaries, and in most cases their geographical and biological limits coincide. The number of species and of genera they contain is always much smaller than in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range. Again, their relations with other lands are often direct and simple, and even when more complex are far easier to comprehend than those of continents ; and they exhibit besides certain influences on the forms of life and certain peculiarities of distribution which continents do not present, and whose study offers many points of interest. In islands we have the facts of distribution often presented to us in their simplest forms, along with others which become gradually more and more complex; and we are therefore able to proceed step by step in the solution of the problems they present. But as in studying these problems we have necessarily to take into account the relations of the insular and continental faunas, we also get some knowledge of the latter, and acquire besides so much command over the general principles which underlie all problems of distribution, that it is not too much to say that when we have mastered the difficult presented by the peculiarities of island life we shall find it comparatively easy to deal with the more complex and less clearly defined problems of continental distribution. (50:*229-230*).

Smith,* Stephen Hawking, Bertrand Russell,† Sir Raymond Firth, Dame Jane Goodall, R.A. Fisher, J.B.S. Haldane, Richard Dawkins, David Lack, David Hume, Alfred Marshall, J.M Keynes, W.F. Lloyd, Clive Granger, F.B. Goldsmith, Captains James Cook & George Vancouver, Kamehameha the Great,‡ Kekuhaupi'o, Father Damien, Edie Akua, Isaac Davis, John Young,§ Adelbert von Chamisso,** Gregory A. Cunningham (Interpretive Ranger, *Pu'ukohala Heiau*), Richard Wisniewski, Stanford B. Dole, Steven Desha, John and Linda Harris, John Harrison,†† Erik the Red, Leif Eriksson,‡‡ Thorvald,§§ Bjarni,***

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* Smith... provided so broad and authoritative an account of the known economic doctrine that henceforth it was no longer permissible for any subsequent writer on economics to advance his own ideas while ignoring the state of general knowledge (11:*59*).

† A follower of the Enlightenment speaks as simply as possible: we want to be understood. In this respect Bertrand Russell is our great master (16:*206*).

‡ Captain Cook decided to exhibit the nature of the cannons placed along the sides of the ship. He commanded his officers to prepare to load the cannons... When the Hawai'i chiefs and Kalani'opu'u saw the powder being inserted in those cannons they were amazed...:

'How now, the black sand is being inserted in those cannons, and what are those people with the flashing eyes engaged in doing?

When they saw the flaming rag being whirled by a certain person close to those cannons, those Hawai'i chiefs asked themselves: 'What is this fire which that person with the cornered head is whirling? These flashing-eyed people are doing something we do not understand....' At that time Captain Cook gave the order to his gunnery officer to fire, and... the cannon... flashed like lightning, with a thundering sound. This terrified those high chiefs of Hawai'i and some of them flattened themselves on the deck in terror and those standing near the gunwales of the ship leaped into the sea and swam to their canoes....

Captain Cook... regarded Kamehameha with admiring eyes, because he was the only one who was not mystified at the thundering cannon of the foreigners....

Kamehameha turned and said to Kekuhaupi'o: *E Kekuhaupi'o e*, do you understand the nature of this great canoe of the foreigner and of our little war canoes? Our canoes are like little pieces of wood alongside this great canoe of the foreigner. How shall we get a large canoe like this? (166:*54-55*).

§ An Englishman named John Young, wandered away from the shore party and was apprehended by Kamehameha's warriors....

Young and Davis quickly caught the keen eye of Kamehameha who needed skilled seamen for his newly acquired foreign vessel. Despite an unsuccessful escape attempt, the two foreigners were well treated. Gradually adjusting to their fate, they taught Kamehameha's warriors how to use the cannons and muskets aboard the *Fair American*. They coached the king on foreign dress, life style and custom. They even taught him tricks in trading with ever-increasing number of ships calling on the islands. Given wives, land and the equivalent status of chiefs, Davis and Young exerted tremendous influence on the ambitious king and later became his confidential advisors (192:*16*).

** [Liholiho] was young (about 22), had a reputation as a gambler and a playboy, and had an affliction for the foreigners' whiskey....

With the rule of the land now divided between Liholiho and Kaahumanu and the custody of the war god, *Ku*, no longer in possession of the person who also ruled the land, the prediction of a well-known German naturalist named Adelbert von Chamisso who had accompanied Kotzebue on his visits to the islands, seemed about to come true: '...after the death of the old hero, his kingdom, founded and kept together by force, will fall to pieces, the partition of it being already decided upon, and prepared [This statement was made between 1816 and 1817, after Kamehameha the Great had formally proclaimed Liholiho as his successor and named a new custodian for the war god, *Ku*] (192:*24*).

†† So little is known of the early life of John Harrison that his biographers have had to spin the few thin facts into whole cloth.

These highlights, however, recall such stirring elements in the lives of other legendary men that they give Harrison's story a leg up. For instance, Harrison educated himself with the same hunger for knowledge that kept young Abraham Lincoln reading through the night by candlelight (193:*62*).

‡‡ Erik the Red (tenth century) was a Norwegian sailor who founded Norse colonies on Greenland about 985. His son, Leif Erikson, landed in Vinland, often identified as Newfoundland, *c.* 1000. Both men are the subject of Icelandic sagas (57:*13*).

§§ A great swarm of skin-boats was then heading towards them down the fjord.

Thorvald said, 'We shall set up breastworks on the gunwales and defend ourselves as best we can, but fight back as little as possible.'

They did this. The *Skraelings* shot at them for a while, and then turned and fled as fast as they could.

Thorvald asked his men if any of them were wounded; they all replied that they were unhurt.

'I have a wound in the armpit,' said Thorvald. 'An arrow flew up between the gunwale and my shield, under my arm—here it is. This will lead to my death. I advise you now to go back as soon as you can. But first I want you to take me to the headland I thought so suitable for a home. I seem to have hit on the truth when I said that I would settle there for a while (194:*60-61*).

*** Then Bjarni said that the people who were to go should be chosen by lot, and not by rank.

But everyone tried to get into the boat. The boat, however, would not hold them all and so they agreed to this suggestion... When the lots were drawn it so happened that Bjarni himself, along with nearly half the crew, drew a place, and these all left the ship for the boat.

When they were in the boat one young Icelander who had been Bjarni's companion said, 'Are you going to leave me here, Bjarni?'

'This is how it has to be,' replied Bjarni.

Sir Karl Popper, FA von Hayek, Lord Glenconner,* Lord Latymer,† the Honourable Brian Alexander,‡ Mick Jagger,§ King George III,** Queen Victoria, Winston Churchill, Margaret Thatcher, William Wallace, Ayn Rand, †† Edward Saxon, Susan Orlean, Charlie Kaufman,‡‡ Haldor Laxness,§§ Florence Peake, Ernest Hemingway,* Norman Maclean, Robert Frost, Robert

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The Icelander said, 'But that is not what you promised when I left my father's farm in Iceland to go with you.'

'I see no other way,' said Bjarni. 'What do you suggest?'

'I suggest we change places; you come up here and I shall go down there.'

'So be it,' said Bjarni. 'I can see that you would spare no effort to live, and are afraid to die.'

So they changed places. The Icelander stepped into the boat and Bjarni went back on board the ship; and it is said that Bjarni and all those who were on the ship with him perished (194:*103-104*).

* Tourism after the war was the setting up of large hotels…, imposed from the outside…. In Mustique I tried building from the inside outwards and events proved I was ahead of my time (195).

† Hugo Money-Coutts – as he was known before he inherited the ancient barony of Latymer in 1987 – did not follow his father and grandfather into the directors' room of Coutts & Co., the exclusive private bank in the Strand which traces its origins to 1692…

Instead, he made his early career with the merchant banking house of Robert Fleming, where he specialized in investment business. In 1963, however, at the age of 37, he left… his job… to sail his 39 ft ketch *Heliousa*, first to Majorca and then, via the Panama Canal, to Australia….

'I suppose my friends will think I'm crazy,' Money-Coutts remarked at the time, 'but I'm tired of fighting my way across London's traffic and tussling with people in the Underground. Everything has come easy to me in life so far, now I want to try it the hard way. Perhaps my friends may envy me, but while they are lashing into large dinners at the Savoy in a year's time, I might be on the dole in Australia.'

Nothing so tiresome came to pass, however…

For some years he diverted a large part of his energies to Mustique where, as managing director and co-owner of the island's development company, he helped his Eton contemporary Colin Tennant (Lord Glenconner) to turn Mustique into an exclusive holiday paradise (196).

‡ The Honourable Brian Alexander has been Managing Director of The Mustique Company… since 1979. He began his long relationship with the island in 1968 while working for the J. Arthur Rank Organization in London. It was here that he first met Colin Tennant, former owner of Mustique…. Mr. Alexander brings a wonderful charm and enthusiasm to his position as he guides Mustique through its constantly evolving, yet controlled growth (197:*1-2*).

§ There are many small islands throughout the world that people have attempted to develop, but not always with the interests of the environment in mind. Since its inception in 1968, *The Mustique Company* has recognized both the aesthetic and economic value of a healthy environment and has tried to protect the island from *ad hoc* and adverse development. This was accomplished by partitioning the island into a limited number of plots, having the island and surrounding waters to one kilometer offshore declared a Conservation Area, and commissioning studies and reports to monitor environmental issues and concerns as they arose. The result of this is an island that is still mostly covered with green space, nearly 70 percent with a diverse collection of plant communities, habitats, and the creatures that depend upon these. The dominant categories of vegetation on Mustique remain unchanged, these being the sheltered forests and the windswept forests alike (198:*foreword*).

** GEORGE THE THIRD by the Grace of God of the United Kingdom of Great Britain and Ireland King Defender of the Faith TO ALL WHOM these presents shall come Greeting

WHEREAS several of our loving Subjects are desirous of forming a Society for the Cultivation of the Science of Natural History in all its branches… having subscribed considerable Sums of money for that purpose have humbly besought us to grant unto them and such other persons as shall be approved and elected as hereinafter is mentioned Our Royal Charter of Incorporation for the purposes aforesaid; KNOW YE, that We being desirous to promote every Kind of Improvement in the Arts and Sciences have of our special Grace certain knowledge and mere motion given and granted And We do hereby give and grant… others as shall from time to time be appointed and elected in the manner hereinafter directed and their Successors be and shall for ever hereafter continue and be by virtue of these presents one Body politic and Corporate by the Name of 'The Linnean Society of London' (85:*3-4*).

†† Man's profound need of art lies in the fact that his cognitive faculty is conceptual, *i.e.*, that he acquires knowledge by means of abstractions, and needs the power to bring his widest metaphysical abstractions into his immediate, perceptual awareness. Art fulfills this need…, it concretizes man's fundamental view of himself and of existence. It tells man, in effect, which aspects of his experience are to be regarded as essential, significant, important. In this sense, art teaches man how to use his consciousness (199:*38-45*).

‡‡ You know why I love plants? Because they're so mutable, so adaptable. Adaptation is such a profound process. (beat) Adaptation means you figure out how to survive in the world. People aren't to good at that sometimes (200:*42*).

§§I was travelling in the south of Sweden a few weeks ago, when I heard the rumor that the choice of the Swedish Academy might possibly fall on me. Alone in my hotel room that night, I naturally began to ask myself what it would mean to a poor wanderer, a writer from one of the most remote islands in the world….

I spent my entire childhood in an environment in which the mighty of the earth had no place outside story books and dreams. Love of, and respect for, the humble routine of everyday life and its creatures was the only moral commandment which carried conviction when I was a child….

My thoughts fly to the old Icelandic storytellers who created our classics, whose personalities were so bound up with the masses that their names, unlike their lives' work, have not been preserved for posterity. They live in their immortal creations and are as much a part of Iceland as her

Edward Turner II, Robert Edward Turner III, Karen Blixen, Father Mark de Silva, Robin Mahon, Joshua Slocum,† Ben & Zarina Funk, Randall Dillard, my wife (Marcy), my son (William), Barney, Edward J., William E., Arlene, Don, Nancy, Dan, Grith, Aline, Luke, Katya, and the rest of my fellow Funks, Clarence and Frieda Holley, Charlotte and Charles Fowler, James Damron, Harry MacLauchlan, Harvey Livingston, Shawn Skinner, Danny Williams, Godfrey Baldacchino, Barry Bartmann, Brian Hoyle, Lorraine Guay, Russell Fielding, Anders Kallgard, Colin MacIntyre, Simone Stahel-Webster, Jordan Walker, Hans Connor Natalie deJong, the Campbells, Fowlers, Ryans, Spellmens, Martins, Roberts, Fitzpatricks, Safais, Lewis, Davis, Grants,‡ Furgesons, Kafers, and McDades, Sherwin Carlquist (*cf.* 206-212),§ John Maynard Smith,** Nicholas Barton,†† Bryan Clarke,‡‡ Rachel Carson,§§ Sandra Knapp, Sarah Darwin, Jos Barlow, and Jim Mallet.***

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landscape. For century upon dark century those nameless men and women sat in their mud huts writing books without so much as asking themselves what their wages would be, what prize or recognition would be theirs. There was no fire in their miserable dwellings at which to warm their stiff fingers as they sat up late at night over their stories.... While their hearts remained warm, they held on to their pens (201).

* The house built on the highest part of the narrow tongue of land between the harbor and the open sea. It had lasted through three hurricanes and it was built solid as a ship. It was shaded by tall coconut palms that were bent by the trade wind and on the ocean side you could walk out of the door and down the bluff across the white sand into the Gulf Stream (202:*3*).

† It was the season for fruit when I arrived at the Azores, and there was soon more of all kinds of it put on board than I know what to do with. Islanders are always the kindest people in the world, and I met none anywhere kinder than the good hearts of this place. The people of the Azores are not a very rich community. The burden of taxes is heavy, with scant privileges in return, the air they breathe being about the only thing that is not taxed....

The day after my arrival at Horta was the feast of a great saint....The deck of the *Spray* was crowded from morning till night....On the day after the feast a kind-hearted native harnessed a team and drove me a day over the beautiful roads about Fayal, 'because,' said he, in broken English, 'when I was in America and couldn't speak a word of English, I found it hard till I met someone who seemed to have time to listen to my story, and I promised... that if ever a stranger came to my country, I would try to make him happy' (203:*56*).

‡ Peter Grant FLS FRS and... Rosemary Grant FRS...have been studying Darwin's finches on the Galápagos islands since 1973. Their fieldwork is designed to understand the causes of an adaptive radiation. It combines analyses of archipelago-wide patterns of evolution with detailed investigations of population level processes (204:*7-8 ; cf.* 205).

§ If Darwin thought that islands were the laboratory for studying evolution, Carlquist took advantage of this concept and has used islands as his personal laboratory... Among his best-known contributions is his 1974... *Island Biology*, which framed his ideas about dispersal, establishment and radiation of biota into new environments. He further expanded this approach... in *Hawaii: A Natural History* (213:*introduction*).

** John Maynard Smith FRS, FLS... was by far the most influential British evolutionary biologist of the second half of the 20th century. Architect of the world-leading Sussex University school of 'mathematical selection', he elevated to a higher plane the mathematical population genetics approaches developed in the UK by RA Fisher, and then compounded this remarkable achievement by applying the previously economically focused game theory to evolutionary problems. These breakthroughs prompted... several technically rigorous but readable books (204:*8-9*).

†† Professor Barton's early research was on the narrow zones of hybridization that subdivide many populations; this involved work on a variety of species, including grasshoppers, butterflies, and toads. More recently, his research has been mainly theoretical and aimed at understanding the influence of selection on complex traits, models of speciation, the evolution of sex and recombination, and the coalescent process (204:*6*).

‡‡ Bryan Clarke FRS, FLS... has had a long and distinguished career as a population geneticist and evolutionary biologist. He is best known for his work on frequency-dependent selection... His research on snails in Moorea, Tahiti and other islands, combined with behaviour and genetics research in the lab, is a classical study of speciation and adaptive diversification (204:*7*).

§§ *It is often outsiders who see a problem first*. This may be because an inventor is rightly keen to have his invention applied, and may therefore overlook its possibly undesirable consequences. Thus, certain chemical inventions proved very successful against mosquitoes and other insects, but with the undesirable result that songbirds died of starvation. The American naturalist Rachel Carson reported all this in her excellent book *Silent Spring* (16:*101*).

*** Although our primary interests are in genetic and systematic studies of populations, geographic forms, and speciation, many of our results have obvious implications for conservation of endangered taxa. I remain committed to and interested in topics such as insecticide resistance, safety concerns about the release of genetically modified organisms..., and in the biodiversity and conservation applications of our work (214).

On Fellowship

Although I am clearly not British, I am a resident of Prince Edward Island—a landed immigrant in your Commonwealth—I love to explore the islands of the world, and, despite whatever truths you may or may not find within this long letter, the short paper enclosed herewith (*cf*. 6), I hope you may find that my interest in natural history is unquestionably *active*,[‡‡‡] that I endeavour to 'learn the ways of nature,' and that you may thus consider extending an invitation to this wayward and unapologetically American naturalist to join you as a Fellow of The Linnean Society of London (See *APPENDIX X: RECOMMENDATION?*).[§§§]

Like my fellow American who shared Darwin's sympathies and date of birth,[****] I grew up in a log cabin along the Iroquois River in Northwest Indiana. The cabin was built by a writer by the name of George Ade, who was born and raised in my hometown of Kentland, Indiana. Years later, when I arrived at The University of Southern California, I fell into a group of like-mined fellows and was soon surprised to discover that Ade was their 'brother,' so to speak, and, moreover, that one hundred years prior he had penned their creed (*APPENDIX XI: ON THE BOND OF FELLOWSHIP*). In due course (and more than two decades ago), I pledged that these fellows had "given me favour and distinction" and that I would "endeavour to so build myself and so conduct myself that I will ever be a credit" to this society—and I remain a loyal member to this day. I trust this letter may suggest that I took this Fellowship to heart, and, to this point, that if you should see fit to grant me your favour and distinction, I would continue to endeavour to so build myself that I will ever be a credit to The Linnean Society as well. If you have interest in reviewing my works in greater detail, I would be happy to forward any or all of my papers, including an exhaustive exploration of insularity and evolutionary stable solution to *The Problem of Sustainable Economic Development* on Earth, expanded upon in one very long, perhaps even entertaining – but no doubt somewhat ridiculous and

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‡‡‡There are no prerequisites for becoming a Fellow other than an active interest in natural history (13).

§§§Every Candidate for Election as a Fellow shall be proposed and recommended by at least one Fellow who shall sign and cause to be delivered to the Executive Secretary a completed *Certificate of Recommendation* (85:*19*).

**** Darwin was aware of Lincoln. The Englishman's wealthy grandfathers, physician-inventor Erasmus Darwin and pottery-maker Josiah Wedgwood, were early, powerful activists against slavery, a cause Darwin also embraced.

'He followed the Civil War through newspapers and rooted for the Union side all the way' (1:5).

arguably shameful* argument—a revolutionary† letter from one islander (yours truly) to another (President Barack Obama), entitled: *The Principles of Economics & Evolution: A Survival Guide for People who Live on Small Islands, Including the Inhabitants of the Small Island of Earth* (217).§

Fortune willing, I will send (39) under separate cover.

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* I am undertaking a work which has no example, and whose execution will have no imitator. I mean to lay open to my fellow-mortals a man just as nature wrought him; and this man is myself....

I have made the first step and the most painful in the obscure and dirty maze of my Confessions. It is not the criminality we are most unwilling to divulge; it is what is ridiculous and shameful. Henceforward I am sure of myself; after what I have dared to disclose, nothing can be able to stop me (215:*3-15*).

† There have been and always will be books which are truly revolutionary—that is to say, inspired and inspiring. They are few and far between, of course. One is lucky to run across a handful in a lifetime. Moreover, these are not books which invade the general public. They are the hidden reservoirs which feed the men of lesser talent who know how to appeal to the man in the street. The vast body of literature, in every domain, is composed of hand-me-down ideas. (216:*11*).

§ Our civilisation depends, not only for its origin but also for its preservation, on what can be precisely described only as the extended order of human cooperation, an order more commonly, if somewhat misleadingly, known as capitalism. To understand our civilisation, one must appreciate that the extended order resulted not from human design or intention but spontaneously: it arose from unintentionally conforming to certain traditional and largely moral practices, many of which men tend to dislike, whose significance they usually fail to understand, whose validity they cannot prove, and which have nonetheless fairly rapidly spread by means of an evolutionary selection – the comparative increase of population and wealth – of those groups that happened to follow them. The unwitting, reluctant, even painful adoption of these practices kept these groups together, increased their access to valuable information of all sorts, and enabled them to be 'fruitful, and multiply, and replenish the earth, and subdue it' (Genesis 1:28). This process is perhaps the least appreciated facet of human evolution.

Socialists take a different view of these matters. They not only differ in their conclusions, they see the facts differently. That socialists are wrong about the facts is crucial to my arguments... I am prepared to admit that if socialist analyses of the operation of the existing economic order, and of possible alternatives, were factually correct, we might be obliged to ensure that the distribution of incomes conform to certain moral principles, and that this distribution might be possible only by giving a central authority the power to direct the use of available resources, and might presuppose the abolition of individual ownership of means of production. If it were for instance true that central direction of the means of production could effect a collective produce of at least the same magnitude as that which we no produce, it would indeed prove a grave moral problem how this could be done justly. This, however, is not the position in which we find ourselves. For there is no known way, other than by the distribution of products in a competitive market, to inform individuals in what direction their several efforts must aim so as to contribute as much as possible to the total produce.

The main point of my argument is, then, that the conflict between, on one hand, advocates of the spontaneous extended human order created by a competitive market, and on the other hand those who demand a deliberate arrangement of human interaction by central authority based on collective command over available resources is due to a factual error by the latter about how knowledge of these resources is and can be generated and utilised. As a question of fact, this conflict must be settled by scientific study. Such study shows that, by following the spontaneously generated moral traditions underlying the competitive market order (traditions which do not satisfy the canons or norms of rationality embraced by most socialists), we generate and garner greater knowledge and wealth than could ever be obtained or utilised in a centrally-directed economy whose adherents claim to proceed strictly in accordance with 'reason'. Thus socialist aims and programmes are factually impossible to achieve or execute; and they also happen, into the bargain as it were, to be logically impossible.

This is why, contrary to what is often maintained, these matters are not merely ones of differing interests or value judgements. Indeed, the question of how men came to adopt certain values or norms, and what effect these had on the evolution of their civilisation, is itself above all a factual one, one that lies at the heart of the [matter]... The demands of socialism are not moral conclusions derived from the traditions that formed the extended order that made civilisation possible. Rather, they endeavour to overthrow these traditions by a rationally designed moral system whose appeal depends on the instinctual appeal of its promised consequences. They assume that, since people had been able to generate some system of rules coordinating their efforts, they must also be able to design an even better and more gratifying system. But if humankind owes its very existence to one particular rule-guided form of conduct of proven effectiveness, it simply does not have the option of choosing another merely for the sake of the apparent pleasantness of its immediately visible effect. The dispute between the market order and socialism is no less than a matter of survival. To follow socialist morality would destroy much of the present humankind and impoverish much of the rest (218:*6-7*).

In the meantime, please find the preview enclosed herewith (6).

Furthermore, not only am I open to any and all criticisms, I would be most grateful to hear them:

> Many of the views which… [follow] are highly speculative, and some no doubt will prove erroneous; but I have in every case given the reasons which have led me to one view rather than to another. It seemed worth while to try how far the principle of evolution would throw light on some of the more complex problems in the natural history of man. False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for every one takes a salutary pleasure in proving their falseness: and when this is done, one path towards error is closed and the road to truth is often at the same time opened (18).*

I hope to have the opportunity to meet you all at Burlington House soon.†

Yours very truly,

(Matt Funk)‡§

Enclosure: *On the Truly Noncooperative Game of Life on Earth: In Search of the Unity of Nature & Evolutionary Stable Strategy* (6).

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* The writer's object in putting forward his views in the present imperfect manner is to submit them to the test of other minds, and to be made aware of all the facts supposed to be inconsistent with them. As his hypothesis is one which claims acceptance solely as explaining and connecting facts which exist in nature, he expects facts alone to be brought to disprove it; not à-priori arguments against its probability (219:*191*).

† Once elected, all Fellows and Associates must come to the Society personally to be formally admitted within the space of six months….

When a Fellow is admitted, his or her name and interests are read to the meeting during which the Fellow signs the Roll and Charter Book (these books contain the signatures of every Fellow Formally Admitted since the Society was instituted in 1788). The President takes the Fellow by the right hand and says, 'A.B. by the Authority and in the Name of the Linnean Society of London, I admit you a Fellow thereof.' This sentence was introduced by Dr Samuel Goodenough, the first Treasurer, in 1791 (220:*3*).

‡ There is something else I should like to say…. Reality is problematic for all of us. And we all continuously send out signals to be sure that we are not dreaming and that we live in a real world. We are like bats: although we do not quite have the technology of bats, we do have something similar. For example, I constantly change my position: it is one of my various techniques of signal transmission, and from the momentary return signals that I actively integrate, I learn that I am not dreaming and that reality does indeed make this strange impression (16:*52*).

§ See *APPENDIX XII: FELLOWSHIP*

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APPENDIX I
GLOSSARY

[PROBLEM:] *Economic theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgement in choosing between rival sets of assumptions* (1:*386*).

[SOLUTION:] *In… economics the most fruitful work may be that of careful, patient description; indeed this may be by far the largest domain for the present and some time to come….*

Economic problems [have been and are often] not formulated clearly and are often stated in such vague terms as to make mathematical treatment a priori appear hopeless because it is quite uncertain what the problems really are. There is no point in using exact methods where there is no clarity in the concepts and issues to which they are to be applied. Consequently the initial task is to clarify the knowledge of the matter by further careful descriptive work (2:*2-4*).*

Austrian Economics

(a). Yet, perhaps the most important lesson, which I have learned from Mises, was a lesson located outside economics itself. What Mises taught us in his writings, in his lectures, in his seminars, and in perhaps everything he said, was that economics—yes, and I mean sound economics, Austrian economics—is primordially, crucially important. Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics.

This is a lesson, which is located almost entirely outside economics proper. But all Mises' work depended ultimately upon this tenet. Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not identified by science as worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability to calmly ignore the sneers of, and the isolation imposed by academic contemporaries, was his conviction that the survival of mankind depends on the development and dissemination of Austrian economics…

Austrian economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race (4).

(b) What made Vienna the distinctive city that it was, as much as any other the fount of Western culture, is a question to be kept in mind…What we might observe is that a milieu such as that in which Hayek spent his childhood and youth, a society in which family and associates, position and accomplishment, knowledge and history were so tightly intertwined, meant that the members of such a society were quickly and always apprised of what *mattered*. This is no small feat, as any teacher of the present generation of youth knows too well. It is the *significance* of knowledge and information that leads to the evolution of understanding (5:*5*).

(c). *Cf. The Austrian Economists* (6).

Consilience/Data Cascade

(a) Of the two major methods for inferring history from single configurations, consilience calls upon a greater range of evidence. This word, coined by William Whewell in 1840, means 'jumping together.' By this term, Whewell referred to proof by coordination of so many otherwise unrelated consequences under a single causal explanation that no other organization of data seems conceivable. In a sense, consilience defines the larger method underlying all

* I shall endeavour to explain, as fully and distinctly as I can, [these] subjects…, for which I must… earnestly entreat both the patience and attention of the reader: his patience in order to examine a detail which may perhaps in some places appear unnecessarily tedious; and his attention in order to understand what may…, after the fullest explication which I am capable of giving…, appear still in some degree obscure. I am willing to run the hazard of being tedious in order to be sure that I am perspicuous; and after taking the utmost pains that I can to be perspicuous, some obscurity may still appear to remain upon a subject in its own nature extremely abstracted (3:*32*).

Darwin's inference from historical records. In a more specific context, I use consilience... for Darwin's principal tactic of bringing so many different points of evidence to bear on a single subject, that history wins assent as an explanation by overwhelming confirmation and unique coordination (7:*104*).

(b) [Darwin] granted even more importance to his relentless presentation of dense documentation for the factuality of change - for only such a cascade of data would force the scientific world to take evolution seriously.... Facts literally pour from almost every page of the *Origin*.... In some parts, the *Origin* reaches an almost frenetic pace in its cascading of facts, one upon the other....
Whenever he introduces a major subject, Darwin fires a volley of disparate facts, all related to the argument at hand... This style of organization virtually guarantees that Whewell's 'consilience...' must become the standard method of the *Origin*. Darwin's greatest intellectual strength lay in his ability to forge connections and perceive webs of implication (that more conventional thinking in linear order might miss). When Darwin could not cite direct evidence for actual stages in an evolutionary sequence, he relied upon consilience - and sunk enough roots in enough directions to provide adequate support for a singe sturdy trunk of explanation (7:*109*).

Darwinian Fitness

(a) The term Darwinian fitness refers to the capacity of a variant type to invade and displace the resident population in competition for available resources (8:*abstract*).

(b) Imagine... two... [people] are contesting a resource of value *V*. By 'value', I mean that the Darwinian fitness of an individual obtaining the resource would be increased by *V*. Note that the individual which does not obtain the resource need not have zero fitness. Imagine, for example, that the 'resource' is a territory in a favourable habitat, and that there is adequate space in a less favourable habitat in which losers can breed. Suppose, also, that animals with a territory in a favourable habitat produce, on average, 5 offspring, and that those breeding in the less favourable habitat produce 3 offspring. Then *V* would equal 5-3=2 offspring. Thus *V* is the *gain* in fitness to the winner, and losers do not have zero fitness (9:*11-12*).

Denaturalization of Economics

[During] the late eighteenth century and the mid-nineteenth,... economic theorists [came] to posit and identify an economy as a distinct entity and maintain that it was subject, not to natural processes, but to the operation of human laws and agency. ...Until the mid-nineteenth century, economic theorists regarded the phenomena of their discourse as part of the same natural work studied by natural philosophers. *Not only were economic phenomena understood mostly by drawing analogies to natural phenomena, but they were also viewed as contiguous with nature*. Economic discourse was, in short, considered to be part of natural philosophy and not, as we would now deem it, a *social* or *human* science. It did not then address an autonomous sphere as it does today.

How and why political economists came to see the economic domain as severed from the physical world, as the product of human action, human deliberation, and human institutions, ...[is] the... *denaturalization* of the economic order (10:*2*).

Earth Island Survival Game

This asymmetric, non-cooperative game unbounded supergame with incomplete information models *The Problem of Sustainable Economic Development* on Earth, and, theoretically any/all inhabitable planets. Thus our master island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All bio-geo-politico regions on Earth are distinguishable by various degrees of relative insularity, and thus, all regions on Earth – islands, continents, and oceans alike – make up the 'island' sub-set: $\{i_1, i_2, i_{3, \ldots}i_n\}$. In other words: $\{i_1, i_2, i_{3, \ldots}i_n\}$ is a sub-set of $\{I_1\}$.

Evolutionary Stable Strategy - ESS

(a) Maynard Smith and Price (1973) [12] introduced the concept of an evolutionarily stable strategy (*ESS*). Initially they were not aware of the relationship between the concept of an *ESS* and that of a Nash equilibrium. Rational game theory looked at mixed strategies as produced by conscious randomization. Nash's interpretation of a mixed equilibrium as a mass action phenomenon was buried in his unpublished dissertation and not found in textbooks on game theory. In biology the mass action interpretation is very natural and guided the work on evolutionary stability already from its beginning.... They defined an *ESS* as a strategy prescribed by a symmetric equilibrium point (11:*168*).

(b) An 'evolutionarily stable strategy', or *ESS*... can be defined as a strategy such that, if all members of a population adopt it, no 'mutant' strategy can do better. A number of simple models of contest situations are analyzed from this point of view. It is concluded that in 'symmetric' contests the *ESS* is likely to be a 'mixed' strategy; that is, either the population will be genetically polymorphic or individuals will be behaviourally variable. *Most real contests are probably asymmetric, either in pay-off to the contestants, or in size or weapons, or in some 'uncorrelated' fashion; i.e. in a fashion which does not substantially bias either the pay-offs or the likely outcome of an escalated contest. An example of an uncorrelated asymmetry is that between the 'discoverer' of a resource and a 'late-comer'.* It is shown that the *ESS* in asymmetric contests will usually be to permit the asymmetric cue to settle the contest without escalation. Escalated contests will, however, occur if information to the contestants about the asymmetry is imperfect (9:*abstract*).

(c) One of the great discoveries of game theory came in the early seventies, when the biologists John Maynard Smith and George Price realized that strategic equilibrium in games and population equilibrium in the living world are defined by the same equations. Evolution be it genetic or memetic – leads to strategic equilibrium (13:*352*).

(d) The first explicit use of game theory terminology in this context was by Hamilton (1967), who sought for an 'unbeatable strategy' for the sex ratio when there is local competition for mates. Hamilton's 'unbeatable strategy' is essentially the same as an *ESS* as defined by Maynard Smith & Price (1973) (9:*2*).

(e) Despite Nash's remarks in his thesis about a possible evolutionary interpretation of the idea of a Nash equilibrium, attention at the time was focused almost entirely on its interpretation as the only viable outcome of careful reasoning by ideally rational players. ...

Fortunately... Maynard Smith's book *Evolution and the Theory of Games* directed game theorists' attention away from their increasingly elaborate definitions of rationality (14:*1*).

Funk-Carlquist Formula

First, I must emphasize that this formula was *named in honour* of the great long-distance dispersal advocate, Professor Sherwin Carlquist, and though this formula was fundamentally influenced by Carlquist's insights and he may thus rightly share in praise for any value this formula may offer, it was developed independently, and thus any and all deficiencies are to be attributed to Funk, not Carlquist.

This formula, which remains in an early, untested, beta release state, is merely *possibly* a practical heuristic for quantifying *Resource Holding Power* (Darwinian fitness). This value also serves to determine *RIS* and *GEMS* status (though, in most instances, the distinction between the two is clear without further analysis). The formula is derived in light of our discovery that *Value* (V) is a derivative function of *relative insularity* (I_R): $V = f'(I_R)$.

I_R *may theoretically* be determined by multiple regression analysis of: *Military Power (GDP + population + annual defense spending + soldiers + NPT Treaty status, cf.* 15*), Land Area (km^2), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Military Power, Nearest Neighbour Land Area (km^2), Elevation (m), Renewable Water Resources (m^3/person/year), Food Imports (%), Population Density (p/km^2), Exclusive Economic Zone (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Fishery (Kg/person/year) Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Nature Preserve (%k m2), Tourist Visits (Land Area/n), Irrigation I (m^3/person/year) Irrigation II (% km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (Land Area/ grammes/p/day), and Cultural Homogeneity (%).* Depending upon research objectives (especially on relatively small islands), two additional qualitative inputs – Sovereign Status and Constitutional balance—may be considered. Multiple regression analysis offers (inherently limited insight to) Darwinian fitness—the economic and evolutionary value for each corresponding bio-geo-politico-economic 'island.' This value suggests *resource holding power* (*RHP*) – the ability for citizens of each, corresponding politico-biogeographic 'island' to protect, maintain, and hold (through *Economic Power* and sustainable harvest practices alike, for example) *property rights* (Land Area, EEZ, Forests, Renewable Water Resources, Nature Preserves, etc.).

Although the scope of our inquiry is focused upon human interests, a reformulation for other species may be derived with modest alterations – *military power*, for example, is re-formulated as *hunting power* (*size + population*), and EEZ, land links, airports, etc. are merely excluded.

Game Theory

(a) It is conventional to call these situations 'games' when they are being studied from an abstract mathematical viewpoint. Here the original situation is reduced to a mathematical description, or model. In the abstract 'game'

formulation only the minimum quantity of information necessary for the solution is retained. What the actual alternative courses of action are among which the individuals must choose is not regarded as essential information. These alternatives are treated as abstract objects without special qualities and are called 'strategies.' Only the attitudes (like or dislike) of the two individuals towards the ultimate results of the use of the various possible opposing pairs of strategies are considered (16:*128-129*).

(b) Game theory is a theory of *strategic interaction*. That is to say, it is a theory of *rational behavior* in social situations in which each player has to choose his moves on the basis of what he thinks the other players' *countermoves* are likely to be.

After preliminary work by a number of other distinguished mathematicians and economists, game theory as a systematic theory started with von Neumann and Morgenstern's book, *Theory of Games and Economic Behavior,* published in 1944. One source of their theory was reflection on *games of strategy* such as chess and poker. But it was meant to help us in defining rational behavior also in *real-life* economic, political, and other social situations (17:*136*).

Globalized Economic Military Superpowers - GEMS

By definition, at any point in the game, there is only one true, dominant player (hegemon with dominant *RHP*, and therefore *ESS*). Presently, the United States and Russia hold 95% of the world's offensive nuclear materials, but in our negotiation model, players include all five signatory members of the *UK-USA* agreement (*UK*, *USA*, Canada, Australia, and New Zealand), often referred to as *AUSCANZUKUS*, and six additional nations which have developed, detonated, and presently maintain nuclear weapons (Russia, France, China, India, Pakistan, and North Korea). Naturally, these roles change hands throughout time and that it would be mark an obvious logical error to succumb to the belief that hands these hands will not change again. Also see: *RIS*.

Human Survival

It is a striking and profoundly meaningful fact that organisms are so constructed, so function, and so behave that they survive and perpetuate themselves in a certain range of environments frequently enough for their species not to become extinct for long periods of time....

Zoologists, and in fact all biologists, should never lose sight of this one highly peculiar, and yet remarkably interesting, animal species—*Homo sapiens*. The worth and utility of biology, and, indeed, of science and of intellectual endeavor as a whole, will perhaps, in the fullness of time, be judged by the contribution they will have made to man's understanding of himself and of his place in the universe....

Man seeks to understand himself. The pursuit of self-understanding is a never-ending quest. Darwin's work marked a turning point in the intellectual history of mankind because it showed that mankind was a product of a biological history. The evidence for this is now overwhelmingly convincing... But just how and why man's bodily structures, physiological functions, and mental capacities have developed as they did is by no means well understood. The working hypothesis now in vogue is that the process of adaptation to the environment is the main propellant of evolutionary change. Evidence is rapidly accumulating which, in my opinion, substantiates the hypothesis. It remains, however, not only to convince the doubters but, whit is more important, to discover just how the challenges of the environment are translated into evolutionary changes.

Man is interested in his future no less than in his past. Evolution is not only a history, it is also an actuality. Of course, *Homo sapiens* evolves culturally more rapidly than it evolves biologically. Man must, however, fact the problem of adapting his culture to his genes, as well as adapting his genes to his culture. Man is being forced by his culture to take the management and direction of his evolution in his own hands. This is perhaps the greatest challenge which mankind may ever have to face...

The big question remains: What is Man? It remains not because it is hopelessly insoluble, but because every generation must solve it in relation to the situation it faces. Biology is here relevant; a solution based only on biology way well be wrong, but, surely, no solution ignoring either the organismic or the molecular biology can be right and reasonable (18:*450-451*).

Islands - I_n / i_n

The foundation to our game theoretical approach to cultural evolution and politico-economic analysis rests on the principles of set theory, and our primary island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All biogeographical regions on Earth are

distinguishable to various degrees of relative insularity, and thus, *all* regions on Earth – continents, and oceans alike – make up the sub-set: $\{i_1, i_2, i_{3, \ldots}i_n\}$. Thus, the 'islands' of Earth are a subset Earth Island: $\{i_1, i_2, i_{3, \ldots}i_n\}$ is a sub-set of $\{I_1\}$.

Island Survival Game

A subgame of *The Earth Island Survival Game* which models *The Problem of Sustainable Economic Development* on RIS. Darwinian fitness is measured by *Resource Holding Power*, the ability to achieve sustainable economic development by protecting and sustaining property and natural resource rights through time, thus overcoming *The Tragedy of the Commons*. *RIS* are elements of the island set: $\{i_1, i_2, i_{3, \ldots}i_n\}$, and, like *GEMS*, are a sub-set of the island of Earth: $\{I_1\}$. In other words: $\{i_1, i_2, i_{3, \ldots}i_n\}$ is a sub-set of $\{I_1\}$.

Mathematics

(a) The problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate 'given' resources-if 'given' is taken to mean given to a single mind which deliberately solves the problem set by these 'data.' It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge not given to anyone in its totality. *This character of the fundamental problem has, I am afraid, been rather obscured than illuminated by many of the recent refinements of economic theory, particularly by many of the uses made of mathematics* (19:*519-520*).

(b) What has gone wrong with the development of economics as a science? Answer: There was a bunch of intelligent people who felt compelled to use mathematics just to tell themselves that they were rigorous in their thinking, that theirs was a science. Someone in a great rush decided to introduce mathematical modelling techniques…without considering the fact that either the class of mathematics they were using was too restrictive for the class of problems they were dealing with, or that perhaps they should be aware that the precision of the language of mathematics could lead people to believe that they had solutions when in fact they had none (20:*177*).

(c) We may also observe that part of the feeling of dissatisfaction with the mathematical treatment of economic theory derives largely from the fact that frequently one is offered not proofs but mere assertions which are really no better than the same assertions given in literary form. Very frequently the proofs are lacking because a mathematical treatment has been attempted of fields which are so vast and so complicated that for a long time to come… there is hardly any reason at all to expect progress more mathematico (2:*5*).

(d) It is an interesting speculation to think what direction the development of Menger's thought would have taken if he had been acquainted with these founders of mathematical analysis. It is a curious fact that, so far as I am aware, he has nowhere commented on the value of mathematics as a tool of economic analysis. There is no reason to assume that he lacked either the technical equipment or the inclination. On the contrary, his interest in the natural sciences is beyond doubt, and a strong bias in favour of their methods is evident throughout his work….He does not even refer to the mathematical method in any of his writings on methodology…Must we conclude that he felt rather sceptical about its usefulness? (21:*15*).

(e) In… *Principles*, Marshall confined his use of diagrams and other mathematical notations to footnotes and appendixes so as not to allow his mathematics to detract from his economics. He was interested above all in plain communication—with businessmen as well as with students. Moreover, he was acutely aware that over reliance on mathematics 'might lead us astray in pursuit of intellectual toys, imaginary problems not conforming to the conditions of real life: and, further, might distort our sense of proportion by causing us to neglect factors that could not easily be worked up in the mathematic machine' (22:*341*).

Natural Selection

(a) The cornerstone of Darwin's paradigm of evolution was the theory of natural selection. Yet, of all his theories this was the last one to be adopted by his followers. It took some eighty years before it was fully accepted by biologists and, of course, even today it still encounters a good deal of resistance among laypersons, particularly those with religious commitments. Actually at the beginning there were good reasons for resistance. Most importantly, for a long time there was little convincing evidence for the occurrence of selection in nature. Such evidence has now been provided abundantly, both in the field and in the laboratory… But there was also considerable uncertainty

about various specific aspects of the selection process. I will not present a full treatment of the subject natural selection in this chapter for I have done so quite recently in *What Evolution Is*... Instead I will single out for special treatment various aspects of selection about which there are still uncertainties...

In view of the persistent controversies, from 1859 on, concerning the nature of selection, it would seem most helpful to begin with a concise definition of selection, but this cannot be done owing to the arguments on the nature of this process. In 1963 I defined natural selection as nonrandom "differential reproductive success." And this is even today a valid formulation, but it stresses the outcome of this process rather than its mechanism. For Darwin and most of his followers for the next sixty years, natural selection was a rather simple process. Owing to the struggle for existence, there was enormous mortality in every generation and only the best survived. Fortunately, nature offered a virtually inexhaustible supply of variation and through the survival of the best there was steady evolutionary advance. Darwin borrowed the term selection from the vocabulary of the animal breeders and plant cultivators. But he overlooked that the breeders actually utilized two very different approaches to improve their stocks and so does nature. According to one of these approaches, those individuals are selected as breeding stock for the next generation that had special characteristics that represented the ideal of what the breeders aimed for in their selection. They would simply say that they would choose "the best individuals" of their flocks as their breeding stock. It was this method that Darwin apparently had in mind when he used the word "select." However, the breeders often used instead a different method to which they referred as "culling." In this method only the truly inferior individuals were eliminated and all the remaining individuals were used for breeding. This, of course, was not at all a "selection of the best." Nature uses the same two methods. In a harsh year as far as survival factors are concerned, only the best individuals survive; all others are eliminated. In a mild year only the worst are culled and most individuals survive. At the beginning of the next breeding season, as a result of such great survival a much more diversified population is available for the action of sexual selection and for selection contingencies. The existence of this culling method was soon pointed out by Herbert Spencer when he called natural selection a "survival of the fittest." He should have said "survival of the fitter." The survivors are those left over after all the inferior individuals have been eliminated. This elimination process is not at all a "selection of the best." Curiously, it has never been remarked that the consequences of an elimination process may be quite different from those of a selection process. A selection process results in the survival of the truly best and there will be only relatively few individuals that qualify for such a designation. In a process of actual selection a bird with a cumbersome tail such as that of a peacock would never emerge as "the best." By contrast, elimination would leave in an average year a much larger percentage of survivors than would the selection of only the best. This large pool of survivors provides ample material for sexual selection and for chance. It provides an explanation for the haphazardness of much of evolutionary change. Evolution by elimination provides a far better explanation for the actual course of events during evolution than the "selection of the best" of the classical evolutionary literature. The elimination of the inferior takes place, of course, simultaneously with the selection of the best, but it differs in strength in different situations. The unpredictability of much of evolution, described so graphically by Gould in his *Wonderful Life*..., is well explained by the process of elimination but could not be accounted for by a restriction to the selection of the best. Actually a selection of the best and an elimination of the worst take place simultaneously. The two processes also can be conceived of as occurring in parallel (23:*133-135*).

(b) By the 'syllogistic core' of natural selection ('the bare-bones argument'), I refer to the standard... presentation of the abstract mechanism of the theory as a set of three undeniable factual statements followed by the inference of natural selection... as a logical entailment of the three facts, viz:

1. Superfecundity: all organisms produce more offspring than can possibly survive.
2. Variation: all organisms vary from other conspecifics, so that each individual bears distinguishing features.
3. Heredity: at least some of this variation will be inherited by offspring (whatever the mechanism of hereditary transition—a mystery to Darwin, but the argument only requires that heredity exist, not that its mode of action be known (7:125).

Problem of Induction

(a) [Problem:] Our foregoing method of reasoning will easily convince us, that there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience (24:*137*).

(b) [Solution:] According to a widely accepted view... the empirical sciences can be characterized by the fact that

they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i.e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences....

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity.' At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads...to an infinite regress (25:*31-35*).

Relatively Insular States - RIS

This category includes sovereign island nations, sub-national island jurisdictions, insular provinces (*e.g.* Newfoundland & Labrador), states (*e.g.* Hawaii), municipalities (*e.g.* Vancouver Island), and relatively insular jurisdictions (*e.g.* The Alpine Convention region) We divide geopolitical regions based upon relative insularity, designating two players (*i*) *RIS* and (*ii*) *GEMS*, but in reality, naturally, the true relative insularity of each bio-geo-politico-economic niche (*i.e.* 'ecological niches' of human habitation) along a sliding scale with true *GEMS* at one end (such as the continental United States and China) and a true *RIS*, such as St. Helena, Molokai, Iceland, and the big island of Hawaii at the other.

Resource Holding Power - RHP

The view is examined that the adaptive value of conventional aspects of fighting behaviour is for assessment of relative *RHP* (resource holding power) of the combatants. Outcomes of aggressive disputes should be decided by each individual's fitness budget available for expenditure during a fight (determined by the fitness difference between adoption of alternative strategies, escalation or withdrawal without escalation) and on the rate of expenditure of the fitness budget if escalation occurs (determined by the *RHPs* of the combatants). Thus response thresholds for alternative strategies ('assessments') will be determined by natural selection on a basis of which opponent is likely to expend its fitness budget first, should escalation occur. This 'loser' should retreat (before escalation) and the winner should stay in possession of the resource. Many aggressive decisions depend on whether one is a resource holder, or an attacker. Assuming the *RHP* of the combatants to be equal, there are many instances of fitness pay-off imbalances between holder and attacker which should weight the dispute outcome in favour of one or other opponent by allowing it a greater expendable fitness budget. Usually the weighting favours the holder; the attacker therefore needs a correspondingly higher *RHP* before it may be expected to win. This is not invariably the case, and much observed data fits the predictions of this sort of model. If assessments are perfect and budget expenditure rates exactly predictable, then there would never seem to be any case for escalation. Escalation can be explained in terms of injury inflictions (expenditures) occurring as discrete events; i.e. as 'bouts' won or lost during fighting. Assessment can give only a probabilistic prediction of the outcome of a bout. A simple model is developed to investigate escalation situations. Each combatant assesses relative *RHP*; this correlates with an absolute probability of winning the next bout (cabs). The stake played for is infliction of loss of *RHP* and is determined by the fitness budgets of the opponents. (Each individual plays for the withdrawal of its opponent.) This defines a critical probability of winning (ccrit) for each combatant, above which escalation is the favourable strategy (cabs > ccrit) and below which withdrawal is favourable (cabs < ccrit). Escalation should occur only where cabs-ccrit is positive

for both combatants. This model gives predictions compatible with the observations, indicating that *RHP* loss alone can be adequate to explain withdrawal: escalation behaviour. Withdrawal tendency will be increased by low searching costs. Escalations should be restricted to closely matched *RHP* opponents if *RHP* disparity is the major imbalance. Outside the 'escalation range' of a given individual, the higher *RHP* individual wins and the lower one loses (*i.e.* it should withdraw after conventional display). *RHP* disparity and holder: attacker imbalance should both interact to shape the observed pattern, though their relative importances will depend on species and situation. In some instances selection may favour immediate withdrawal from an occupied territory even without assessment of *RHP* (26:*abstract*).

Science

The central idea I should like to present in this talk may be expressed in the following way.

The natural as well as the social sciences always start from *problems*, from the fact that something inspires *amazement* in us, as the Greek philosophers used to say. To solve these problems, the sciences use fundamentally the same method that common sense employs, the method of *trial and error*. To be more precise, it is the method of *trying out* solutions to our problems and then discarding the false ones as erroneous. This method assumes that we work with a large number of *experimental* solutions. One solution after another is put to the test and eliminated.

At bottom, this procedure seems to be the only logical one. It is also the procedure that a lower organism, even a single-cell amoeba, uses when trying to solve a problem. In this case we speak of testing movements through which the organism tries to rid itself of a troublesome problem. Higher organisms are able to *learn* through trial and error how a certain problem should be solved. We may say that they too make testing movements – mental testings – and that to learn is essentially to try out one testing movement after another until one is found that solves the problem. We might compare the animal's successful solution to an *expectation* and hence to a *hypothesis* or a *theory*. For the animal's behaviour shows us that it expects (perhaps unconsciously or dispositionally) that in a similar case the same testing movements will again solve the problem in question (27:*3*).

Scientific Method

(a) As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them*. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(*i*) There is no method of discovering a scientific theory.

(*ii*) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.

(*iii*) There is no method of ascertaining whether a hypothesis is 'probable', or probably true (28:*5-6*).

(b) (*i*) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.

(*ii*) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.

(iii) If a proposed solution is refuted through our criticism we propose another solution.
(*iv*) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.
(*v*) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error' (27:*66-67*).

(c) The past and the present are intertwined. History cannot be written 'as it actually took place.' One has to weigh and select, and this means that one inevitably uses filters. Historians who pretend to be neutral merely are saying they have never seriously questioned their biases. Facing our biases does not abolish them, but his is the only way to try to attenuate the effect of filters (29:*xiii*).

Strategic Equilibrium

What do I mean by 'strategic equilibrium'? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior* (13:*352*).

Theory

(a) Every scientific theory is a system of sentences...or ASSERTED STATEMENTS (30:*3*).

(b) The empirical sciences are systems of theories. The logic of scientific knowledge can therefore be described as a theory of theories.

Scientific theories are universal statements. Like all linguistic representations they are systems of signs or symbols. Thus I do not think it helpful to express the difference between universal theories and singular statements by saying that the latter are 'concrete' whereas theories are merely symbolic formulae or symbolic schema; for exactly the same may be said of even the most 'concrete' statements.

Theories are nets cast to catch what we call 'the world': to rationalize, to explain, to master it. We endeavour to make the mesh finer and finer (25:*37-38*).

(c) A theory attempts to identify the factors that determine a class of phenomena and to state the permissible relationships among the factors as a set of verifiable propositions. A purpose is to simplify our education by substituting one theory for many facts. A good theory points to possible factors and relationships in the real world that would otherwise remain hidden and thus stimulates new forms of...research (31:*5*).

Tragedy of the Commons

(a) See *APPENDIX IV: ON THE TRAGEDY OF THE PRINCE EDWARD ISLAND COMMONS* for a short discourse.

(b) Hardin 1968 (32) remains 'one of the most influential articles written in the last half century' (33), but this important citation presents a hereto undetected problem: Hardin 1968 is not a single theory, but rather *four* major theories in a dark and stormy sea of a myriad of auxiliary conjectures. Hardin's central thesis—the theory presented first and foremost—is his restatement of Oxford economist W.F. Lloyd's 1832 (34) original problem statement: *The Tragedy of the Commons*. Hardin offers a strong defense for this useful, illustrative, conceptual tool—as have thousands of problem-solvers who have followed his footsteps for the past forty years. However, Hardin also forwards four other significant theories in this work—two of which may be readily defended, but the third and fourth, however, are readily falsified and refuted. In five short pages, Hardin also erected a myriad of minor conjectures upon small, scenic, sandy patches of theoretical shoreline which have since eroded into the sea. This creates a special problem for writers who issue unlimited 'Hardin 1968' citations (without limiting the theoretical range) without carefully considering the logical implications of their citation.

The solution is simply not to reference Hardin 1968 at all, but rather to cite the original and thus proper source: Lloyd 1832.

(c) William Forster Lloyd (1794-1852)... made a lasting if long unrecognized mark in economics... From 1832 to 1837 Lloyd held the Drummond chair of political economy at the University of Oxford. A collection of his lectures... were first published in 1833 in Oxford under the title *Two Lectures on the Checks to Population*.... The chief original contribution in Lloyd's discussion of population issues is his recognition and incisive analysis of the deleterious consequences that ensue 'when the constitution of society is such that as to diffuse the effects of

individual acts throughout the community at large, instead of appropriating them to the individuals, by whom they are respectively committed.' Lloyd's discussion of this problem... [is] best known to modern readers through Garrett Hardin's influential 1968 article... *'The Tragedy of the Commons'* (34: *473*).

(d) It should be clear by now that the idea of the commons did not suddenly arise out of nothing in the year 1968. Passing references to the problem occur as far back as Aristotle, and Lloyd certainly saw it clearly in 1833. H. Scott Gordon's work in 1954 saw the beginning of a new concern with the problems presented by this politico-economic system. Yet the fact remains that a widespread recognition of these problems did not develop until after 1968. Why the delay? Two reasons are apparent. First, a favourable climate of opinion was needed for remarks about the commons to be noticed. This was created in the 1960's by the rapid growth of the environmental movement, which alerted people to the consequences of distributional systems. Second, it was necessary that the properties of the commons be stated in no uncertain terms if people were to consider the matter seriously. It was necessary that the human tragedy of adhering to a commons-type distribution be emphasized.

A good, solid fortissimo minor chord had to be sounded. Before 1968 most of the sounds were either mere grace notes or extended passages played pianissimo. The down-playing was for good reason, of course: the clear message of the commons threatened cherished beliefs and practices. Abandoning any traditional practice requires a political upset (though revolution may be too strong a word) (35:*1*) [And Stewart (36) "saw the beginning of a new concern with the problems presented by this politico-economic system" in 1925!].

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APPENDIX II: PRINCIPLES OF DISPERSAL & EVOLUTION

1. Disharmony in composition of an insular biota in considered a prime source of evidence for the occurrence of long-distance dispersal.

2. Positive adaptations for long-distance dispersal and for establishment are the key to disharmony, and disharmony is thus not a negative concept. All elements in disharmonic biotas such as those of oceanic islands are capable of long-distance dispersal or are derived from ancestors that were capable of it.

3. Long-distance dispersal is probably not achieved invariably by only a single individual or dissemnule, but may in some instances be expected to result from simultaneous (or nearly simultaneous) introduction of more than one individual or disseminule. This could be said to constitute a single "dispersal event."

4. Among organisms for which long-distance dispersal is possible, eventual introduction to an island is more probably than nonintroduction.

5. Elements are present in proportion to not only dissemination ability but also to establishment ability. Establishment ability is a characteristic of every species and group but cannot be viewed except in relation to the ecological conditions provided by the recipient island.

6. Migration to islands is governed by probability, and ordinary concepts of migratory routes and biological provinces do not apply well to many islands.

7. Guyots and other now-vanished high islands or lands more extensive formerly than now may have aided dispersal to oceanic islands as subsidiary source areas or "stepping-stones" but not as dry land bridges. Continental drift does not explain oceanic island patterns, and even inter-continental disjunctions are more easily explained by long-distance dispersal, in many cases.

8. The size and systematic composition of insular biotas are determined by many factors that differ in relative importance from island to island.

9. Relicts in the strictest sense are few or absent on oceanic islands, although every immigrant group has a history, and once can designate older island autochthones as "recent relicts."

10. Immigrant species must overcome the restriction of genetic material related to the very small size of the initial population if effects such as inbreeding are to be countered; in any case, the portion of the genetic content of a species that the insular establishment represents will influence the nature of the resulting insular population.

11. Rapid evolution of island immigrants is not only possible but frequent. Change after arrival is inevitable.

12. Situations new to immigrants will dictate their course of evolution on islands – if they can cross ecotones into them. Adaptive radiation is the inevitable result on an island or archipelago where a small number of immigrants meets a broad spread of ecological opportunities.

13. An immigrant group that is not faced with, or cannot enter, because of inherent limitations, a broad spectrum of ecological opportunities on an island may evolve into one or a few niches.

14. New growth forms evolve among plants on oceanic islands. Most conspicuously, there is a tendency toward increased stature.

15. Changes in form, size, and color of animals often occur in islands: gigantism, dwarfism, changes in body proportions, and melanism are among the changes represented.

16. Dispersal mechanisms and dispersal ability may be lost during the evolution of plants on oceanic islands.

17. Flightlessness may evolve in volant groups of animals in response to insular conditions. Ecological shift may produce equivalent restriction to insular areas.

18. Competitive ability is often decreased slightly to markedly among endemics of oceanic islands.

19. Means for outcrossing tend to be highly developed in at least the long-term autochthonous biotas of oceanic islands. Species without potential for outcrossing are probably doomed to shorter tenures.

20. Natural hybridization acquires a positive value in evolution of the waif flora and, in some cases, fauna.

21. Pollination relationships correspond to and change with respect to availability of insects and other pollinating agents on islands.

22. Some mutations that would be lethal or disadvantageous in continental environments have a more nearly neutral value in the less competitive environment of an oceanic island.

23. Endemism, although high on oceanic islands, in not itself a criterion for identification of an island as oceanic. There are various relations for high and low endemism. The nature of endemism may prove informative as a way to illustrate certain features concerning insular biotas.

24. Evolutionarily plastic groups are sensitive indicators of directions of evolution in the biota that results from colonization by means of long-distance dispersal (1:6-35).

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APPENDIX III: ON THE PROBLEM OF IVORY TOWERS

My dear son,

I am appalled, even horrified, that you have adopted Classics as a major. As a matter of fact, I almost puked on the way home today. I suppose that I am old-fashioned enough to believe that the purpose of an education is to enable one to develop a community of interest with his fellow men, to learn to know them, and to learn how to get along with them. In order to do this, of course, he must learn what motivates them, and how to impel them to be pleased with his objectives and desires.

I am a practical man, and for the life of me I cannot possibly understand why you should wish to speak Greek. With whom will you communicate in Greek? I have read, in recent years, the deliberations of Plato and Aristotle, and was interested to learn that the old bastards had minds which worked very similarly to the way our minds work today. I was amazed that they had so much time for deliberating and thinking, and was interested in the kind of civilization that would permit such useless deliberation. Then I got to thinking that it wasn't so amazing - - after all they thought like we did because my Hereford cows today are very similar to those ten or twenty generations ago. I am amazed that you would adopt Plato and Aristotle as a vocation for several months when it might make pleasant and enjoyable reading to you in your leisure time as relaxation at a later date. For the life of me I cannot understand why you should be vitally interested in informing yourself about the influence of the Classics on English literature. It is not necessary for you to know how to make a gun in order to know how to use it. It would seem to me that it would be enough to learn English literature without going into what influence this or that ancient mythology might have upon it. As for Greek literature, the history of Roman and Greek churches, and the art of those eras, it would seem to me that you would be much better off by learning something of contemporary literature and writings and things that might have some meaning to the people with whom you are to associate.

These subjects might give you a community of interest with an isolated few impractical dreamers, and a select group of college professors. God forbid!

It would seem to me that what you wish to do is to establish a community of interest with as many people as you possibly can. With people who are moving, who are doing things, and who have an interesting, not a decadent, outlook.

I suppose everybody has to be a snob of some sort, and I suppose you will feel you are distinguishing yourself from the herd by becoming a Classical snob. I can see you drifting into a bar, belting down a few, turning around to the guy on the stool next to you - - a contemporary billboard baron from Podunk, Iowa - - and saying, 'Well what do you think about old Leonidas?' Your friend, the billboard baron, will turn to you and say, 'Leonidas who?' You will turn to him and say, 'Why, Leonidas, the prominent Greek of the twelfth century.' He will, in turn, say to you, 'Well, who the hell was he?' You will say, 'Oh, you don't know about Leonidas?' and dismiss him, and not discuss anything else with him the rest of the evening. He will feel that you are a stupid snob and a flop; you will feel that he is a clodhopper from Podunk, Iowa. I suppose this will make you both happy, and as a result of it, you will wind up buying his billboard plant.

There is no question that this type of useless information will distinguish you, set you apart from the doers of the world. If I leave you enough money, you can retire to an ivory tower, and contemplate for the rest of your days the influence that the hieroglyphics of prehistoric man had upon the writings of William Faulkner. Incidentally, he was a contemporary of mine in Mississippi. We speak the same language - - whores, sluts, strong words and strong deeds.

It isn't really important what I think. It's important what you wish to do with your life. I just wish I could feel that the influence of those oddball professors and the ivory towers were developing you into the kind of a man we can both be proud of. I am quite sure that we both will be pleased and delighted when I introduce you to some friend of mine and say, 'this is my son. He speaks Greek.'

I had dinner during the Christmas holidays with an efficiency expert, an economic adviser to the nation of India, on the Board of Directors of Regents at Harvard University, who owns some 80,000 acres of valuable timber land down here, among his other assets. His son and his family were visiting him. He introduced me to his son, and then apologetically said, 'He is a theoretical mathematician. I don't even know what he is talking about. He lives in a different world.' After a little while I got talking to his son, and the only thing he would talk to me about was his work. I didn't know what he was talking about either so I left early.

If you are going to stay on at Brown, and be a professor of Classics, the courses you have adopted will suit you for a lifetime associated with Gale Noyes. Perhaps he will teach you to make jelly. In my opinion, it won't do much to help you learn to get along with people in this world. I think you are rapidly becoming a jackass, and the sooner you get out of that filthy atmosphere, the better it will suit me.

Oh, I know that everybody says that a college education is a must. Well, I console myself by saying that everybody said the world was square, except Columbus. You go ahead and go with the world, and I'll go it alone.

I hope I am right. You are in the hands of the Philistines, and dammit, I sent you there. I am sorry.

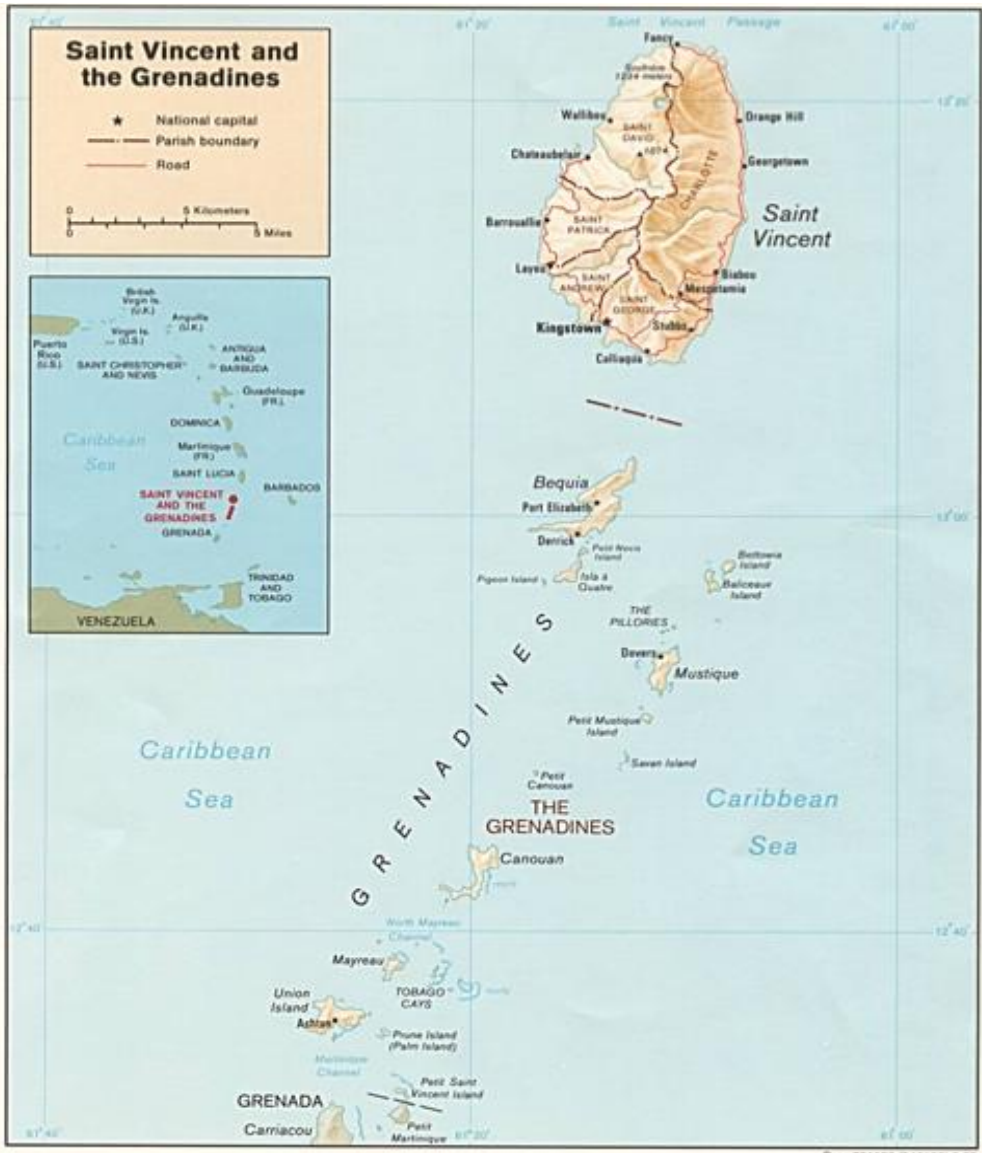
Devotedly,

Dad (1:*34-36*).

1. Turner T (2008) *Call Me Ted* (Grand Central, New York).

APPENDIX IV

IN SEARCH OF A BETTER WORLD



-----Original Message-----

From: Matt Funk, Sent: Wednesday, March 19, 2008 12:05 PM, To: rmahon@caribsurf.com, Subject: Mustique[§§§*]

Greetings from Prince Edward Island, Robin…I've been studying your work for the past several months, and, as I'm headed to Barbados on Saturday, and then heading over to Mustique on Monday, I hope that you may have some time to meet. Over the past year I've developed a *Universal Theory of Value* based upon relative insularity – and although most of those efforts have been informed by observations of various bio-geo-politico-economic mechanisms at work on Prince Edward Island, Iceland, Hawaii, and the Gaspe peninsula, when my good cousin Ben brought the curious case of Mustique to my attention, I realized it may serve as the most descriptive model[†] for a theoretical solution to

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* Mustique is in the Lesser Antilles, and is administratively part of the State of St. Vincent [SVG].... Mustique is small (1400 acres) [and] privately owned… It is one of the outer, older arc of volcanic islands, free from the threat of renewed volcanic activity…, and not exceeding 480 feet in height. The eastern windward side is very exposed to the prevailing easterly winds but the whole coast consists of very attractive white coral sand beaches dissected by rocky headlands. The interplay between these and the green of forest and scrub produces an extremely beautiful landscape. In the late 18th and early 19th centuries the island was intensively cultivated for sugar-cane and more recently for cotton, but these land-uses have been abandoned and now all except the flattest land is covered with secondary forest and scrub (1:*266-267*).

† What has gone wrong with the development of economics as a science? Answer: There was a bunch of intelligent people who felt compelled to use mathematics just to tell themselves that they were rigorous in their thinking, that theirs was a science. Someone in a great rush decided to introduce mathematical modelling techniques…without considering the fact that either the class of mathematics they were using was too

The Problem of Sustainable Economic Development I've encountered to date. I've attached an Abstract and the slides from a presentation I gave last week [3] (no doubt you'll recognize some insights from your works!).

While on Mustique, I intend to develop a study which I may begin, but plan to conduct in earnest when I return in November. Generally speaking, I'm looking to assess the relative successes and failures (my preliminary research, as you will see from my two attachments, anticipates I may discover more successes than failures) as they relate to the adherence to the development suggestions set forth in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970. *Mustique: proposals for a development study*, unpublished [4]. To date, however, I have not been able to obtain a copy of this original report. (Of course I would be very glad to hear if you knew where I might find one. I would also be grateful to know who commissioned this report). Thus my research endeavours will most likely be based upon the details from Goldsmith's 1973 *The ecologist's role in development for tourism: a case study in the Caribbean* [5]* (which, I'm sure you may know, is a review of this 1970 report; if you haven't reviewed this, I'll forward it. Naturally, I would be very grateful for any general insights you may have to offer, and if you have time to get together on either island, that would be great. In any case, we'll be on Barbados the 22nd -24th (arriving this Saturday), then on to Mustique for a week late on the 24th.

Are there any library and/or bookstore (UWI? CERMES?) resources I should explore while on Barbados? I have not yet procured a good topo map nor a nautical chart - would I find these on Barbados as well? Also, if you have any relevant papers which are not archived on the CERMES site (I have read your excellent works posted there), I would also be grateful for those. Any other suggestions? Also, has anyone surveyed the turtle populations on Mustique? Are there any notable and relatively readily surveyed Mustique endemics?

Finally, I will note that I hold your *Coastal resources and livelihoods in the Grenadine Islands: Facilitating Change in Self-organizing Systems* [3] in utmost high-regard, and it has greatly enriched my research. If you think any of your co-authors on this piece (or anyone else for that matter) would find mutual benefit in exchanging ideas and drinking iced tea with me (on Barbados, Mustique, or elsewhere in the Grenadines), please feel free to forward my email and/or attachments.

Sincerely...Matt Funk

-----Original Message-----
On March 21, 2008 at 10:55 PM Matt Funk wrote:

Thanks for the great insight, Robin - and the contacts.

I'm sorry I won't have the opportunity to meet you on this trip, I hope we can connect in November....

Too bad to hear The Mustique Co. is not particularly interested, especially considering it would even serve selfish interests, as the transboundary externalities are problematic for all Caribbean islands – SVG in particular.† I

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restrictive for the class of problems they were dealing with, or that perhaps they should be aware that the precision of the language of mathematics could lead people to believe that they had solutions when in fact they had none (2:*177*).

* Ecologists are increasingly in demand to provide both background information to development and to conduct validatory studies prior to funding. This paper describes an advisory study [2] conducted on the Caribbean island of Mustique prior to development for tourism. It is argued that the ecologist uses biological as well as physical indicators to assess suitability of different areas for development and to anticipate possible problems. In this study the primary environmental determinants and biological and human factors have been interpreted to identify the distribution and degree of seriousness of exposure, erosion potential and water yield and quality. The compatibility of physical and ecological factors with different categories of proposed development have been assessed, and maps of vegetation, soil and exposure transferred onto gridded overlays. The use of these overlays combined with a consideration of the compatibilities permitted the degree of restraint to the various categories of development to be presented in map form. The problems that are likely to be encountered as a result of development are discussed, and finally it is suggested that the development be subjected to regular ecological monitoring (5:*abstract*).

† Informal interviews conducted as well as personal experience have presented a myriad of problems when dealing with legislation throughout [St. Vincent and the Grenedines, and Grenada]. A significant and potentially detrimental issue is the lack of coordination between many Ministries and Departments. Coordination is necessary and is exemplified in Grenada where the country's Forestry Act currently falls under both the Department of Forestry and the Ministry of Tourism. Although the relative remoteness of the islands forces dispersal of human resources, having relevant officials to distribute, make available or even enforce the laws in each island is an essential element in the quest for good governance. In addition, gaining and maintaining public interest has emerged as a critical factor in these islands.

The comprehensive government website of St. Vincent and the Grenadines must be noted, which contains digital copies of some environmental legislation as well as printable copies of application forms for various activities. As the world enters a new digital age, the availability of electronic documents represents a significant step towards this era.

Since these islands are all located in close proximity, disasters that occur in one state can have an effect of the same magnitude on neighbouring islands. Environmental disaster preparedness can become more efficient if both parties form an alliance to combat and deal with

actually find it rather odd that they wouldn't be at the forefront of conservation efforts in SVG, especially the near-neighbouring islands.

In any case, thanks again and enjoy your holiday with your family!

Happy Easter...Matt Funk

-------- *Original Message* --------

From: Matt Funk, Sent: Mar 18, 2008, at 3:53 AM, To: Mark De Silva, Subject: Mustique

Greetings from Prince Edward Island!

Just wondering if you have completed your Bio-Inventory of Mustique? Do you have a report and/or checklist available? What's the status of your study? I'll be on Mustique on the 24th, conducting a bit of research of my own – let me know if I may be of any assistance, as I hope to conduct an informal, general ecological survey.

Thanks! Matt Funk

-------- *Original Message* --------

On Mar 19, 2008, at 3:18 AM, Matt Funk wrote:

Excellent, they were already holding a copy for me! Wow, I only realized who you were after receiving your reply - I've been studying your work for the past month. Indeed, it would be really great to meet – I believe you may find that our common interests are heavily aligned! Over the past year I've developed an *Unified Theory of Value* based upon relative Insularity - and when I discovered Mustique several months ago, I realized it may serve as a more descriptive model for my solution than any island I've encountered to date. I've attached the Abstract for a current working paper, and the slides from a presentation I gave last week [3].

While on Mustique, I intend to develop a study which I may begin, but plan to conduct in earnest when I return in November. Generally speaking, I'm looking to assess the relative successes and failures (my preliminary research, as you will see from my two attachments, anticipates I may discover more successes than failures – but of course I realize how prone we are to error!) as they relate to the adherence to the development suggestions set forth in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970. *Mustique: proposals for a development study*, unpublished [4]. To date, however, I have not been able to obtain a copy of this original report. (Of course I would be very glad to hear if you knew where I might find one. I would also like to know who commissioned this report. Tennant? Money-Coutts? The Mustique Co.? I would also very much like to know your opinions regarding the most influential and effective custodian/s of Mustique's ecology?). Thus my research endeavours will most likely be based upon the details from Goldsmith's 1973 *The Ecologist's Role in Development for Tourism: A Case Study in the Caribbean* [5].

Naturally, I would be very grateful for any general insights you may have to offer, and of course would love to have a personal introduction to Mustique (and/or the Tabogo Cays). Depending upon which day may be available, we may have an extra room for you and a guest. In any case, we'll be on Barbados the 22nd -24th (arriving this Saturday), then on to Mustique for a week late on the 24th. Thanks again for your reply, Mark, I hope to meet you next week!

Sincerely...Matt Funk

Mark de Silva flew to Mustique to meet with me. He joined our party for a picnic lunch under a palapa on windswept Pasture Bay: fruit, mixed salads, home-made pizza slices, and a fine assortment of refreshments and French wines set on linen, china, silver, crystal, and served with cheer by four members of the house staff. We had several hours of great conversation; Fr. de Silva imparted very interesting anecdotes, filled in some gaps in my research, and expressed great interest in my endeavour, paying me a far greater compliment than I deserve by exclaiming "I've been waiting all my life for someone to tell this story!" He then led us on an excellent tour of the lagoon and nature preserve, and kindly gave me two copies of his excellent new book: "The Spiders and their relatives of St. Vincent & the Grenadines" [7] (and I in turn gave one copy to my generous cousin Ben!).

----- *Original Message* -----

Subject: Sustainable Economic Development, From: Matt Funk, Date: Mon, 10 Mar 2008 12:01:49 -0300, To: Brian Alexander

Greetings from Prince Edward Island! For the past several years I have been utilizing islands to model various problems and solutions relating to the problem of sustainable economic development; much of my research has

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possible disasters. This will not only assist in creating a comprehensive plan, but will also deal with matters such as liability and will clearly identify responsibilities of each parties. These countries have relatively small populations and thus can tackle environmental issues on a more personal level (:90).

focused upon the strategic advantages relative insularity offers on islands and other relatively insular states, and over the past several months Mustique has emerged as the most descriptive model of my theoretical solution to this global problem. In the course of my research, I have developed a unified (economic and evolutionary) *Theory of Value* based upon relative insularity, which I believe you may find rather interesting. And, regarding Mustique in particular, I have reached a conclusion that (*i*) privatization, (*ii*) stringent land-use policy based upon a thorough carrying-capacity study & inter-related economic development plan, (*iii*) amendments to this plan based upon the principle of *gradualism*, and (*iv*) your management of Mustique have been largely responsible for this sustainable development and pursuant success. Of course I realize nothing would have been remotely possible without Lord Glenconner's initial purchase (*i.e.* fencing off the 'commons' through privatization), commitment, vision, tireless enthusiasm, deep pockets, and extraordinary efforts. Indeed, events *have proved he was way ahead of his time!* It seems that Lord Latymer, Mr Neumann, and the more recent efforts from individuals such as Mick Jagger may also certainly be credited as well, but I would be very interested in hearing your thoughts on these and several other points. I will head to Mustique on the 24th (for one week) to conduct some field research, and if you have any time available I would be very grateful to discuss your island endeavours, struggles, and extraordinary accomplishments. I plan to spend most of the week taking stock of the island in regards to the original ecological development report Goldsmith (1973) outlined in *The Ecologist's Role in Development for Tourism: a Case Study in the Caribbean*. If possible, I would also be very grateful to review a copy of LLEWELYN-DAVIES, WEEKS, FORESTIER-WALKER, BOR (1970) *Mustique: Proposals for a Development Study* [4], and/or any other documentation you believe might serve my research purposes well. I will be on Barbados for two days prior to my arrival on Mustique; if you are aware of any special library collections there, please advise. Also, I am giving a seminar at The University of Prince Edward Island tomorrow entitled *On the Problem of Islandness: Lessons from Mustique* [5], and I am submitting a proposal to deliver [8] a paper [9] at the Åland International Institute of Comparative Island Studies entitled *On the Problem of Connectivity: The Value of Relative Insularity & lessons from Mustique*. Naturally, if you should have any interest, I would be happy to share any of my research and/or seminars with you and/or your board members. I look very forward to visiting Mustique later this month!
Sincerely...Matt Funk

-----Original Message-----
From: Matt Funk, Sent: 18 March 2008 22:47, To: Brian Alexander, Subject: [Fwd: RE: Mustique Presentation...]

Greetings Brian....Not sure if you received my email last week, so I wanted to follow up in hopes that we might be able to visit. I also thought perhaps you may be more inclined to visit with me if I were able to paint a better picture of my research endeavour. I've attached a pdf copy of a recent presentation of my research on Mustique [3].

It seems likely that you have had an extraordinarily positive impact upon the sustainable development of Mustique, and I would like the opportunity to document your contribution in my research.

Also, I have been waiting to hear back from your rental department regarding the availability of Fort Shandy for this November. I would also be very keen to learn if the property is for sale. Otherwise, I would also be interested in any property able to demonstrate cash-flow independence (if, that is, such a property should exist).

I'll call your office Thursday to see if you have the time or interest in meeting with me next week.

Sincerely...Matt Funk

-----Original Message-----
On 21 March 2008 at 22:41 Matt Funk wrote:

Thank you for your reply and offer to get together with me, Brian. We leave for Barbados tomorrow, then on to Mustique on Monday. My cousin Ben and his wife, Zarina have graciously invited us to spend the week with them at *Windwords*. If you have time to come over for lunch, that would be great, otherwise perhaps we could meet somewhere for a bite or drink? In any case, I realize I'm catching you in the middle of your busy season, and I'd appreciate any time you might have available.

I'm sorry you didn't receive my previous email; I'll sketch an outline of my rather unusual research interest:

I'm conducting research here on Prince Edward Island, and over the past year I've developed a unified Evolutionary & Economic *Theory of Value,* based upon relative insularity - and when my cousin, Ben Funk, brought Mustique to my attention several months ago, I realized it may serve as a very accurate and descriptive model for my theoretical solution to *The Problem of Sustainable Economic Development* (not only on islands, but at the global level as well). You kindly reviewed the presentation slides I forwarded, but I imagine that, out of context and without

the dialogue, at best they may merely hazily outline my efforts; thus I've attached the Abstract from a current working paper which may also shed some light on my research.

While on Mustique, I hope to distil a general assessment and develop a study which I may begin, but would like to conduct in earnest when I return in November. Generally speaking, I'm looking to assess the rather extra ordinary – perhaps even *singular* – success Mustique has achieved through privatization, initial carrying-capacity assessments, strict land-use policies, a community of stakeholders with heavily aligned values, resource holding power, and prudent management (which is, of course, where I believe your efforts factor heavily in the equation) as they all relate to the adherence of the development plan outlined in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970, *Mustique: Proposals for a Development* [4]. To date, I have not had the fortune of reviewing this report. If you are aware of a copy that I may be able to review, I would be extraordinarily grateful.

Thus my research objectives have been based upon the only source of the early planning stage that I am aware of: Goldsmith's 1973 *The Ecologist's Role in Development for Tourism: A Case Study in the Caribbean* [5]. (which, I'm sure you're well aware, is a review of the LLEWYN-DAVIES report; if by chance you're not familiar with this study, I'll attach it to this email as well.

Naturally, I would be also be very grateful for any general insights, direction, archives, or opinions you may have to offer.

Also, I should note that I've discovered that my central thesis seems rather controversial in certain circles (for I have discovered that many are very uncomfortable considering the conjecture that individuals with relatively extraordinary means may offer the dominant solution to global ecological degradation (and thus, in the long run, human survival, as well). But I have also discovered that, for others, Mustique simplifies a powerful – yet illusive – solution to perhaps the single greatest complex problem facing human civilization.

Thanks again Brian, I look forward to meeting and speaking with you next week.

Happy Easter…Matt Funk

I met with the Hon. Brian Alexander at the Mustique Co. Office, and we engaged in a long, interesting, and enlightening conversation (Mr Alexander was equally generous with his time, spirit, and insights) about the developmental history of Mustique, and Mr Alexander offered his insights regarding my research, which he had kindly reviewed. His secretary went off to photocopy the original development plan [4] by hand, and returned with my copy just as we were wrapping up our conversation! Mr Alexander also gave me a parting gift: a fine reproduction of Billinghurst's 1804 Mustique map, as cited in The Mustique Development Plan and Goldsmith 1973! The Mustique Co. has a framed print of the same map on the wall just outside of Mr Alexander's office. As Fortune would have it, I made it back to PEI with the plan and the map in perfect condition—the plan was never beyond arm's-reach during our entire trip home!

1. Mahon R, *et al.* (2002) Coastal resources and livelihoods in the Grenadine Islands: Facilitating Change in Self-organizing Systems. *Proc Gulf Caribb Fish Instit* 55:1-11.
2. Taleb N (2001) *Fooled by Randomness* (TEXERE, New York).
3. Funk M (2008) *On the Problem of Islandness*. Seminar presented to the Faculty of Arts, 11 March 2008, 11:00 AM. The event program noted: "A *Theory of Value* based upon relative insularity is introduced by outlining its various aspects as they affect Mustique. The island's positive features, which have altered its isolation and peripherality into economic assets, will be discussed" (UPEI, Charlottetown).
4. Llewelyn-Davies, *et al.* (1970) *Mustique Developmet Plan* (The Mustique Co., Mustique).
5. Goldsmith F (1973) The Ecologist's Role in Development for Tourism. *Bio J Linn Soc* 5:265-287.
6. Mattai, I Mahon R (2006). *CERMES Technical Report No. 15: Review and Interpretation of Environmental and Sustainable Development Legislation for the Grenadines Islands* (CERMES, Barbados).
7. Silva M, *et al.* (2006) *The Spiders and Their Relatives of St. Vincent & the Grenadines* (Mayreau Environmental Development Organization, Kingstown).
8. Funk M (2008) *On the Problem of Connectivity: The Value of Relative Insularity*. A seminar delivered 11 June 2008, 1:00 PM, at the Åland International Institute of Comparative Island Studies Annual Conference, "Islands of Competence: Branding Identities in a Globalized World," Parliamentary Building, Mariehamn, Åland (AICIS, Åland).
9. Funk M (2008) *On the Problem of Sustainable Economic Development I: A Tenable Solution to this Prisoners Dilemma in an Open Letter to the Åland International Institute of Comparative Island Studies* (AICIS, Åland).

APPENDIX V

THE MUSTIQUE CO. DEVELOPMENT PLAN

In December 1970 the Mustique Company, sole owners of the Eastern Caribbean Island of Mustique, appointed the firm of Llewelyn-Davies Weeks Forestier-Walker & Bor to prepare a 20-year Development Plan for the island by May 1971. It was stressed that the study should concentrate on establishing the feasibility of low density high-income residential tourist development with small hotels both for the international and the local market. Proposals for immediate action were also required.

Within these wide terms of reference we have attempted to produce a Plan that is both a document showing existing and proposed use of land, and an instrument that embodies social, economic and ecological policies.

Despite the small size of the island a study of this kind involves consideration of most of the interacting components of a much larger system and similar or perhaps greater problems in making projections for future development.

We have felt therefore that the Plan should afford as much freedom as possible for the Mustique Company to respond to future opportunities, while at the same time providing policies that are firm and clear enough to guide development and to offer assurances to those investing.

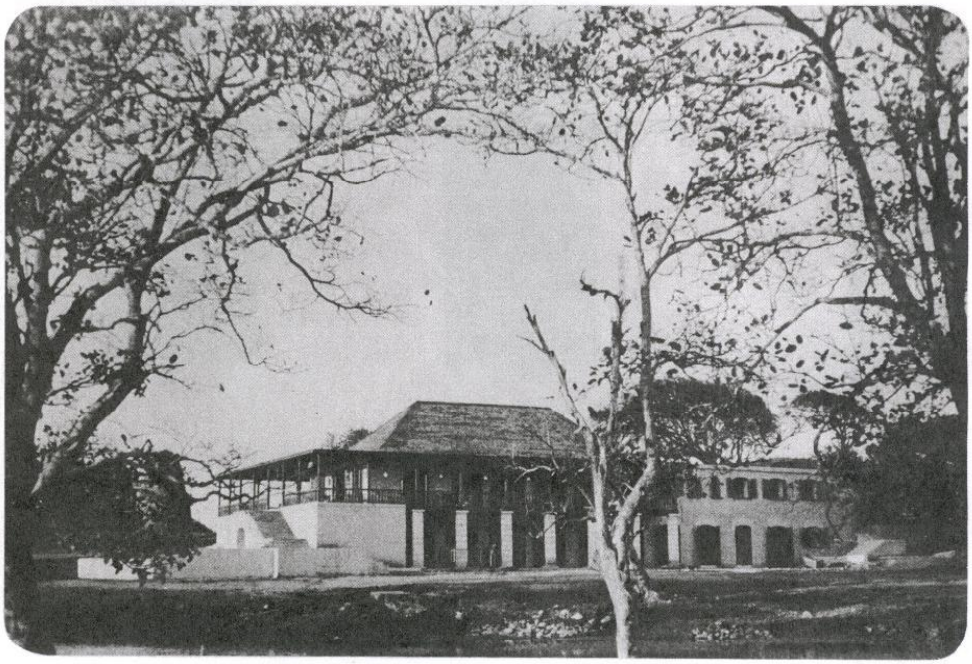

FIGURE 1: MUSTIQUE 1970 : THE COTTON HOUSE HOTEL

1 GOALS OF THE DEVELOPMENT PLAN 2

The development of Mustique involves the relationship of 3 groups of people: the Vincentians, the Visitors and the Mustique Company. The plan will need to assure potential investors that the proposals offer them the facilities they need within a context of reasonable long-term environmental and socio-economic stability.

This study has therefore attempted to identify the ecological and socio-economic constraints to development on the island and to make proposals that will offer a framework for maximising return on investment taking into account those constraints.

The goals of the plan have therefore been seen as:

1 To identify that sector of the potential regional market that will complement rather than compete with development elsewhere in the St Vincent Grenadines and provide suitable residential, recreational and service facilities on Mustique.

2 To minimise disturbance to the ecology of the island by achieving the most suitable relationships between proposed uses and the natural resources, and ensuring that the capacity of the island is not exceeded.

3 To maximise returns on capital invested by the Mustique Company within the constraints, ensuring that at each stage investments can be seen to be related to specific returns.

4 To adopt generally a policy of gradualism so that the effects of development can be carefully monitored; and in the short-term, to optimise the use of already existing and committed infrastructure.

5 To maximise the benefits accruing to the people of St Vincent from the development of Mustique.

[Key content:]

Since Mustique is a small island under single ownership..., development will be inherently expensive. But it will also offer the opportunity of preserving an especially high quality of environment ....

Although we have found some indications from the regional demands and projections, it is the nature of the island itself that must determine the actual quality and quantity of the potential demands that should be accommodated, firstly in terms of environment, secondly in terms of service problems and costs....

The charm of Mustique derives largely from its hilly topography. These hills, acted upon by the sea and the prevailing winds have divided the island's 1400 acres into a number of distinctly different microclimates, and have given rise to a curving coastline that is long (12 miles) in relation to the area it encloses....

The variety of these separate places, with their interplay of forest, rocky headland, sandy bay and turquoise sea, creates an impression that makes the island seem much larger than it actually is. The hills also afford fine views of the white beaches and out over the neighbouring islands....

In order to discover the most suitable use for the land and achieve the best fit between the activities of man and the natural systems, an ecological survey was undertaken..., for it is obvious that the varied geology, vegetation and wild life of Mustique and the sea around are crucial to the attractiveness of the island....

The aim of this study was to identify areas of special interest for conservation, and to find ecological indicators for the degree of intensity and type of use for which the land is best suited....

It is necessary to ensure that no unique species or features of outstanding natural beauty are destroyed by development. Similarly the extent and variety of the vegetation on Mustique contributes greatly to the charm of the island, and must be preserved.....

Mustique is an extremely beautiful island and one which is very rich biologically. At the same time, the natural resources of the island are in limited supply or extremely sensitive to development. The challenge that must be met by

the developers is to utilize its charm and habitat richness whilst maintaining its delicately balanced ecosystems in as natural a state as possible....

Several primary physical features of the island combine to determine the range of possibilities for development. These are, most notably, the availability of water, the pronounced alternation of wet and dry season, the physical make-up of soils, wind velocity, salt spray and soil salinity. These same features also determine the kind and distribution of the naturally renewable resources of plant and animal communities and, at the same time, determine their response to various kinds of development. Careful exploitation and management will be required to ensure that the biological habitat-types represented in the island's ecosystems continue to contribute to the beauty and interest of the environment...

The biotic component of the island's ecosystems is seen as a resource in its own right. It contributes to the quality of the landscape and contains plants and animals in a little-disturbed, semi-natural environment which justify conserving in their own right. It is difficult to make an assessment of the conservation status of Mustique from a scientific point of view without a more extensive survey of neighbouring islands and literature. However, it is clear that some individual species obviously deserve protection and these include the turtles and iguana. More important, in the context of the proposed future development, and as an important contribution to the island's character, is the conservation of a range of habitat types and these should include more mature areas of forest, coastal scrub, sea-grape communities, and mangrove swamp...

There appears to be universal agreement that the scenery on Mustique is superb and this beauty is derived from an interplay of forest, rocky headland, sandy bay and turquoise sea. The quality is partly the result of the small scale of this heterogeneity and the feeling of being on a small, secluded island and yet one so little exploited that an excursion to any beach or headland requires a half-day expedition. This sensation of being on both a very small and a very big and varied island is important to preserve.

Secondly there is a smaller scale of beauty and interest. This is totally attributable to biological components of the environment such as the widely distributed solitary cacti, the palm plantations, epiphytic plants, windswept distorted trees, and the occasional tortoise, humming-bird or butterfly. Thirdly there is interest that derives from past and present forms of land-use. Relics of the past include an abandoned village, Fort Shandy, Carib remains, a solitary cannon, a sugar-cane press, old wells and water-tanks. Present day activities also contribute to the interest of the landscape and most visitors will appreciate seeing cattle and ponies, fields of pigeon pea and cassava, scattered mangoes and tamarinds. citrus groves and banana plantations....

The case for maintaining and developing the agriculture of the island partly rests on the importance of preserving the feeling for the visitor of being part of a functioning system as well as to open-up views and increase diversity in the landscape....

Most visitors would appreciate interpretative facilities to enable them to understand more of the variety and richness of the flora, fauna and history of the island. We suggest that an information centre be provided and short, self-guided nature trails from natural focal points such as beaches and the lagoon. These should not be *too* arduous and should provide an alternative route back to the starting point....

Mustique is a special and unusual place. The natural resources of this beautiful island must be safeguarded, and all development carefully designed to complement the landscape. We have tried in this report to create a planning framework of which the principles are comprehensible as a kind of language of "the way things are done here".

In this report we have particularly concerned ourselves with the relationship between peoples and places. We feel that for the charm of the present day Mustique to grow into a special identity that can be comprehended by people arriving on the island, the development of tourism must be seen to enhance the landscape and benefit the local islanders. Only if the planning framework is administered by people who care about this, will visitors wish to belong there and participate in the island's plan for growth. For when people belong to a place and feel that they can interact with it, the place will grow fruitfully. We hope that the principles outlined in this report, both physical and methodological, will help ensure a harmonious and profitable future for Mustique (1:7-*43*).

1. Llewelyn-Davies, *et al.* (1970) *Mustique Developmet Plan* (The Mustique Co., Mustique).

APPENDIX VI

DEVELOPMENT PLAN FOR PRINCE EDWARD ISLAND

A 15-YEAR FEDERAL-PROVINCIAL PROGRAM FOR SOCIAL AND ECONOMIC ADVANCEMENT

AGREEMENT COVERING DEVELOPMENT PLAN FOR PRINCE EDWARD ISLAND

THIS AGREEMENT made this seventh day of March, 1969.

BETWEEN: THE GOVERNMENT OF CANADA, (hereinafter referred to as "Canada")... AND: THE GOVERNMENT OF THE PROVINCE OF PRINCE EDWARD ISLAND, (hereinafter referred to as the "Province")...

[Key content:]

DEVELOPMENT STRATEGY

CURRENT SITUATION

The Province of Prince Edward Island, with an area of some 2,200 square miles, had a population in 1966 of 109,000 and an estimated labour force of 35,400. Levels of unemployment are consistently 3% to 7% above the national average, on an annual basis, and seasonal unemployment usually ranges between 15% and 20% in February and March.

In addition to indicated unemployment there is, in the Province, a substantial degree of underemployment. The economy is characterized by a heavy dependence upon land based resource industry, particularly agriculture, and the resources of the sea. The small amount of manufacturing is related almost entirely to these resources and is organized in small production units. Output per worker in all sectors is well below the national average, by as much as 50% in agriculture. Accordingly, per capita income ranges between 60% and 70% of the national average. Aggregate output in the commodity sectors has been growing very slowly, averaging about 2.2 % per year over the period from 1961 to 1965.

STRATEGY

This Plan is based on a development strategy that would bring about full economic exploitation of the Island's large and potentially profitable resources for agriculture. Other main features of the strategy are: a considerable development of tourist facilities; better utilization of forest assets; rationalization of fisheries; extension of education programs and training for the full development of the labour force potential; increased efficiency and some expansion in processing and manufacturing industry; investment in housing, health and welfare services and other infrastructure required for effective development.

The common aim of these programs is to create conditions in which the people of Prince Edward Island can create viable economic enterprises for themselves.

The programs for the renewable resource sectors of agriculture, forestry and tourism are based on land use adjustment, in response to land capabilities and market demands, and on policies and measures to promote development. To encourage the reallocation of land to its most profitable use, as indicated by Canada Land Inventory data and other detailed socio-economic information, a resource management team is being formed to work directly for the farmers and others concerned. The team will include agriculture, recreation, and forest specialists; soil and water engineers; geographers and counsellors.

The programs available to assist this reallocation include land acquisition and resale, commercial leases, commercial credit, management training, technical assistance, training and mobility for other employment, and pensions.

The objective is to reallocate some 93,000 acres of poor agricultural land to forestry, tourist and wildlife use and to add, over time, approximately 270,000 acres of unused good agricultural land to the 550,000 acres presently being farmed. There will be zoning control and licensing to concentrate tourist and recreation developments in the most suitable areas, where they will not detract from the best use of farm land.

Development in the resource sectors will be further fostered by basic improvements in marketing facilities for

agriculture, by some stand improvement and management inputs into forestry, and through assistance to the tourist industry by technical advice on design and credit, quality regulation, and some investments in public facilities. In addition, a careful effort will be made to foresee and encourage the development of manufacturing and processing related to the resource base.

Taken together, these programs can be expected to attract substantial private development capital into the resource sectors of the Island economy....

Arising out of these basic programs are requirements for roads, water supply, power, housing and community improvements and changes in health and welfare programs. Road requirements are linked directly to the activities they serve....

The growth in levels of economic activity is expected to reduce the rate of net emigration from the Province. The projected effect will be to increase the population of the Island from the 1966 level of 109,000 to approximately 124,000 in 1978 and 129,000 in 1983. This is approximately 7% above the levels which might be expected in the absence of the Plan....

RESOURCE ADJUSTMENT AND DEVELOPMENT

The historical pattern of land ownership in Prince Edward Island is badly adapted to the needs of modern technology for agricultural, forestry and tourist development. Holdings are small and often scattered and the market mechanism for allocating land between these three sectors has been ineffective.

In this environment the first step required, to permit full development of the Island's resources, is a Province-wide land management program. This must be designed to remove the barriers to efficient land reorganization and reallocation to more effective uses. The projects below outline three areas of activity which together will provide the data for a single, broadly based geo-information system which will serve as the guide for land use decisions and investments....

Under the direction of the management group, and with funds provided by ARDA, staff of the Policy and Planning Branch of the Department of Energy, Mines and Resources are conducting an intensive survey of property ownership, land use, and ownership characteristics. Through this survey all property ownerships of five acres or more in size are mapped with the aid of air photos and local interviews. In addition to the ownership information, a detailed socio-economic interview is conducted with each property owner to establish age, income sources, family size, future plans and other information. The ownership information is transferred to 1:50,000 topographic map bases which are correlated with the socio-economic information and the Canada Land Inventory land capability information in the central data bank.

A staff of approximately 40 people will analyze this information to plan the most effective uses of land. Of these 40, 10 to 12 will be professional in the fields of agriculture, forestry, recreation, legal aid, appraisal economics and farm management. This process will lead to full implementation of the resource development projects described below. These projects, together with some of the other programs described in this program guide, provide the necessary conditions in which individual men and women can undertake the reallocation and efficient management of the Island's resources....

DEVELOPMENT OF LAND BASED RESOURCES SECTORS

Agriculture is the base of the economy of Prince Edward Island. An analysis of Canada Land Inventory data indicates that, from a physical point of view, there is a substantial amount of high quality land available for expansion and that there is capacity for intensifying agricultural land use.

In addition, the analysis of future markets for Island products indicates that many of them can be sold in greatly increased quantities provided that production is efficient and provided that better mechanisms for handling, grading, processing and transportation are developed. If these conditions are met, the limiting factor on the rate of development will not be markets so much as the rate at which it proves possible to achieve the structural and social adjustments required to use the Island's agricultural resources more fully.

In the light of these factors, the objective of the measures to be implemented for agriculture is to double net value added to $48 million by 1976. This income may be produced from a resource base farmed by 2,500 commercial farm units. By 1983, it is expected that value added will have approximately tripled, to $68 million. In order for this program to be effective, the main restructuring of the sector must take place in the first seven years. The second period will be a rapid growth period, with continuing adjustments as required....

IMPLEMENTATION

Land Consolidation and Improvement: The main function of the integrated land management program is to provide the guidelines for land consolidation and farm enlargement in agriculture. There must also be mechanisms to assist the actual transfers of land.

Essentially, this can be reduced to two requirements. The first is to enable those who wish to leave farming to release their land when they wish, and to allow those who want to expand their holding to acquire such land when and as they are able to manage it. The second requirement is to ensure that sufficient credit is available. Because of the present low level of returns from the industry and because many of the people who will participate in this sector are young, credit becomes a crucial factor in making such land transfers possible.

Accordingly, it is intended that, as far as necessary, the Government will act as an intermediary, standing ready to buy land offered for sale by individuals within or outside the integrated land management program. The Government will then improve and lease or sell good agricultural land in units of viable size. This land will be available to qualified farmers and to those who become qualified as a result of training. Through these transactions, the Government will play an active role in financing where there are gaps in the present credit system.

The Province will offer owners of low income farms the market value of farm land and buildings. This value will be determined by an agreed professional appraisal process with appropriate audit....

On the basis of the surveys and the age and income structure of the population, it is estimated that over a ten year period a total of 411,600 acres of land could be offered to the Province. Of this land 306,000 acres would be land Class 2 and 3, of which 157,000 acres would be improved and 149,000 acres unimproved. In addition, there will be 17,000 acres of improved Class 4 soils suitable for crop production and about 93,000 acres that should be withdrawn from the agricultural sector and diverted to alternative uses such as forestry, recreation, wildlife and watershed management.

Before sale or lease of agricultural land, it is intended that improvements such as soil erosion control, and hedgerow and fence removal, will be undertaken by the Province. The Province will also make provision for clearing and improving the 149,000 acres of Class 2 and 3 land acquired and approximately 121,000 acres which can be brought into production by farmers clearing on their own property.... Lands acquired will be consolidated by the Development Corporation, improved, and resold or leased as farm units or for the enlargement of existing farm units which are potentially economic.

The Corporation will also, on request, make arrangements for clearing land owned by farmers who have the capability and intention to expand....

OBJECTIVES AND STRATEGY

The objective of the program, therefore, is to assist the development that must take place in the face of the pressure of demand and to provide the degree of regulation necessary to optimize the returns to the Island's economy....

1. Canada (1970) *Development plan for Prince Edward Island : A 15 year federal-provincial program for social and economic advancement, 1970* (Queen's Printer for Canada, Ottawa).

APPENDIX VII

ON THE TRAGEDY OF THE PRINCE EDWARD ISLAND COMMONS

Solving Island Problems with Island Solutions:
Amplification by Compression, Complex Systems, & Cultural Evolution
IST 604 Research Methods & Designs for Island Studies
Main, 311, 6:00 PM, 26 January 2009
Matt Funk

On the Tragedy of the Commons & The Problem of Induction on Prince Edward Island

North Rustico Moving Ahead on Housing Development
NANCY WILLIS
The Guardian
Last updated at 12:34 AM on 26/01/09

NORTH RUSTICO — The village of North Rustico is taking a pro-active route in dealing with the current economic slowdown by creating a 63-lot housing development that *will* attract new families to the community.

Village chairman David Blacquiere and his commission received approval from residents at a recent public meeting, giving the OK to launch the project and move ahead on funding arrangements with a local financial institute.

The development will be located on property that borders land already owned by the village.

This will be a two-fold project involving green space and targeting affordable housing for young families.

"We have a good school and a declining population and we want to reverse," Blacquiere said.

"One way is by attracting them to this available land we have left."

The development would allow for 63 individual lots, however, the village is not opposed to including some cluster-type housing for seniors or other sorts of occupation.

Blacquiere said he was pleased with the turnout for the public meeting, which saw over *50 residents, 90 per cent of whom cast their vote in favour of the development.*

He said players in the industry seem to think this is the right time to get into this type of thing and he is not afraid the village might be left holding a load of property it can't sell.

"Both the federal and provincial governments are encouraging home construction right now, and *this slowdown is not expected to last beyond a few years, then things will pick up again*. Because this development is not going to happen overnight, we will be right in the right place and time when it does."

The municipalities of Miscouche and Kinkora have had success with housing development.

Blacquiere is meeting with these councils to review their activities.

"*We are doing our homework*, you can be sure."

The commission is also looking at the possibility of hiring a project manager.

North Rustico's outlook is to the future.

"You can sit on a commission and be a caretaker, or move forward and bring in more revenue, and the only way to do that without increasing taxes is by bringing in more people," said Blacquiere, adding that's what North Rustico intends to do.

[All italics mine, MF]

Dr Michael Anastasio, *Director* 12 February 2009
Las Alamos National Laboratory
Post Office Box 1663
Los Alamos, New Mexico, 87545
RE: On the Problems of National Security, Human Survival, & Job Number: 216210

Sir:

Last Monday I delivered a *Scientific Method* lecture, *Solving Island Problems with Island Solutions: Amplification-by-Compression, Complex Systems, & Cultural Evolution* to graduate students at The University of Prince Edward Island. At the end of my talk, after I had thanked them for "letting someone who knows so little speak for so long," Canada's research chair in Island Studies, Godfrey Baldacchino, paid me one of the greatest compliments I have ever received. After offering undue praise for the earnest and manner in which I attempted to impart several difficult truths*—to illuminate the complex inter-dependencies which regulate the *Struggle for Life* on earth—Baldacchino said, *"I wish we were recording your lectures..."*

Solving Island Problems with Island Solutions

27 January 2009

Yesterday my lecture 'on Method' commenced with the circulation of the previous page, a news release from that morning's edition of *The Guardian,* and I politely requested that all present read it before we set off, noting that we would conclude our talk by considering it in light of my talk.

While my gracious attendees were busy reading, I spread out a dozen books and papers before me, face-down and open to the pages which I had planned to weave into the narrative I had been arranging in my mind for several days.

Baldacchino is gifted with Promethean vision, pays attention to detail, and, true to these qualities, had brought along the copy of *In Search of a Better World* (1) which I had given him as a gift last year, and had inscribed a note on the title page, suggesting that the first three pages captured the essence of life and scientific method, alike; he remarked that he agreed with this conjecture and passed the book around the class. Baldacchino's thoughtfulness accompanied my introduction quite well, as I began by stating,

> The central idea I should like to present in this talk may be expressed in the following way.
>
> The natural as well as the social sciences always start from *problems*, from the fact that something inspires *amazement* in us, as the Greek philosophers used to say. To solve these problems, the sciences use fundamentally the same method that common sense employs, the method of *trial and error*. To be more precise, it is the method of *trying out* solutions to our problems and then discarding the false ones as erroneous. This method assumes that we

* In science, a mistake we make – an error – consists essentially in our regarding as true a theory that is not true... to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can *never* be *completely certain* that we have not made a mistake (1:*4*).

> work with a large number of *experimental* solutions. One solution after another is put to the test and eliminated.
>
> At bottom, this procedure seems to be the only logical one. It is also the procedure that a lower organism, even a single-cell amoeba, uses when trying to solve a problem. In this case we speak of testing movements through which the organism tries to rid itself of a troublesome problem. Higher organisms are able to *learn* through trial and error how a certain problem should be solved. We may say that they too make testing movements – mental testings – and that to learn is essentially to try out one testing movement after another until one is found that solves the problem. We might compare the animal's successful solution to an *expectation* and hence to a *hypothesis* or a *theory*. For the animal's behaviour shows us that it expects (perhaps unconsciously or dispositionally) that in a similar case the same testing movements will again solve the problem in question (2:*1*)

These words were read from the transcript of a talk given on North German Radio (NDR) on 7 March 1972, published on the first page of *All Life is Problem Solving* (2), Popper's sequel to *In Search of a Better World* (1).

I further remarked that these two slim volumes, Popper's clear, concentrated, distillations and reflections on his long, fruitful journey, may represent the two best introductions to 'Scientific Methods,' and though this may be true, I will further note that I dedicated a full year studying the collected works of Karl Popper (and his intellectual brother, F.A. von Hayek), and, as Henry Miller knew well,* there are no shortcuts: a comprehensive review of these considerable works (addressed in due course) may represent the only true path.

The second two points I'd like to offer are (*i*) an expansion upon a element within the previous point, and (*ii*) to offer a notable discovery regarding *The Tragedy of the Commons,* as this great tragedy is particularly germane to this thesis. The point I would like to expand upon is the critical role correction-of-error plays in scientific discovery.

Following this methods guest lecture, I recognized that I had made an error, and though I had set-off to write an email to Baldacchino and his class, calling the error to their attention; however, not long after sitting down to offer my written apology and correction-of-error, I recognized that the error and related problem I had identified was significant enough to warrant a thorough exploration (and thus this appendix). Therefore, I must also apologize to Baldacchino *et. al.* for the delay in this offering. Also, though this point is not especially complex, we must spin a fair yarn, so I will offer an abstract for the remainder of this appendix…

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* In this age, which believes that there is a short cut to everything, the greatest lesson to be learned is that the most difficult way is, in the long run, the easiest (3:*12* ; *cf.* 4).

PRÉCIS

Garrett Hardin's 1968 *Tragedy of the Commons* remains one of the most frequently cited works in most research communities, but this wide-spread acceptance presents a hereto undetected problem: Hardin 1968 is not a *single* theory, but rather four (4) major theories in a dark and stormy sea of auxiliary conjecture. Hardin's central thesis—the theory presented first and foremost—is his restatement of Oxford economist W.F. Lloyd's 1832 original problem statement: *The Tragedy of the Commons*. Hardin offers a strong defense for this useful, illustrative, conceptual tool—as have thousands of problem-solvers who have followed his footsteps for the past forty years. However, Hardin *also* forwards three *other* significant theories in this work—two of which may be readily defended, but the third, however, is readily falsified and refuted. In five short pages, Hardin also erected a myriad of minor conjectures upon small, scenic, sandy patches of theoretical shoreline which have subsisted into the sea. This creates a special problem for thousands of writers who have, and who continue to issue unlimited "Hardin 1968" citations (without limiting the theoretical range) without carefully considering the logical implications of their citation. We investigate this problem and offer two solutions: Lloyd 1832 and Stewart 1925. In closing, we also offer a brief abstract of our evolutionary stable solutions to Hardin's *Population Problem* (which we discover was not in fact a problem after all) and, moreover, to *The Problem of Sustainable Economic Development*.

As noted, this discovery began as I sat down to write an email, which I have preserved in it's original, unsent form:

Hi Godfrey,

Thanks again for inviting me in for our discussion on Monday night, I really enjoyed it, appreciated my attentive and gracious audience, and I hope to see you all again soon!

And, thanks to you and our round-table discussion, I've also discovered that I made a mistake. Please consider forwarding this email to your class, because (*i*) I would like to offer a correction, and (*ii*) because I believe it may help solidify a point I made at the outset: If you'll recall, at the beginning of my talk I remarked that my presentation itself was in fact part of my *Method* - my approach to problem solving, was essentially a process of *trial and error*. A bit more specifically, I can roughly identify six methodical steps associated with the delivery of my presentation: (*i*) Weighing the trials & tribulations associated with communicating my theories in the past, (*ii*) considering and planning my presentation, (*iii*) Delivering my talk (which, of course, is invariably different from iii for innumerable reasons), (*iv*), listing carefully to all comments, questions, criticisms, & praise, (*v*), attempting to detect any errors which may have occurred in stages these first five steps, (*vi*) attempt to correct those errors, and finally (*vii*), reporting any errors and, hopefully, any solutions I might find.*

And thus, I accept the responsibility of communicating my error and a more it to you and your class. And in this

* Oppenheimer certainly concurred with (*vii*), and I might at that *The Open Mind* represents another great, concise gem *On Methods* I most highly recommend.

case, since it relates to statements I made regarding *The Tragedy of the Commons,* it seems especially important, as I left with the sense that several students may be integrating this foundational concept into their own research endeavours. Before offering my correction, however, I should briefly attempt to re-emphasize the critical role *error* plays in the process, that it is not, as Popper suggested and many Nobel Laureates have agreed, something to hide from, but rather to rejoice: *the elimination of error serves as an indication that we're getting closer to the truth.*

In our discussion you made some excellent points and regarding *truth* and *knowledge*, and as I had emphasized the role *correction-of-error* plays in our search for truth, it may prove helpful to frame these abstract concepts within one concrete definition:

> Knowledge consists in the search for truth–the search for objectively true, explanatory theories... It is not the search for certainty. To err is human. All human knowledge is fallible and therefore uncertain. It follows that we must distinguish sharply between truth and certainty.
>
> That to err is human means not only that we must constantly struggle against error, but also that, even when we have taken the greatest care, we cannot be completely certain that we have not made a mistake.
>
> In science, a mistake we make–an error–consists essentially in our regarding as true a theory that is not true... to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can never be completely certain that we have not made a mistake (1:*4*).

Now, I'll attempt to relate how I recognized my error. Although I have only recognized one significant error, several minor regrets come to mind which I I'll mention first. First, in general, I noticed that, as I read key statements from a few of the books which I had brought along, recommended various texts and papers, and quoted other passages, titles, and dates from my questionable memory, several students were busy writing it down—I should have brought along copies of a selected bibliography which would have made this unnecessary. Also, looking back, it seems my attempt to bring *The Problem of Induction* (*cf. GLOSSARY*) into what was already a fairly complex presentation may have been a mistake, as there wasn't time to address it adequately, and, thus, it seems possible that I offered more confusion than illumination on this important topic. Alas, there is little I'm able to offer you all on this point other than an apology, an open offer to discuss it at another time, and to re-recommend (1) and (2) and, perhaps for those interested in an in-depth exploration, his magnum opus and original, detailed, revolutionary solution to this problem in *The Logic of Scientific Discovery* (5). I might also add that, since we have been recently graced by the presence of a rare black swan,* the present offers an opportune time in which to

* Thank you Mr. Chairman and members of the Committee.

begin to explore, and, most importantly, to grasp the true nature of this problem.

Otherwise, however, our discussion sat fairly well with me; that is, until I began to reply to an email yesterday: Colin had written to say thanks for passing along Popper's final response from his *Spiegel Verlag* interview in 1992, and tell me that he kindly planned to attend my *International Development Week* talk on Monday [10]. And, as I had thought of him (and even mentioned him in my talk, as you may recall) on Monday night when I recommended a great *Tragedy* paper (6) to your class, I began to reply as follows:

> You're a good man, Colin, thanks! I'll look forward to seeing you there - it would be great to catch up!
> How has your research been coming along? Did I ever send you Stewart's 1925 *A Land Policy for the Public Domain* [6]?
>
> If not, you've got to check him out, because I think of your PEI historical narrative whenever it comes to my mind or I recommend it to someone. The article was from the premier issue of *Economic Geography*; it essentially offers a visual (the black and white photos are excellent) historical documentary of *The Tragedy of the Commons* as it played out on the rangelands of the American West.
>
> I know that I've told this story before, but, although the tragedy was popularized by Hardin in 1968 [7], it was first theorized by Oxford economist W.F. Lloyd in 1832 [8]. I think Lloyd's contribution is very important to recognize and emphasize, because, as I noted my *Methods* guest-lecture on Monday, in 1832 the problem was still essentially theoretical (and it was still relatively unknown in 1925, when Stewart wrote his excellent piece). And although Hardin may be credited for broadcasting the pervasive nature of this problem, by the time he had written his work in 1968, Carson's *Silent Spring* (1962) had been out for over three years, and the problem of land degradation was already a very popular topic. Hardin and a few others since (most do not bother and/or do not seem to be aware of Lloyd's work, despite the fact that Hardin always credited Lloyd) have cited this work as '1833,' but I need to clarify this point in the APA style guide - Lloyd's lectures were delivered in 1832, but the paper wasn't published until 1833 - I'm not sure which dates to use....

But, as I was about to add a point about *"Hardin's solution*," something you [Baldacchino] said during my presentation on Monday began to weigh on me; as you may have noticed, *one of your comments had conflicted with one of my comments*.

When you and I simultaneously commented upon "*Hardin's controversial solution,*" we each said two very different things: If, you may recall, you said, "population control," as I said, "privatization." If my sensory perception serves me faithfully, we looked at one another for a curious, perhaps even slightly awkward moment, then I moved on by relating Hardin's position on privatization.

Although I was generally familiar with Hardin's positions on population control, I simply—*and quite erroneously*—concluded that you had confused (7) with another paper.

The salient feature of the current financial crisis is that it was not caused by some external shock like OPEC raising the price of oil or a particular country or financial institution defaulting. The crisis was generated by the financial system itself. This fact-that the defect was inherent in the system-contradicts the prevailing theory, which holds that financial markets tend toward equilibrium and that deviations from the equilibrium either occur in a random manner or are caused by some sudden external event to which markets have difficulty adjusting. The severity and amplitude of the crisis provides convincing evidence that there is something fundamentally wrong with this prevailing theory and with the approach to market regulation that has gone with it. To understand what has happened, and what should be done to avoid such a catastrophic crisis in the future, will require a new way of thinking about how markets work (9:*1*).

But, as I was writing my reply to Colin (above), and about to convey another point about 'Hardin's solution,' your comment began to weigh on me. So, I did the only responsible thing a researcher can do at this juncture and I re-read (7).

As I began to read, I was relieved to discover that I was correct.

But as I read on, *I became shocked to discover that I was also incorrect!*

And as pressed on, thinking through the logical implications which this misunderstanding represents, I recognized that a may have identified a rather significant problem: *Hardin 1968 and/or The Tragedy of the Commons is an inherently flawed theory with unlimited potential to represent very different things to different people!*

The problem, as I was very surprised to discover under cursory examination, is that Hardin 1968 tables four (iv) major theories in one paper: One theory describes the problem *(The Tragedy of the Commons*), and three conjectures offer solutions. Two of these solutions relate to privatization, but the third does in fact table population control a the *most* tenable solution to *The Tragedy of the Commons*—which I have clearly falsified (6): The problem is that one, all, or any combination of these theories may be true or false, but they are invariably cited as one theory.

This may seem like a trivial matter, but the implications are significant. (7) remains one of the single-most influential (and most heavily cited) papers across the so-called 'social' and biological sciences. I have several dozen 'Tragedy' papers (several of which have become fairly influential in their own right) which address this problem from various angles and perspectives, and, when I reviewed them again to put this problem into perspective, I discovered that m most merely cite *The Tragedy of the Commons*/Hardin 1968, but several define the "Tragedy" and it is *fairly* clear from the context in *most* of these articles that the writers *intend* to cite one of Hardin's four theories, (his description of the problem) but it is most often not completely clear, and, moreover, they have all unintentionally created a source of unnecessary and readily avoided confusion: As we try to understand problems and develop our solutions it is important that we develop crystal clear pictures of our problems, firm grasps upon our conceptual tools, and 'concrete' definitions (as Ayn Rand often said in her excellent lectures on writing) for all the terms that we utilize in our thoughts, speech, and our writings.

As you may have noted, all of my working papers feature a *GLOSSARY* with two quotations placed rather conspicuously at the over the entry-way to my glossaries (cf. GLOSSARY); thus, with this critical problem and much-needed solution in mind, please allow me to offer a correction of my error, an error committed by failing to state clearly my assumptions regarding *The Tragedy of the Commons* and Hardin 1968. I'll do so by briefly noting all four (*iv*) of Hardin's

theories.

The first theory, the theory I suggest most intend to imply in reference to *The Tragedy of the Commons* and/or "Hardin 1968," is his theoretical description of W. F. Lloyd's promethean problem statement of 1832 (8):

> [i] Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching, and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point, the inherent logic of the commons remorselessly generates tragedy. As a rational being, each herdsman seeks to maximize his gain. Explicitly or implicitly, more or less consciously, he asks, "What is the utility to me of adding one more animal to my herd?" This utility has one negative and one positive component.
>
> a) The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.
>
> b) The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is only a fraction of -1.
>
> Adding together the component partial utilities, the rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another. . . . But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit—in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons (7:*1444*).

And here Hardin calls forth several credible witnesses to offer unimpeachable testimony:

> It is not mathematically possible to maximize for two (or more) variables at the same time. This was clearly stated by von Neumann and Morgenstern, but the principle is implicit in the theory of partial differential equations, dating back at least to D'Alembert (1717–1783). (7:*1443*).

The second theory is Hardin's first proposed solution: *privatization*.

> [*ii*] What shall we do? ....We might sell [the commons] off as private property (7:*1444*).

And, although at first glance this following three sentences may merely appear to offer support and description for [*ii*], above, but, much to our horror, if we read carefully, we discover that Hardin fired off four more mini-theories in a Mac-10 burst:

> [*iii*] We must admit that our legal system of private property [*iv*] plus inheritance is unjust—but [*v*] we put up with it because [*vi*] we are not convinced, at the moment, that anyone has invented a better system. [*vii*] The alternative of the commons is too horrifying to contemplate. [viii] Injustice is preferable to total ruin (7:*1448*).

Indeed, if you read carefully, you'll find this five page pager is loaded with pot-shot-theories which, though we are all certainly free to table as many as we'd like, they typically require more than a half or whole sentence to substantiate.

Here's another example:

> [ix] The laws of our society follow the pattern of ancient ethics, and therefore are poorly suited to governing a

complex, crowded, changeable world (7:*1445*).

Indeed, I stopped counting at this point, there are not doubt many more, but I believe I've illustrated my point—you're getting more (or, more accurately, *much less*) than you've likely bargained for by citing "Hardin 1968." This is exactly why Popper argued that the more simple a theory is, the more descriptive power it holds.

Perhaps Hardin's tenth theory (though we've stopped trying to count them all, we'll note a few more) offers is what I have classified as his second major theory, which offers an important defense for solution [ii] and, moreover, clarifies the simple mechanism which lends [ii] evolutionary stability:

> [xi] The morality of bank-robbing is particularly easy to understand because we accept complete prohibition of this activity. We are willing to say "Thou shalt not rob banks," without providing for exceptions. But temperance also can be created by coercion. Taxing is a good coercive device. To keep downtown shoppers temperate in their use of parking space we introduce parking meters for short periods, and traffic fines for longer ones. We need not actually forbid a citizen to park as long as he wants to; we need merely make it increasingly expensive for him to do so. Not prohibition, but carefully biased options are what we offer him. A Madison Avenue man might call this persuasion; I prefer the greater candor of the word coercion. Coercion is a dirty word to most liberals now, but it need not forever be so. As with the four-letter words, its dirtiness can be cleansed away by exposure to the light, by saying it over and over without apology or embarrassment. To many, the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats; but this is not a necessary part of its meaning (7:*1447*).

Here Hardin offers more poignant commentary on the *Tragedy*, and consider how his argument offers support for my Theory of Value based upon Relative Insularity, which I outlined Monday night (10):

> Perhaps the simplest summary of this analysis of problems is this: the commons, if justifiable at all, is justifiable only under conditions of low-population density. As the human population has increased, the commons has had to be abandoned in one aspect after another. First we abandoned the commons in food gathering, enclosing farm land and restricting pastures and hunting and fishing areas. These restrictions are still not complete throughout the world. Somewhat later we saw that the commons as a place for waste disposal would also have to be abandoned. Restrictions on the disposal of domestic sewage are widely accepted in the Western world; we are still struggling to close the commons to pollution by automobiles, factories, insecticide sprayers, fertilizing operations, and atomic energy installations.
>
> In a still more embryonic state is our recognition of the evils of the commons in matters of pleasure. There is almost no restriction on the propagation of sound waves in the public medium. The shopping public is assaulted with mindless music, without its consent. Our government is paying out billions of dollars to create supersonic transport which will disturb 50,000 people for every one person who is whisked from coast to coast 3 hours faster. Advertisers muddy the airwaves of radio and television and pollute the view of travelers. We are a long way from outlawing the commons in matters of pleasure. Is this because our Puritan inheritance makes us view pleasure as something of a sin, and pain (that is, the pollution of advertising) as the sign of virtue? Every new enclosure of the commons involves the infringement of somebody's personal liberty. Infringements made in the distant past are accepted because no contemporary complains of a loss. It is the newly proposed infringements that we vigorously oppose; cries of 'rights' and 'freedom' fill the air. But what does "freedom" mean?
>
> When men mutually agreed to pass laws against robbing, mankind became more free, not less so. Individuals locked into the logic of the commons are free only to bring on universal ruin once they see the necessity of mutual coercion, they become free to pursue other goals. I believe it was Hegel who said, 'Freedom is the recognition of necessity' (7:*1448*).

Here's another D-flawless diamond Hardin unearths, which, I suggest, illuminates Einstein's commentary on *The Problem of Induction:* Recall that I related that Einstein once said, "Man has a crush desire for certainty, that's why Hume's message is [or perhaps 'was,' that comes, once again from memory] so crushing."

Here's Hardin's rendition of the same insight (and yes, no matter how self-evident it may appear, it represents in yet another theory):

> [xii] In our day (though not in earlier times) technical solutions are always welcome. Because of previous failures in prophecy, it takes courage to assert that a desired technical solution is not possible(7:*1443*).

Up to this point, my theoretical findings, if you compare the positions I presented in my paper and my introductory commentaries upon my discoveries on Mustique, Prince Edward Island, and Iceland, are perfectly aligned and are confirmed by and offer confirmation for (7). My great error, however, it my failure to recall that Hardin had tabled on more very significant theory in this paper which my Theory of Value, by the way, single-handedly falsifies and refutes (this point being quite irrelevant to my current argument however, which is simply that Hardin tabled more theories than one).

Here's his third major theory (the thirteenth I've counted thus far):

> [xiii] We can make little progress in working toward optimum population size until we explicitly exorcize the spirit of Adam Smith in the field of practical demography. In economic affairs, *The Wealth of Nations* (1776) popularized the "invisible hand," the idea that an individual who "intends only his own gain," is, as it were, "led by an invisible hand to promote . . . the public interest". Adam Smith did not assert that this was invariably true, and perhaps neither did any of his followers. But he contributed to a dominant tendency of thought that has ever since interfered with positive action based on rational analysis, namely, the tendency to assume that decisions reached individually will, in fact, be the best decisions for an entire society. If this assumption is correct it justifies the continuance of our present policy of laissez-faire in reproduction. If it is correct we can assume that men will control their individual fecundity so as to produce the optimum population.
>
> To couple the concept of freedom to breed with the belief that everyone born has an equal right to the commons is to lock the world into a tragic course of action. Unfortunately this is just the course of action that is being pursued by the United Nations. In late 1967, some 30 nations agreed to the following: The Universal Declaration of Human Rights describes the family as the natural and fundamental unit of society. It follows that any choice and decision with regard to the size of the family must irrevocably rest with the family itself, and cannot be made by anyone else.

Yes, he's quite emphatic about [xiii]:

> The most important aspect of necessity that we must now recognize, is the necessity of abandoning the commons in breeding. No technical solution can rescue us from the misery of overpopulation. Freedom to breed will bring ruin to all (7:*1445*).

And:

> The optimum population is, then, less than the maximum. The difficulty of defining the optimum is enormous; so far as I know, no one has seriously tackled this problem. Reaching an acceptable and stable solution will surely require more than one generation of hard analytical work—and much persuasion (7:*1443*).

If you review… [6], you may discover my findings do not agree with [xii], Hardin 1968's third major theory, for which I thank you wholeheartedly for brining to my attention. Considering the fact that I've been utilizing this theoretical tool for so long, it is somewhat embarrassing to realize the egregious nature of this mistake.

Though this should have been clear long ago, and for a far more significant reason, the most honest, scholarly solution is simply not to reference Hardin 1968 at all, but rather to cite the proper source for *The Tragedy of the Commons*: (8) (by the way, I did refer to the APA style guide, and have thus determined that Hardin's reference to (8) is inaccurate, as Lloyd's paper, though published by Oxford University Press in 1833, was presented at Oxford in two lectures in 1832. For proper citation, see Lloyd 1832). I should qualify this solution however: If you intention is in fact to cite all 14+ theories tabled in (7) , then, by all means, perhaps that's what you're looking for after all.

However, it seems to me that there may be another, secondary, practical option. As Oppenheimer noted, since scientists tend to be teachers, too, (6) has much to offer for teachers and students, alike. My position on this second solution is certainly not as strong nor as well-founded as my first—I suppose what I'm really trying to do is bring this excellent, seemingly forgotten work to your attention.

And finally, I'll leave you with the answer to a question which Hardin quite clearly could not see, but I suspect now, that you may all be able to see:

> Has any cultural group solved this practical problem at the present time, even on an intuitive level? One simple fact proves that none has: there is no prosperous population in the world today that has, and has had for some time, a growth rate of zero. Any people that has intuitively identified its optimum point will soon reach it, after which its growth rate becomes and remains zero (7:*1444*).

Yes, there is such a group who have solved this problem at the 'intuitive' *and* the 'practical' level, and, as my research shows, they live (or, perhaps more accurately, own second homes) on the island of Mustique. Furthermore, if you review the paper which I sent to you last week (*cf. ENCLOSURE*) you may conclude that perhaps I have in fact offered a theoretical solution to this problem.

Hardin failed to recognize two things, one of which seems inexcusable, the other for which we may offer a pardon. His first failure was a failure to recognize one of the most elementary principles of evolutionary theory, the *Principle of Superabundance*. Since (11) had clearly intuited this principle in 1798 and Darwin had clearly detailed it in 1859, it seems difficult to comprehend how a biologist failed to recognize this in 1968. The other failure, however, his inability to grasp

The Law Which Regulates the Introduction of New Species, is understandable, since I was not even born until 1968, and had not tabled my *Principle of Relative Insularity* until 2009!

Yes, (7) is collection of disparate theories—a few of which strike the bull's-eye, several of which miss the entire target —and I am grateful to you for bringing this elusive problem to my attention. I hope this letter clarifies any confusion I may have caused with my generous audience, and, moreover, offers a clear solution. If you have any questions or if I may be of assistance in your research endeavours, feel free to drop me a line.

Yours very truly....Matt Funk

1. Popper K (1994) *In Search of a Better World* (Routledge, London).
2. Popper K (1999) *All Life is Problem Solving* (Routledge, London).
3. Miller H (1957) *The Books in My Life* (New Directions, New York).
4. Llobera M, Sluckin, (2007) Zigzaging: theoretical insights on climbing strategies. *Journal of Theoretical Biology* 249:206-217.
5. Popper K (1959) *The Logic of Scientific Discovery* (Routledge, London).
6. Stewart G (1925) A Land Policy for the Public Domain. *Economic Geography* 1:89-106.
7. Hardin G (1968) The Tragedy of the Commons, *Science* 162:1243-1248.
8. Lloyd W (1832) *Two lectures on the checks to population.* Reprinted in (1980) *Population and Development Review* 6.
9. Soros G (2008) *Statements of George Soros before the U.S. House of Representatives Committee on Oversight and Government Reform, 13 November 2008* (Hose of Representatives, Washington).
10. Funk M (2009) *On the Extinction of Species by Means of Insularity Lost, or The Law Which Regulates the Struggle for Life: Lessons from Mustique.* International Development Week presentation. 2 February 2009, 1:30 PM, Atlantic Veterinary College, Lecture Theatre A (UPEI, Charlottetown).
11. Malthus T (1798) *An Essay on the Principle of Population* (Johnson, London).

APPENDIX VIII

A THUNDERBOLT FOR A WEAPON

[A story] is told of a young prince who had just completed his military studies under a world-renowned teacher. Having received, as a symbol of his distinction, the title Prince Five Weapons, he accepted the five weapons that his teacher gave him, bowed, and, armed with the new weapons, struck out onto the road leading to the city of his father, the king. On the way he came to a certain forest. People at the mouth of the forest warned him. 'Sir prince, do not enter this forest,' they said, 'an ogre lives here, named Sticky-hair; he kills every man he sees.'

But the prince was confident and fearless as a maned lion. He entered the forest just the same. When he reached the heart of it, the ogre showed himself. The ogre had increased his stature to the height of a palm tree; he had created for himself a head as big as a summer house with bell-shaped pinnacle, eyes as big as alms bowls, two tusks as big as giant bulbs or buds; he had the beak of a hawk; his belly was covered with blotches; his hands and feet were dark green. 'Where are you going?' he demanded. 'Halt! You are my prey!'

Prince Five Weapons answered without fear, but with great confidence in the arts and crafts that he had learned. 'Ogre,' said he, 'I knew what I was about when I entered this forest. You would do well to be careful about attacking me; for with an arrow steeped in poison will I pierce your flesh and fell you on the spot!'

Having thus threatened the ogre, the young prince fitted to his bow an arrow steeped in deadly poison and let fly. It stuck right in the ogre's hair. Then he let fly, one after another, fifty arrows. All stuck right to the ogre's hair. The ogre shook off every one of those arrows, letting them fall right at his feet, and approached the young prince.

Prince Five Weapons threatened the ogre a second time, and drawing his sword, delivered a masterly blow. The sword, thirty-three inches long, stuck right to the ogre's hair. Then the prince smote him with a spear. That also stuck right to his hair. Perceiving that the spear had stuck, he smote him with a club. That also stuck right to his hair.

When he saw that the club had stuck, he said: 'Master ogre, you have never heard of me before. I am Prince Five Weapons. When I entered this forest infested by you, I took no account of bows and suchlike weapons; when I entered this forest, I took account only of myself. Now I am going to beat you and pound you into powder and dust!' Having thus made known his determination, with a yell he struck the ogre with his right hand. His hand stuck right to the ogre's hair. He struck him with his left hand. That also stuck. He struck him with his right foot. That also stuck. He struck him with his left foot. That also stuck. Thought he: 'I will beat you with my head and pound you into powder and dust!' He struck him with his head. That also stuck right to the ogre's hair.

Prince Five Weapons, snared five times, stuck fast in five places, dangled from the ogre's body. But for all that, he was unafraid, undaunted. As for the ogre, he thought: 'This is some lion of a man, some man of noble birth--no mere man! For although he has been caught by an ogre like me, he appears neither to tremble nor to quake! In all the time I have harried this road, I have never seen a single man to match him! Why, pray, is he not afraid?' Not daring to eat him, he asked: 'Youth, why are you not afraid? Why are you not terrified with the fear of death?'

'Ogre, why should I be afraid? for in one life one death is absolutely certain. What's more, I have in my belly a thunderbolt for weapon. If you eat me, you will not be able to digest that weapon. It will tear your insides into tatters and fragments and will kill you. In that case we'll both perish. That's why I'm not afraid!'

Prince Five Weapons, the reader must know, was referring to the Weapon of Knowledge that was within him....

'What this youth says is true,' thought the ogre, terrified with the fear of death. 'From the body of this lion of a man, my stomach would not be able to digest a fragment of flesh even so small as a kidney bean. I'll let him go!'

And he let Prince Five Weapons go (1:*85-88*).

1. Campbell J (1949) *The Hero with a Thousand Faces* (Bollingen Foundation, Princeton).

APPENDIX IX

ON THE PROBLEM OF HEAD-ON COLLISIONS

-------- Original Message --------

Subject: On the Problem of Head-on Collisions[*]

Date: Wed, 24 Dec 2008 06:31:58 -0400

From: Matt Funk <matt@funkisland.org>

To: My loving Wife on Christmas Eve

Heavy stuff, baby: they're closing the 90 year-old assembly-line our Suburban rolled off last year in Janesville, Wisconsin, a small-town half way between Kentland and Lake Gogebic (see article [3], below). But fear not: although the road ahead will be considerable for many, opportunities may be considerable for those who grasp the value of relative insularity ;).

I also really like the first photograph in this piece – the American spirit remains strong! xoxoxoxo Matt

PS: [3] also highlights a counter-intuitive, silver lining: recall that choosing an automobile represents a classical case of the *Prisoner's Dilemma* [4] – that, although you may choose to drive a small, fuel efficient car, you cannot 'communicate', much less 'control' the other 'prisoners' (including, for example, the intoxicated driver swerving back and forth over the double-yellow, screaming at you at 100 mph from the opposite direction). Thus, alas, the rational solution to this Prisoner's Dilemma– like all such dilemmas – is not the 'best' possible solution: ESS = the most mass, structural integrity, and tertiary safety features you're able to afford (in our case, 6,000 lbs on a fully-boxed frame, air bags, traction control, *etc.*). Moreover, with fewer SUV's on the road, the probability of our survival is thereby enhanced further yet, as we're more likely to tangle with an intoxicated ecologist in a Prius (Google 'Al Gore's son Prius' for more on that ironic note) than another SUV. Remember, NHSTA star ratings are based upon 30 mph collisions with a wall which is incredibly misleading: When was the last time you opened the paper to discover that four people were killed when their slow moving vehicle crossed the center-line and hit a brick wall? When a fully loaded, 80,000 lb. 18-wheeler hits a Smart Car head-on, it doesn't 'feel' like a brick-wall to either driver: it feels like a sea-foam to the trucker and an asteroid impact to the 'smart' guy. *Ceteris paribus* (*i.e.* airbags, ABS, traction control, halogen lights, *On-Star*, head's-up radio controls, *etc.*). Vehicle selection is more a matter of Newtonian physics than home economics or 'environmentalism', since millions of years of hominid evolution have produced a phenotype maladapted for travel at rates of velocity >20 mph (running like hell and to catch something to eat or running like hell from the jaws of a lion); our skinny necks offer little insufficient support in the event of rapid cerebral deceleration.

When I was sixteen or seventeen, before I knew anything of evolution or the theory of games (it was in fact a time in which I knew very close to nothing), Dad took Dan and I on a road-trip through the Appalachians in a custom Prevost bus he had just bought, and early in our tour, as we were cruising through Nashville, sitting drinking Cokes around the kitchen table when something suddenly occurred to me: "Jesus, Dad," I said, "there are no seatbelts in here!" Dad swirled the ice cubes around in the drink in his hand (we had a driver behind the wheel), gazed down the street which we were headed, pointed to a car stopped at a traffic light at an intersection ahead and said, "See that car?"

I nodded—yeah.

"Well," he said, "if that car pulls out in front of us, we won't even spill our drinks."

That, is *relative insularity* in motion—that also suggests how *relative insularity* is attained through *RHP* ($)!

1. Levitt S, Porter J (2001) How Dangerous Are Drinking Drivers? *Journal of Political Economy* 109:1198–1237.
2. Hagen E, Hammerstein P (2006) Game Theory and Human Evolution *Theoretical Population Biology* 69:339-348.
3. Bunkley N, Vlasic B (2008) Nearly the End of the Line for SUV's. *The New York Times*. December 23, 2008.
4. Tucker A (1950) *A two*person dilemma* (Stanford).

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* (a) The irrational plea to drive small, lightweight, fuel-efficient cars is an excellent example of *ideological environmentalism* gone awry, and it's effects are especially malignant, given the mismatch effect (see *b*, below). The environmentalist creed asks that you surrender your will-to-survive for the 'common good'. Traffic accidents represent the number one killer for North Americans between the ages of 3 and 34.

(b) Mismatch phenomena are well documented. The neurotoxins of many spiders and snakes, for example, were a real danger to ancestral humans, as well as our distant primate ancestors. Now, however, they kill less than 20 people a year in the US (virtually all of whom were owners of dangerous spiders and snakes), whereas automobile accidents kill about 40–50,000 people a year [1]… Yet decades of research have shown that fear of spiders and snakes is more readily learned than fear of contemporary dangers like automobiles…, a clear example of a mismatch. More generally, mismatches are successfully exploited by many large industries, including advertising and entertainment (2:*342*).

APPENDIX X

RECOMMENDATION?

CERTIFICATE OF RECOMMENDATION

For Election to Fellowship of the Linnean Society of London

This recommendation must be signed by one or more Fellows personally acquainted with the Candidate or his work, or by Officers of the Society. The full name of the Candidate, with the usual style of address, and place of residence, must be given, with any relevant qualifications, including degrees and the universities at which they were obtained. This is a permanent record so please print clearly.

Title and Full Name: *Matthew William Funk* Date of Birth: *13 August 1968*

Qualifications: *A deep interest in Natural History, truth, problem solving, & survival; BS, MFA, MA.*

Profession and Position: *Naturalist, guest-lecturer, Department of Island Studies, The University of Prince Edward Island*

Address: *465 University Avenue, No. 21021, Charlottetown, PE, C1A-9H6, Canada, matt@funkisland.org, http://www.funkisland.org,*

attached to the study of Natural History of Mustique, Iceland, Hawaii, and other relatively insular bio-geo-politico-economic 'islands,'

(and where applicable the precise field of current research)

especially - - through comparative study - - as they clearly illustrate the evolutionary stable strategy for sustainable economic development and, thus, ultimately, offer to help foster human survival,

being desirous of becoming a Fellow of THE LINNEAN SOCIETY OF LONDON, those whose names are undersigned, beg leave to recommend h__ to that Honour

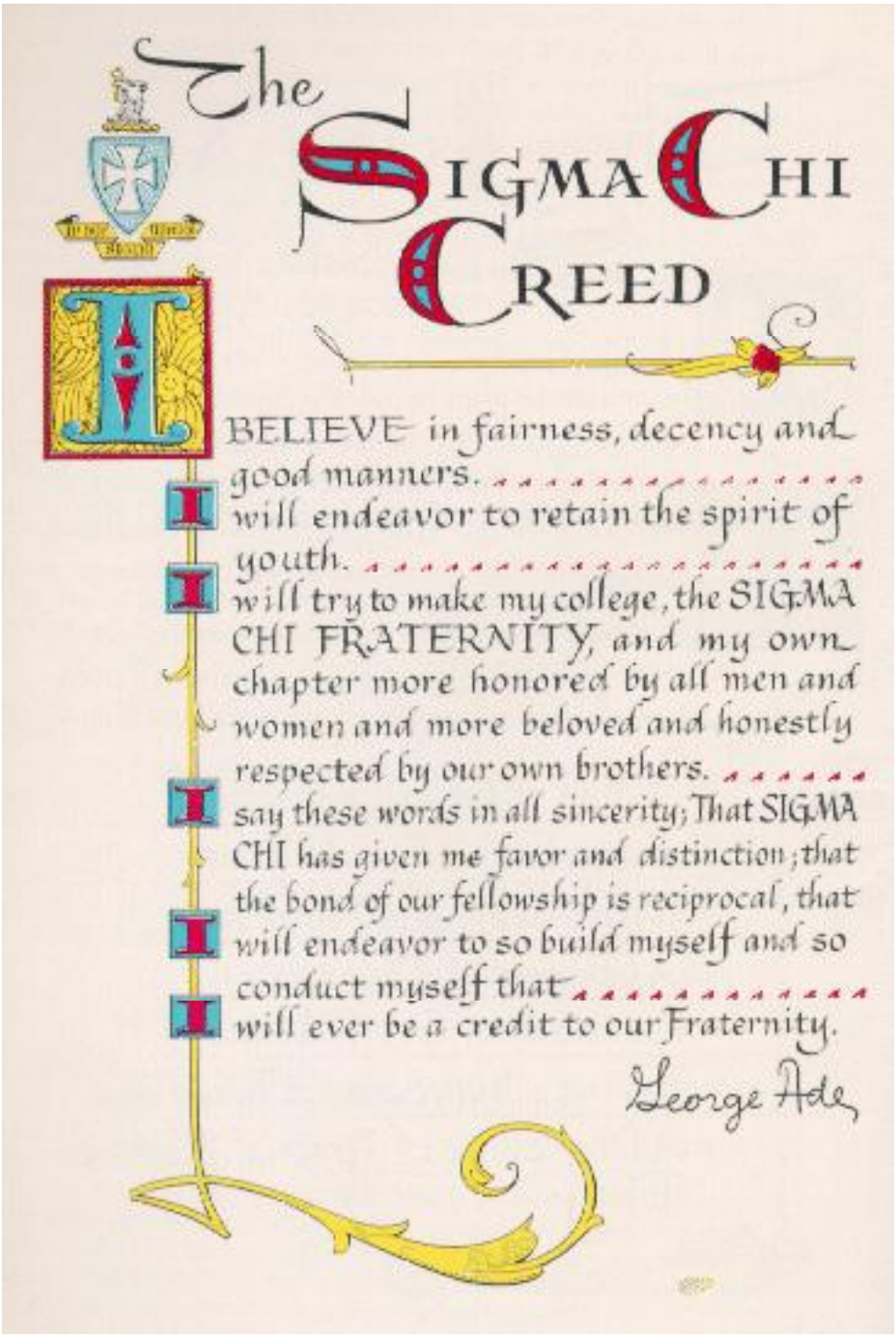
Name	Signature

This Certificate was received on _____

The Ballot will take place on the_____ day of _____

APPENDIX XI

ON THE BOND OF FELLOWSHIP



1. Ade G (1887) *The Sigma Chi Creed* (Sigma Chi, Lafayette).

APPENDIX XII

FELLOWSHIP

THE LINNEAN SOCIETY OF LONDON

FOUNDED 1788

for the Cultivation of the Science of Natural History in all its branches

MATTHEW WILLIAM FUNK

I have the honour to inform you that at a Meeting of the Society held yesterday you were elected a Fellow of The Linnean Society of London in accordance with the Charters and Bye-Laws.

Executive Secretary

20th March 2009

On the Travesty of the Tragedy of the Commons: Hardin's Nontrivial Error

Funk, Matt
The Linnean Society of London

11. December 2009

Garrett Hardin's 1968 *Tragedy of the Commons* (1) remains one of the most frequently cited works across the spectrum of science — indeed, a visit to http://www.sciencemag.org/feature/misc/top_articles/ reveals that this revolutionary communique remains amongst *Science's* 'top articles'. But as great philosophers from Xenophanes to Socrates to Popper to Russell have all reminded us: "In all affairs it's a healthy thing now and then to hang a question mark on the things you have long taken for granted."

Hardin's enduring, highly influential (2) theoretical development presents a serious problem: it is not a single theory, but rather four major theories in a dark and stormy sea of ill-conceived and untenable auxiliary conjecture. Moreover, the solid core of Hardin's central thesis was simply a *restatement* of *a previously published theory* (3 ; *cf.* 4), the promethean vision of William Forster Lloyd, Drummond chair of political economy at the University of Oxford, delivered in two lectures on the checks to population in 1832 and published in 1833 (3). Alas, to add insult to injury, Lloyd's advancement of the marginal theory of value was also sadly neglected (5).

To his credit, Garrett Hardin focused much attention upon this useful, illustrative, abstract conceptual tool (1) — as have thousands of dedicated problem-solvers who have followed his footsteps. However, upon reflexion (6) of a talk delivered on scientific method and a particularly nasty strain of the tragedy of the commons which infects islands and islanders alike (7), it became clear that Hardin (1) *also* tabled three *other* significant hypotheses — two of which may, perhaps, be defended. The third hypothesis, however, is readily falsified, *reductio ad absurdum*, in the light of evolutionary game theory (8). Briefly, in five short pages, Hardin (1) erected a conjectural house of cards upon small, scenic, sandy patches of theoretical shoreline which have long-since subsisted into the sea (8). This creates a special problem for those who have cited and continue to cite 'Hardin 1968' without considering the wide array of grave, logical implications this misattribution freights. Hardin's Nontrivial Error and the travesty of the tragedy of the commons is indeed a serious affair (6 ; 8) which will be further detailed, illuminated, and contextualized in a forthcoming issue of the *Proceedings* of The Linnean Society of London (9).

But the clear and obvious solution is to simply give credit where credit is due (3).

"This sketch is most imperfect; but in so short a space I cannot make it better. Your imagination must fill up very wide blanks" (10, p. 50).

Matt Funk, FLS[$]

1. Hardin G (1968) The Tragedy of the Commons *Science* 162:1243-1248.
2. Fersht A (2009) The most influential journals: Impact Factor and Eigenfactor *Proc Natl Acad Sci USA* 106:6883-6884.
3. Lloyd W (1833) Two Lectures on the Checks to Population. Reprinted in *Population and Development* Review, Vol. 6, No. 3, Sep., 1980:473-496.
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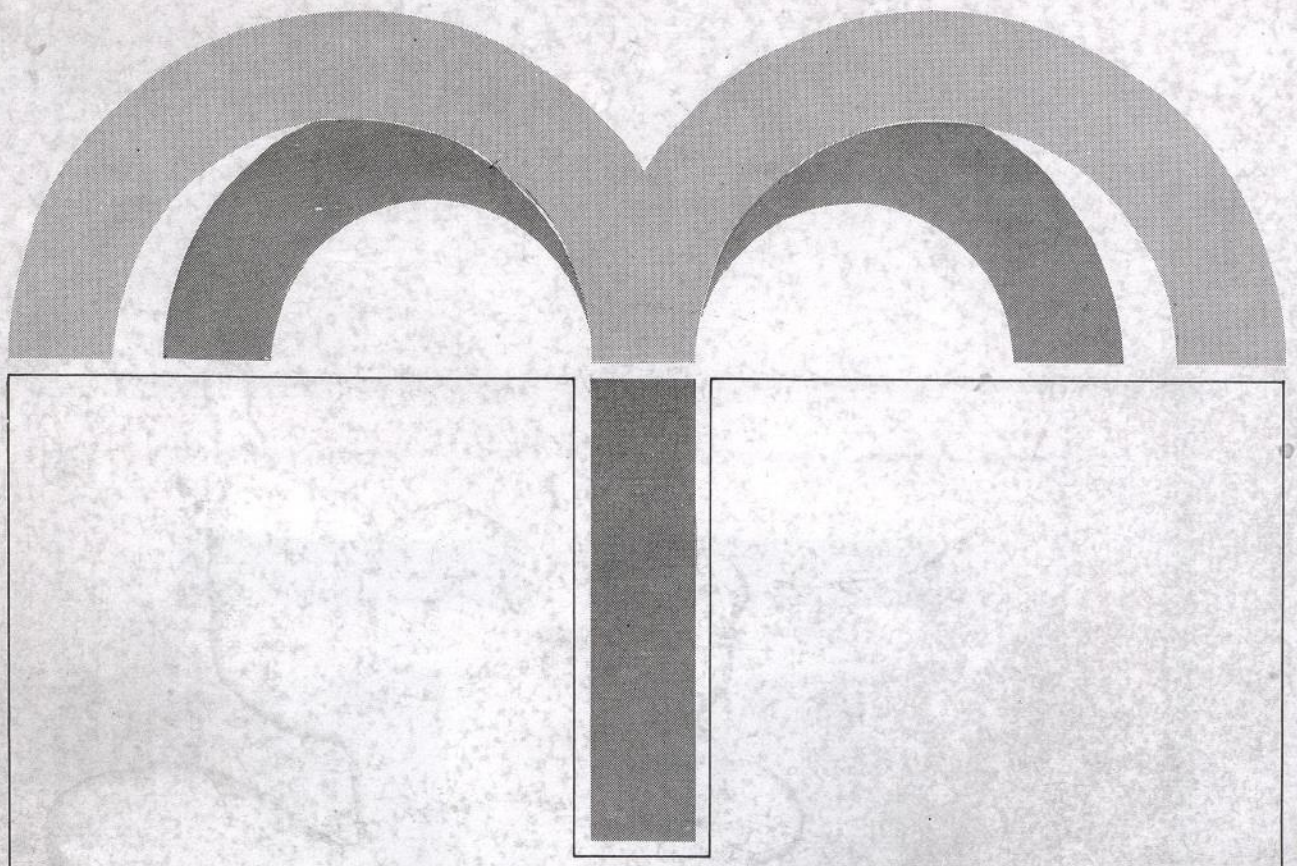
5. Gordon B (1966) W.F. Lloyd: A Neglected Contribution *Oxf Econ Pap* 18:64-70.
6. Funk M (2009) On the Truly Noncooperative Game of Island Life: Introducing a Unified Theory of Value & Evolutionarily Stable Island Economic Development Strategy. Appendix VII: "On the Tragedy of the Prince Edward Island Commons". *MPRA* 19049:97-113
7. Funk M (2009). A lecture on checks to population and the tragedy of the commons: "Solving Island Problems with Island Solutions: Amplification by Compression, Complex Systems, & Cultural Evolution." Delivered 26 January 2009, Research Methods & Designs for Island Studies (IST 604):
8. Funk M (2008) On the Truly Noncooperative Game of Life on Earth: In Search of the Unity of Nature & Evolutionary Stable Strategy. *MPRA* 17280:1-21.
9. Funk M (forthcoming) On the Origin of Mass Extinctions: Darwin's Nontrivial Error *Proc Linn Soc*.
10. Darwin C (1858) Letter to Asa Gray of Boston, mailed from Down, 5 September 1857. *Proc Linn Soc* 3:45-62.

[$] I only know that he who forms a tie is lost. The germ of corruption has entered into his soul.
—Joseph Conrad, *Victory: An Island Tale*, 1915

⇒ The Author declares no conflict of interest.

To whom correspondence should be directed: matt@funkisland.org
The Linnean Society of London, Burlington House, Piccadilly, London W1J 0BF, United Kingdom



MUSTIQUE
DEVELOPMENT PLAN

LLEWELYN-DAVIES WEEKS FORESTIER-WALKER & BOR

THE CONSULTANTS TEAM

PLANNING CONSULTANTS

Llewelyn-Davies Weeks Forestier-Walker & Bor

Walter Bor	Partner in Charge
Jonathan Smulian	Associate in Charge
Michael Macrae	Project Leader
John Lockerbie	
Graham Martin	
Simon Winstanley	

ECOLOGY

Barrie Goldsmith	(University College London) (Department of Botany & Microbiology)
Brian O'Connor	(Department of Zoology)

ECONOMICS

George Psacharopoulos	(London School of Economics)

CONSULTING ENGINEERS

Malcolm Cooke	Archibald Shaw & Partners

MUSTIQUE DEVELOPMENT PLAN

CONTENTS

In December 1970 the Mustique Company, sole owners of the Eastern Caribbean Island of Mustique, appointed the firm of Llewelyn-Davies Weeks Forestier-Walker & Bor to prepare a 20-year Development Plan for the island by May 1971. It was stressed that the study should concentrate on establishing the feasibility of low density high-income residential tourist development with small hotels both for the international and the local market. Proposals for immediate action were also required.

Within these wide terms of reference we have attempted to produce a Plan that is both a document showing existing and proposed use of land, and an instrument that embodies social, economic and ecological policies.

Despite the small size of the island a study of this kind involves consideration of most of the interacting components of a much larger system and similar or perhaps greater problems in making projections for future development.

We have felt therefore that the Plan should afford as much freedom as possible for the Mustique Company to respond to future opportunities, while at the same time providing policies that are firm and clear enough to guide development and to offer assurances to those investing.

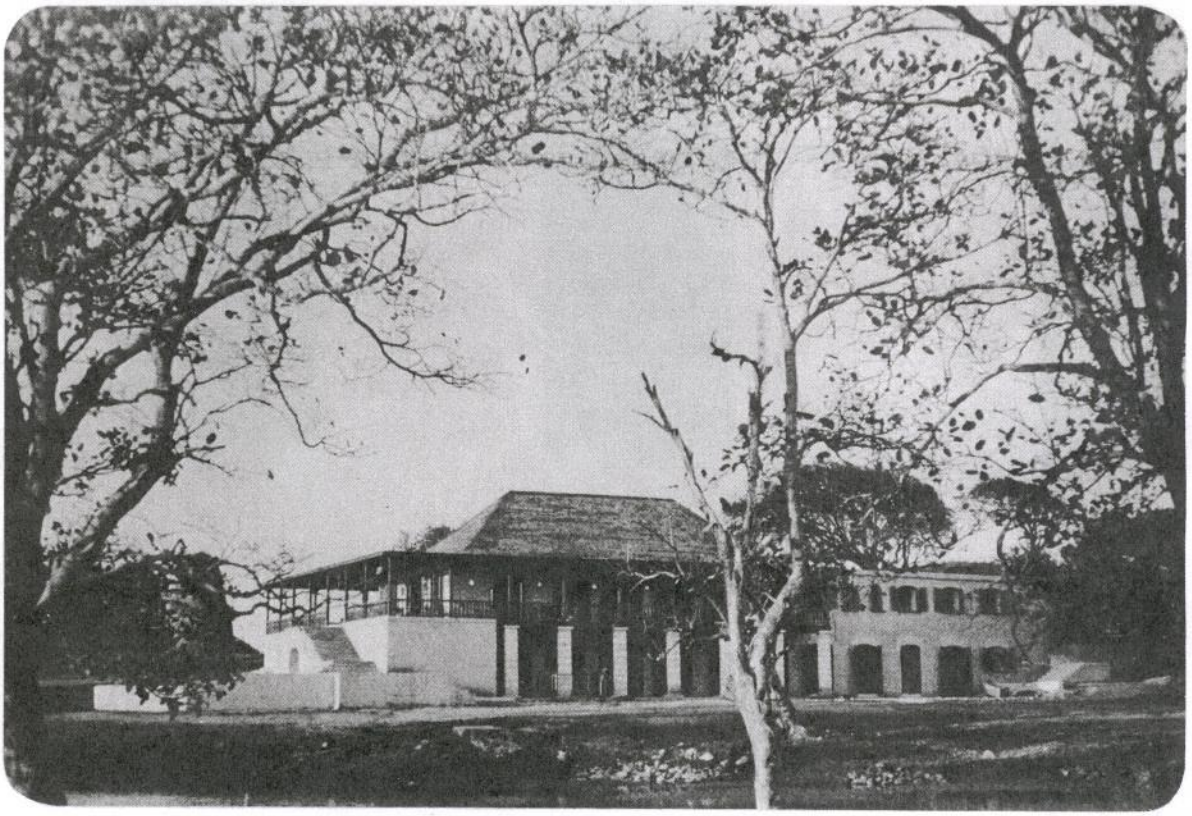


FIGURE 1: MUSTIQUE 1970 : THE COTTON HOUSE HOTEL

SECTION 1 : GOALS OF THE DEVELOPMENT PLAN

The development of Mustique involves the relationship of 3 groups of people: the Vincentians, the Visitors and the Mustique Company. The plan will need to assure potential investors that the proposals offer them the facilities they need within a context of reasonable long-term environmental and socio-economic stability.

This study has therefore attempted to identify the ecological and socio-economic constraints to development on the island and to make proposals that will offer a framework for maximising return on investment taking into account those constraints.

The goals of the plan have therefore been seen as:

1 To identify that sector of the potential regional market that will complement rather than compete with development elsewhere in the St Vincent Grenadines and provide suitable residential, recreational and service facilities on Mustique.

2 To minimise disturbance to the ecology of the island by achieving the most suitable relationships between proposed uses and the natural resources, and ensuring that the capacity of the island is not exceeded.

3 To maximise returns on capital invested by the Mustique Company within the constraints, ensuring that at each stage investments can be seen to be related to specific returns.

4 To adopt generally a policy of gradualism so that the effects of development can be carefully monitored; and in the short-term, to optimise the use of already existing and committed infrastructure.

5 To maximise the benefits accruing to the people of St Vincent from the development of Mustique.

SECTION 2: SUMMARY OF PROPOSALS

1 That the island can support the viable and profitable development of residential Tourism for about 2, 200 people and some 200 hotel bedrooms. This will allow the sale of some 500 acres while preserving sufficient land for wildscape and all ancilliary services.

2 That the attractive scale and identity of the present landscape should be maintained by locating development mainly on the side slopes of the hills so that the top lands can form a continuous wildscape and the fertile valley bottoms can be used for agriculture pasture and recreation. By using gentle slopes in the re-entrants, sufficient housing sites can be located on economic building land to acheive a rate of development suitable to the marketing economics.

3 That a new wharf and warehouse area should be developed at Old Plantation to cope with increased demands. That the lagoon should be developed in two stages as a small marina facility to provide a sheltered anchorage for residents' boats. That the existing runway should be maintained for the for-seeable future, but that new passenger handling facilities should be designed in such a way as to keep open the option for readjustment east/west.

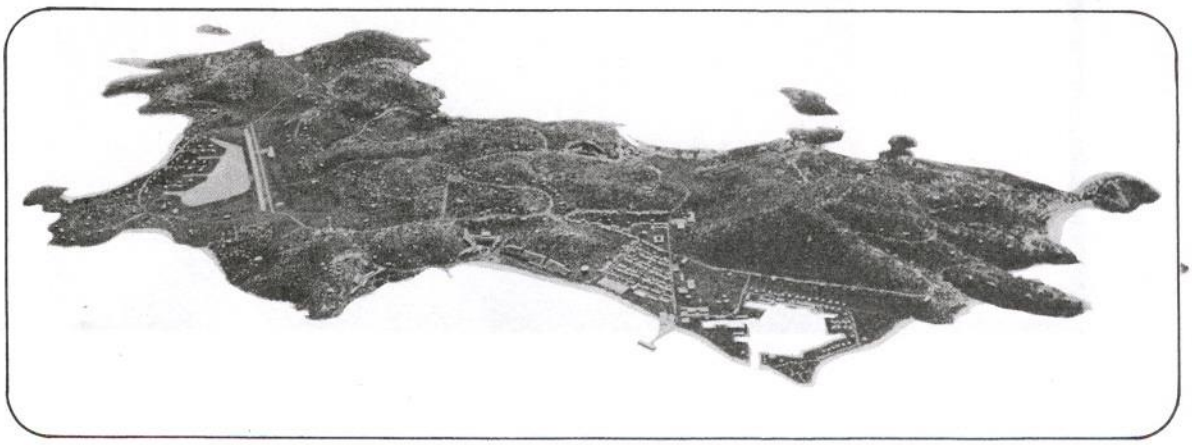
4 That the working population cannot be expected to commute daily to Mustique and that, since the existing village location is unsuitable, a new village to house the workers and their families, comprising some 2, 500 persons, should be constructed in Old Plantation, where there is sufficient centrally located flat land with good soil to allow economic development.

5 That an immediate action programme should be initiated to make available (from December 1971) about 100 acres for sale at Endeavour Hills and Gelliceaux Bay. That it will be feasible to do this by using the existing infrastructure with only a minimal input of fresh development capital.

6 That it will be possible to maximise the use of local labour, services, materials and products in such a way as to ensure that the people of St. Vincent benefit as much as possible from this development of Mustique.

7 That it would be of benefit to have the proposals for Mustique adopted by the Government of St. Vincent as a non-statutory Development Plan in order to help maintain good relations with those of the local population affected by the development.

FIGURE 2: MODEL OF PROPOSED DEVELOPMENT FROM WEST

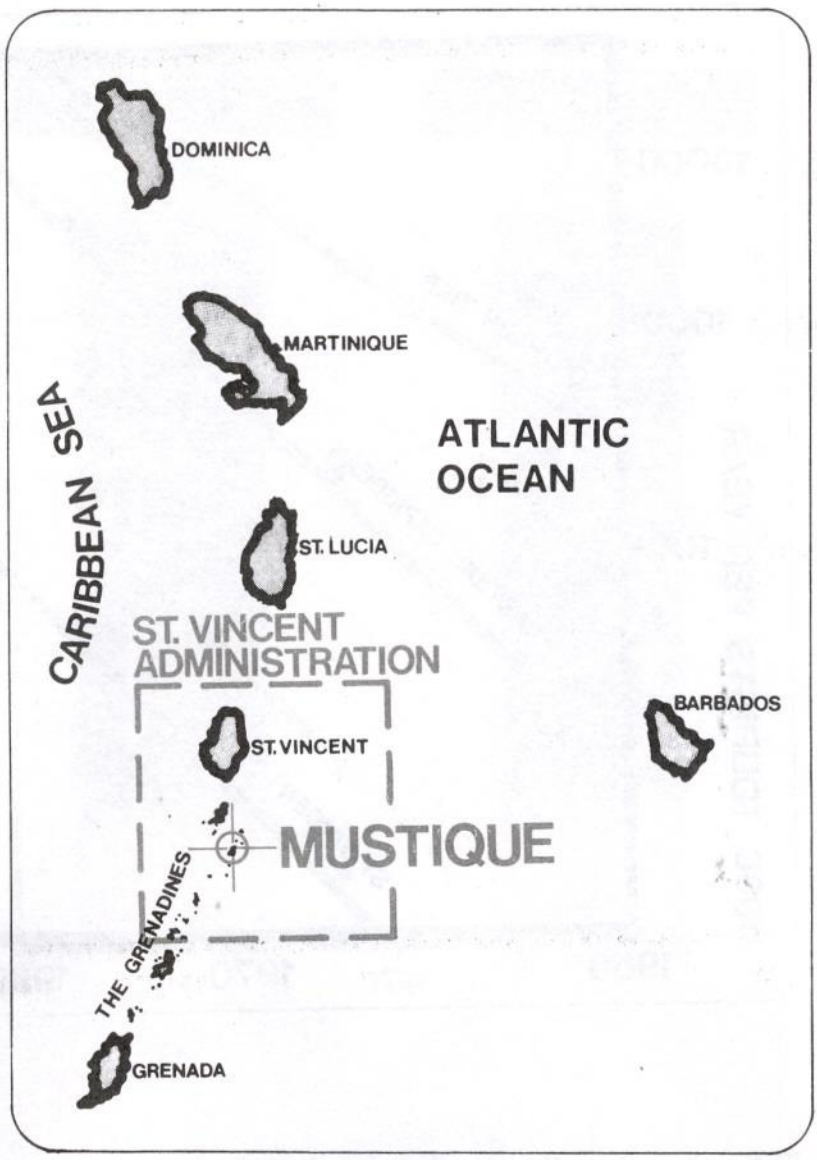


SECTION 3 : DEMAND : THE REGIONAL CONTEXT

The attraction of Mustique derives from the fact that it is a small, privately owned island of great charm and variety of landscape, and with a sunny, healthy climate with temperatures ranging from 75-85° throughout the year.

This potential is enhanced by the surrounding archipeligo, for the St Vincent-administered Northern Grenadines have been described as the primary yachting area of the Eastern Caribbean.

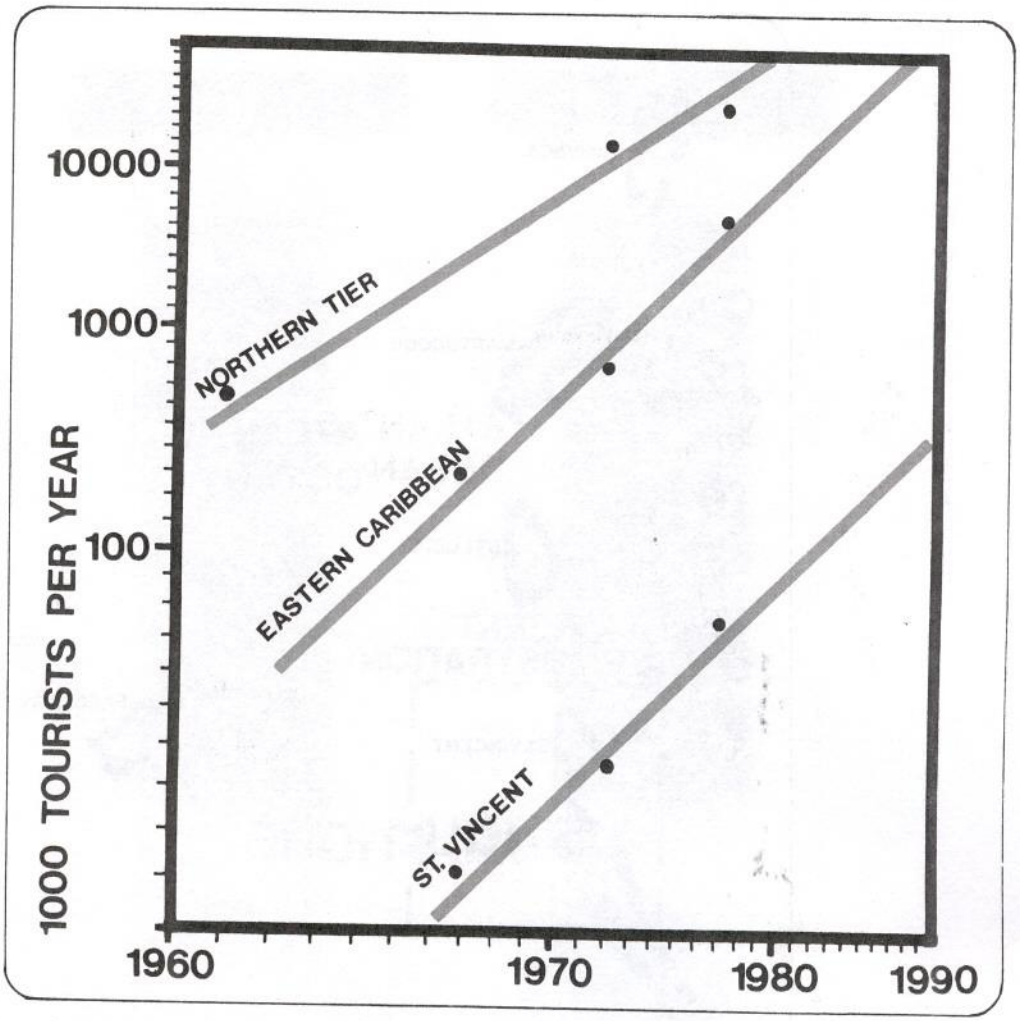
FIGURE 3 : LOCATION



Accessibility to the north American and European markets is high: Mustique is 20 minutes from the new international jet airport of Beanfield, St Lucia, which is 4 hours from New York and 8 from London.

Tourism in the Eastern Caribbean, although still relatively small by global standards, has been growing rapidly at an average rate of increase of about 20% per year. This growth has been largely due to spin-off from Puerto Rico and the U.S. Virgin Islands, and the Eastern Caribbean market is heavily dominated by North Americans, who form 33% of the visitors to Barbados and 66% to Antigua.

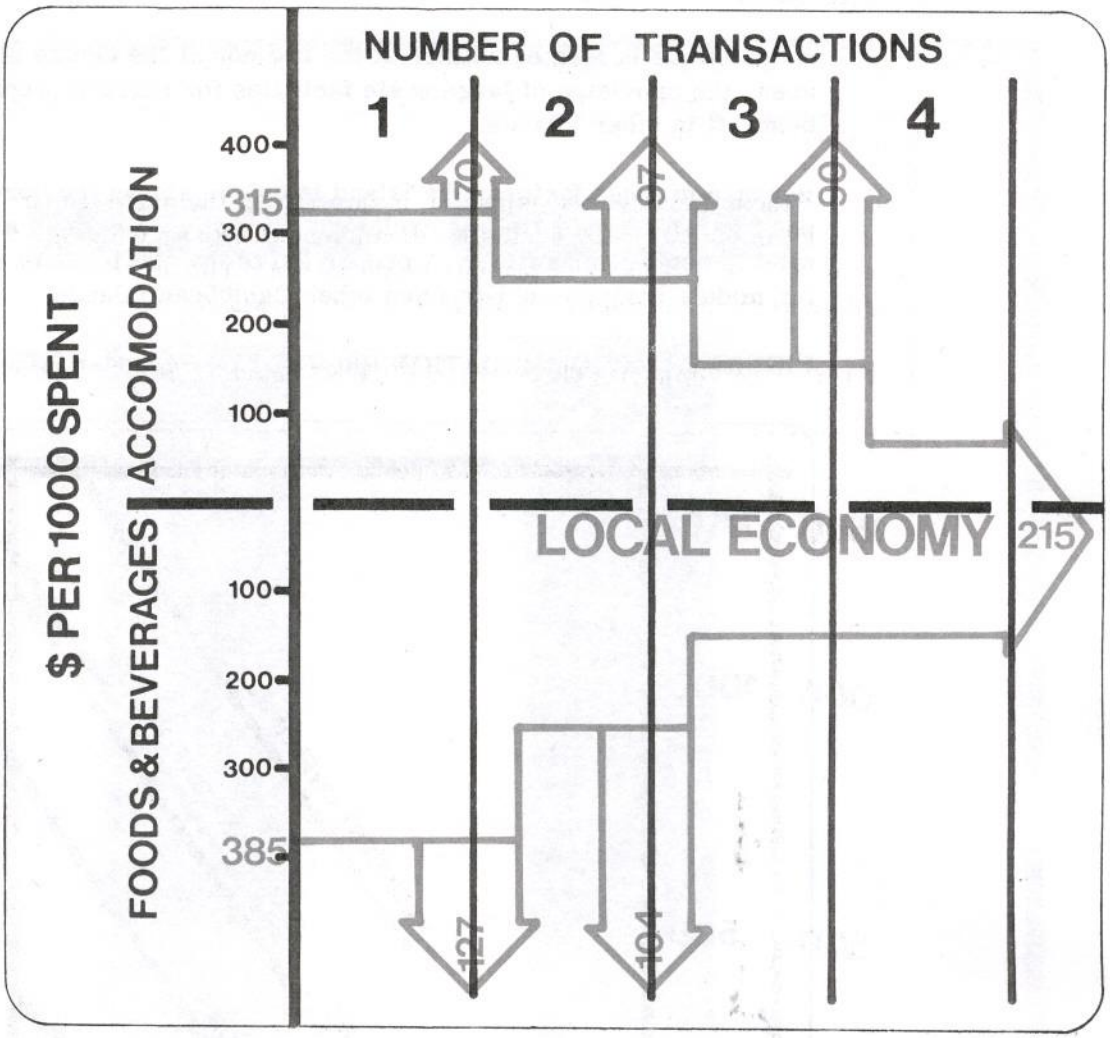
FIGURE 4 : GROWTH OF TOURISM IN THE REGION (Zinder 1969)



The main factors limiting the rate at which the area can absorb tourists are lack of accessibility, roads, utilities and other services, coupled with a scarcity of the skilled labour needed to build and operate hotels and other facilities. In the past the Tourist Promotion budgets and programmes of the different islands have not been co-ordinated.

Investment in tourist development must be seen to benefit the local people, and measures are needed to minimise the leakage of tourist spending out of the local economy through the purchase of imported materials, products and services.

FIGURE 5 : LEAKAGE OF TOURIST SPENDING (Zinder 1969)



At present the rate of leakage is higher in the Eastern Caribbean than anywhere else in the world, and although inherent in part to the nature of small open economies, there are measures that can help to retain this money. Development on Mustique should seek wherever possible to:

1 Maximise the use of local materials, products and services.

2 Maximise labour intensive rather than capital intensive methods.

3 Stimulate the retention of local savings

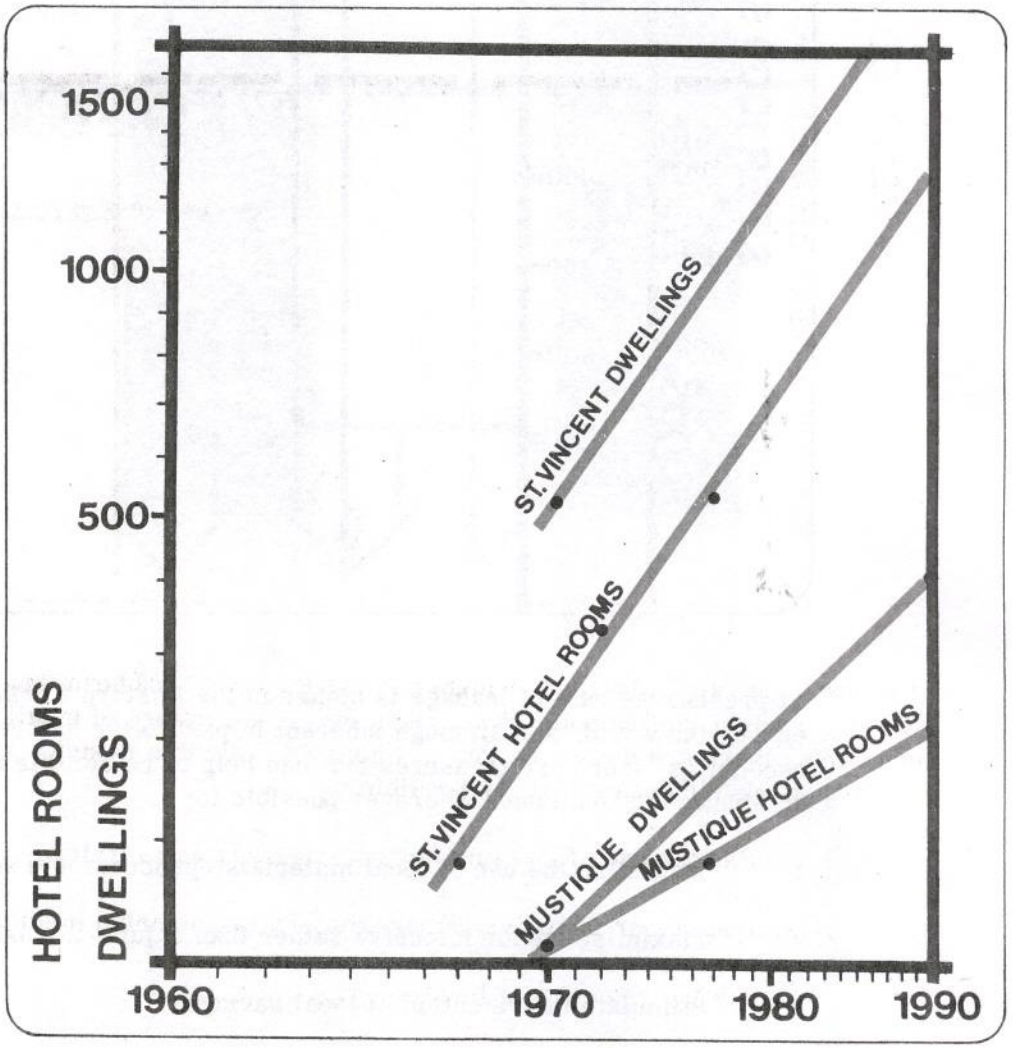
It is in the interests of both the Mustique Company and the St. Vincent Government that Mustique should not compete with developments on the other islands but complement them.

Since Mustique is a small island under single ownership and with only a very small existing settlement and infrastructure, development will be inherently expensive. But it will also offer the opportunity of preserving an especially high quality of environment.

As Mustique is located neither at the end nor at the centre of the prime yachting area, the provision of large scale facilities for charter, repair and anchorage is best left to other islands.

Because of these factors, the island is unique among the northern Grenadines in possessing the potential for exclusive development with an above average residential to hotel room ratio. A proportion of the hotel rooms should be suitable for middle income tourists from other Caribbean islands.

FIGURE 6: ACCOMMODATION PROJECTIONS (Zinder 1969)



The proportion of hotel bedrooms to bedrooms in visitors dwellings in Mustique could thus be in the order of 15% compared to 20% in the rest of the State.

Mustique will draw its labour force largely from the main island of St. Vincent. Population projections for the State suggest a growth rate of 3.2% per annum.

Allowing for an increase in the employment participation rate (decrease in relative unemployment) there could be a labour force in the State of St. Vincent of about 70,000 by 1990. The demands made upon this by Mustique would be relatively small, although additional jobs will be generated on the main island. (See Appendix II)

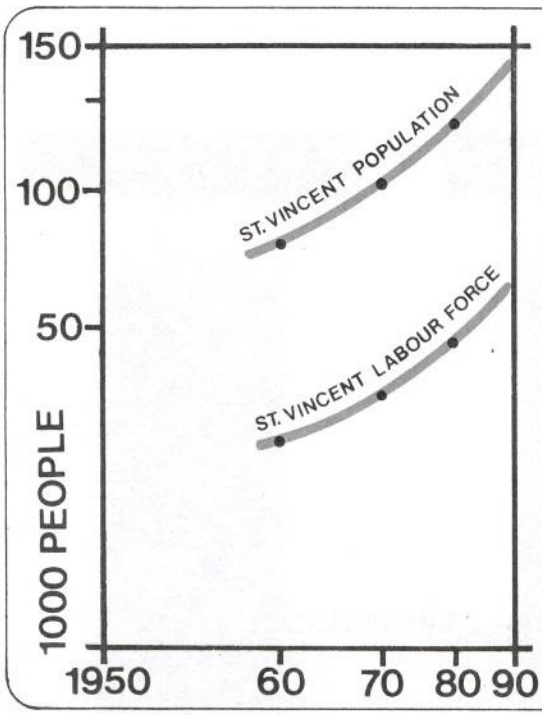


FIGURE 7:

POPULATION PROJECTIONS
ST. VINCENT (O'Loughlin 1968)

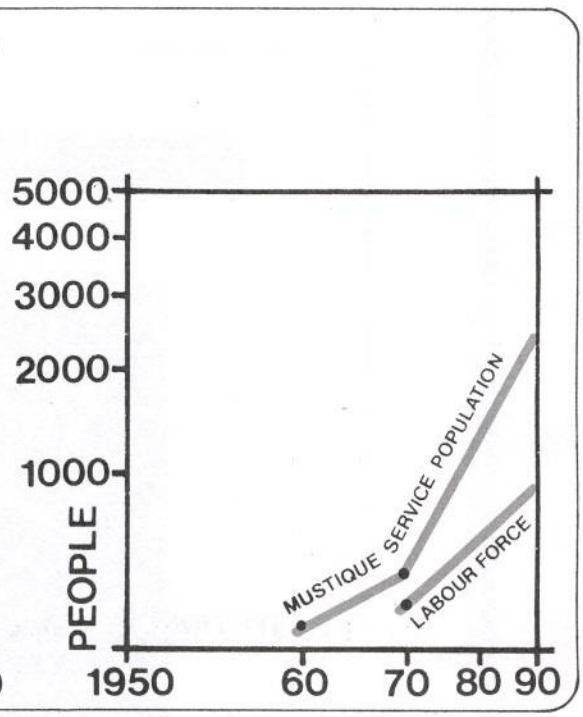


FIGURE 8:

PROJECTIONS FOR MUSTIQUE
LABOUR FORCE & DEPENDANTS

The limiting factor will however be the demand for skilled labour on the island, for which there will be some competition, since job opportunities, housing and services may be more varied in the larger islands. In order to attract skilled labour to the construction and service industries it will be necessary to offer accommodation on Mustique, related to the "end state" 1990 employment demand.

At the present time a large proportion of the labour force is not permanently housed with their families on the island. The growth of the total Mustique service population will therefore need to be more rapid than that of the Mustique labour force or that of the main island population.

The possibility of recruiting skilled Vincentians in the United Kingdom should be investigated.

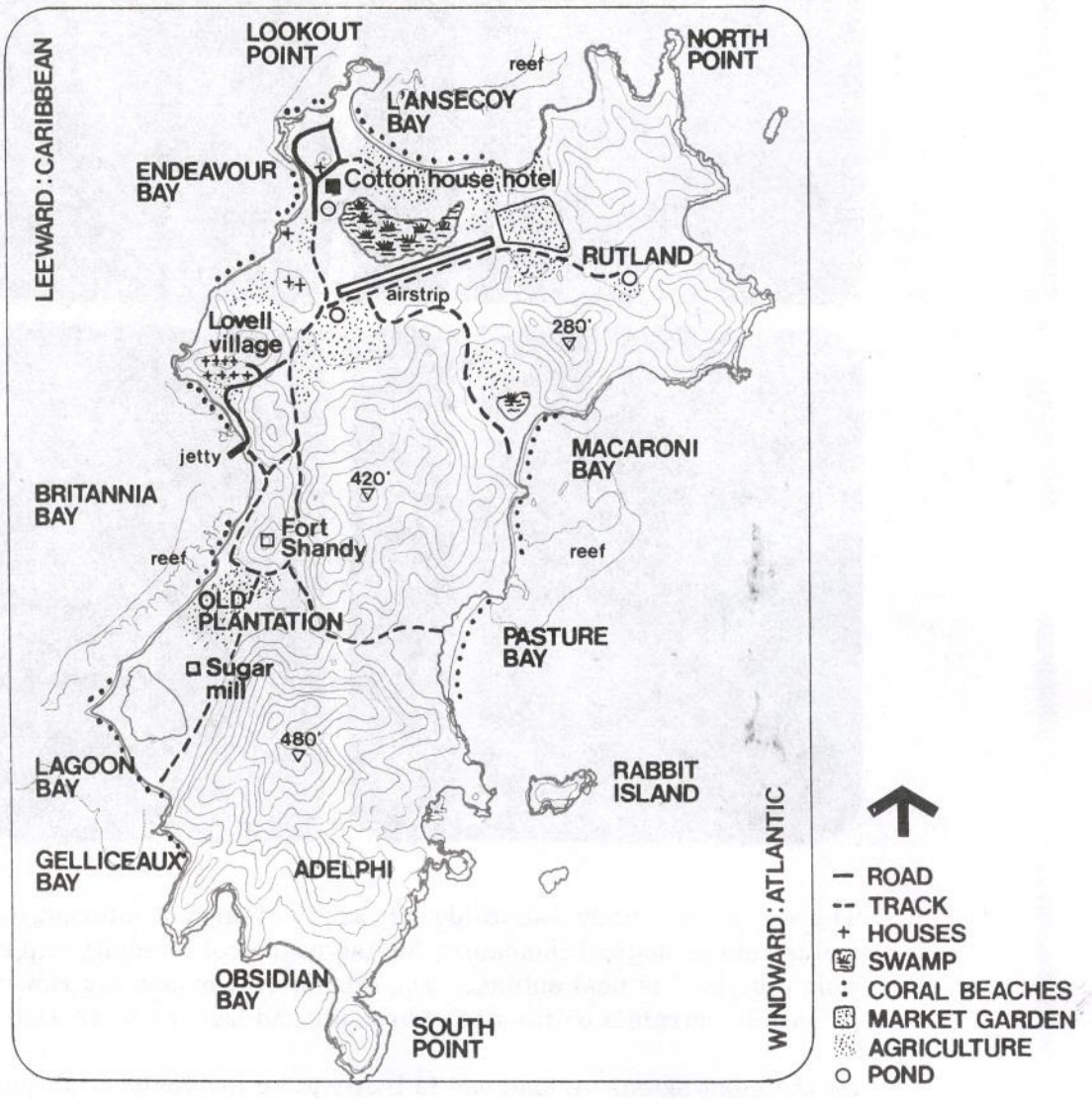
SECTION 4 : SUPPLY : THE ISLAND

Although we have found some indications from the regional demands and projections, it is the nature of the island itself that must determine the actual quality and quantity of the potential demands that should be accommodated, firstly in terms of environment, secondly in terms of service problems and costs.

The charm of Mustique derives largely from its hilly topography. These hills, acted upon by the sea and the prevailing winds have divided the island's 1400 acres into a number of distinctly different microclimates, and have given rise to a curving coastline that is long(12 miles) in relation to the area it encloses.

The variety of these separate places, with their interplay of forest, rocky headland, sandy bay and turquoise sea, creates an impression that makes the island seem much larger than it actually is. The hills also afford fine views of the white beaches and out over the neighbouring islands.

FIGURE 9 : EXISTING LAND USE



Although Mustique was cultivated extensively for sugar in the 18th and 19th centuries vegetation has re-established itself luxuriantly in all but a few of the most exposed windward areas, and there are many fine trees. (See Appendix I). Past history has bequeathed also some interesting remains and a legacy of delightful placenames.

In order to discover the most suitable use for the land and achieve the best fit between the activities of man and the natural systems, an ecological survey was undertaken (which is published in detail in Appendix 1), for it is obvious that the varied geology, vegetation and wild life of Mustique and the sea around are crucial to the attractiveness of the island.

FIGURE 10: PHOTOGRAPHIC EXAMPLES OF FLORA

The aim of this study was to identify areas of special interest for conservation, and to find ecological indicators for the degree of intensity and type of use for which the land is best suited. The effects of demands for raw materials and potential contraints on the use of beaches and lagoons were also studied.

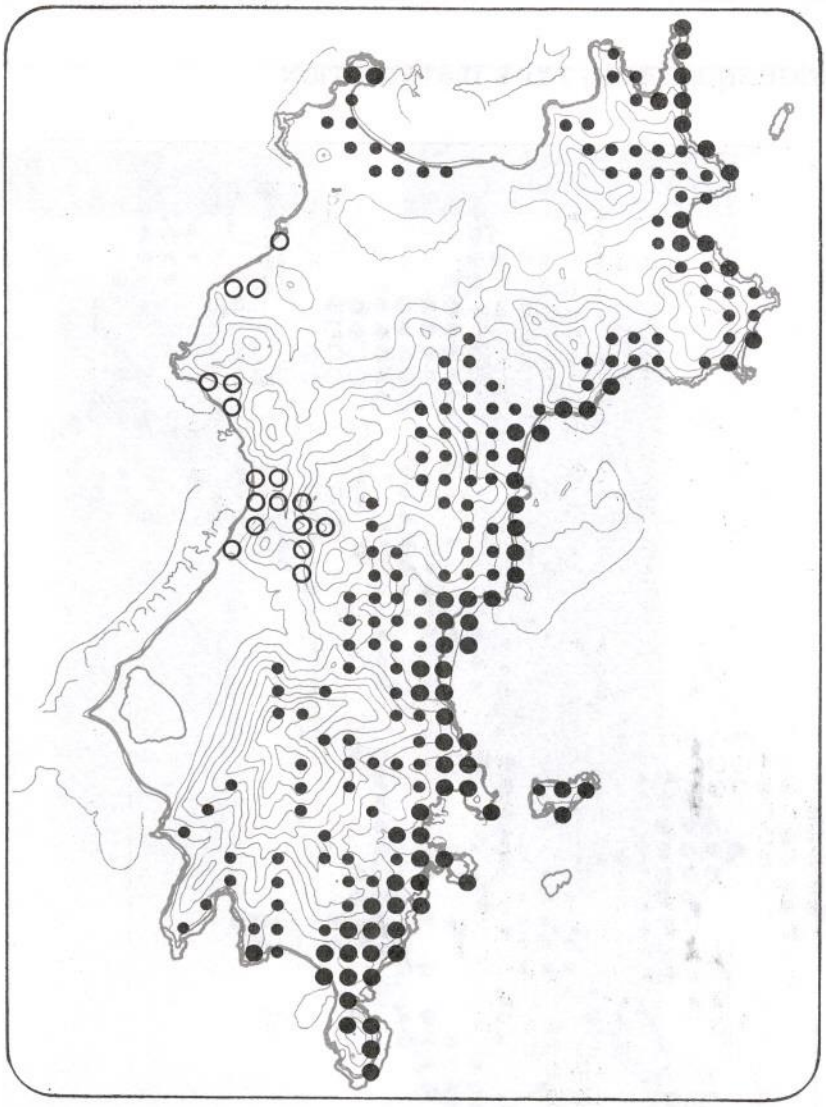
As the most extensive land use is likely to be for residential purposes it is useful to examine first the constraints on normal residential development. These were considered to be primarily those imposed by considerations of exposure, soils, vegetation, and slope.

A classification map of each of these factors was therefore prepared and then transposed onto a common base map gridded into one hectare squares so that the degree of constraint could be quantified and compared from place to place.

Wind itself can be extremely damaging and annoying due to its mechanical effects but it is even more serious when it carries sea-salt which has a desiccating and corrosive effect on a wide range of natural and man-made materials.

Salt deposition does however decline rapidly with increasing distance from the windward shore.

FIGURE 11 : RELATIVE EXPOSURE

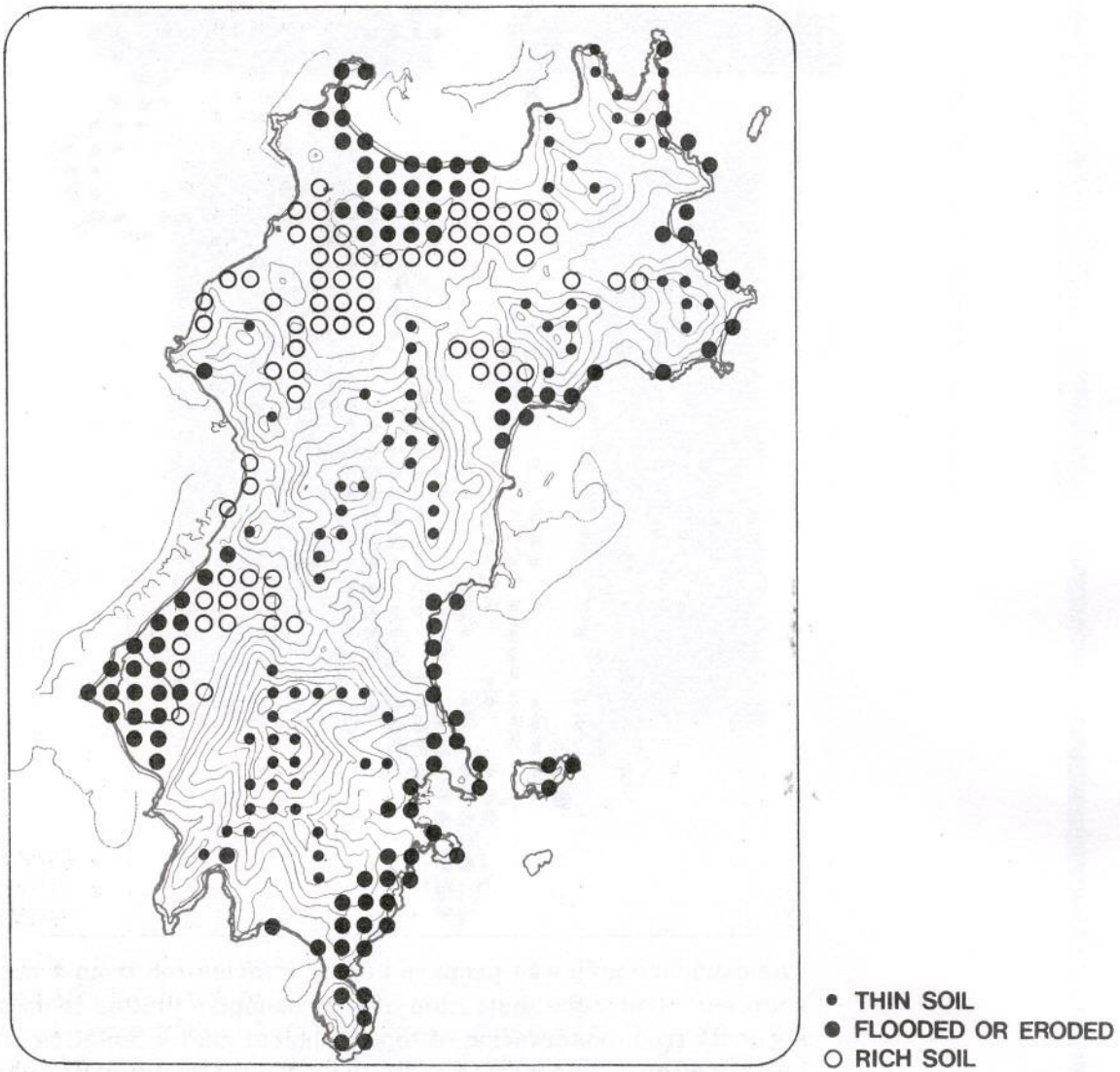


The exposure map was prepared using information from a combination of three sources; firstly the distortion of tree canopies plotted from aerial photographs; secondly from observation of topographical characteristics such as watersheds, local shelter and aspect; thirdly from the distribution of indicator species with characteristic habitats corresponding to degrees of exposure.

Apart from small areas with soils of marine origin, the soil variation on Mustique is controlled principally by position in relation to topography. Soil depth is the most obvious variable feature and it increases progressively from a few inches on the crests of ridges to several feet in the valley bottoms.

Residential development should not generally be located in areas where the soil is too thin to support gardens or is unsuitable for septic tanks, where it is difficult to excavate for service runs or in areas liable to flooding.

FIGURE 12 : SOIL TYPE DISTRIBUTION

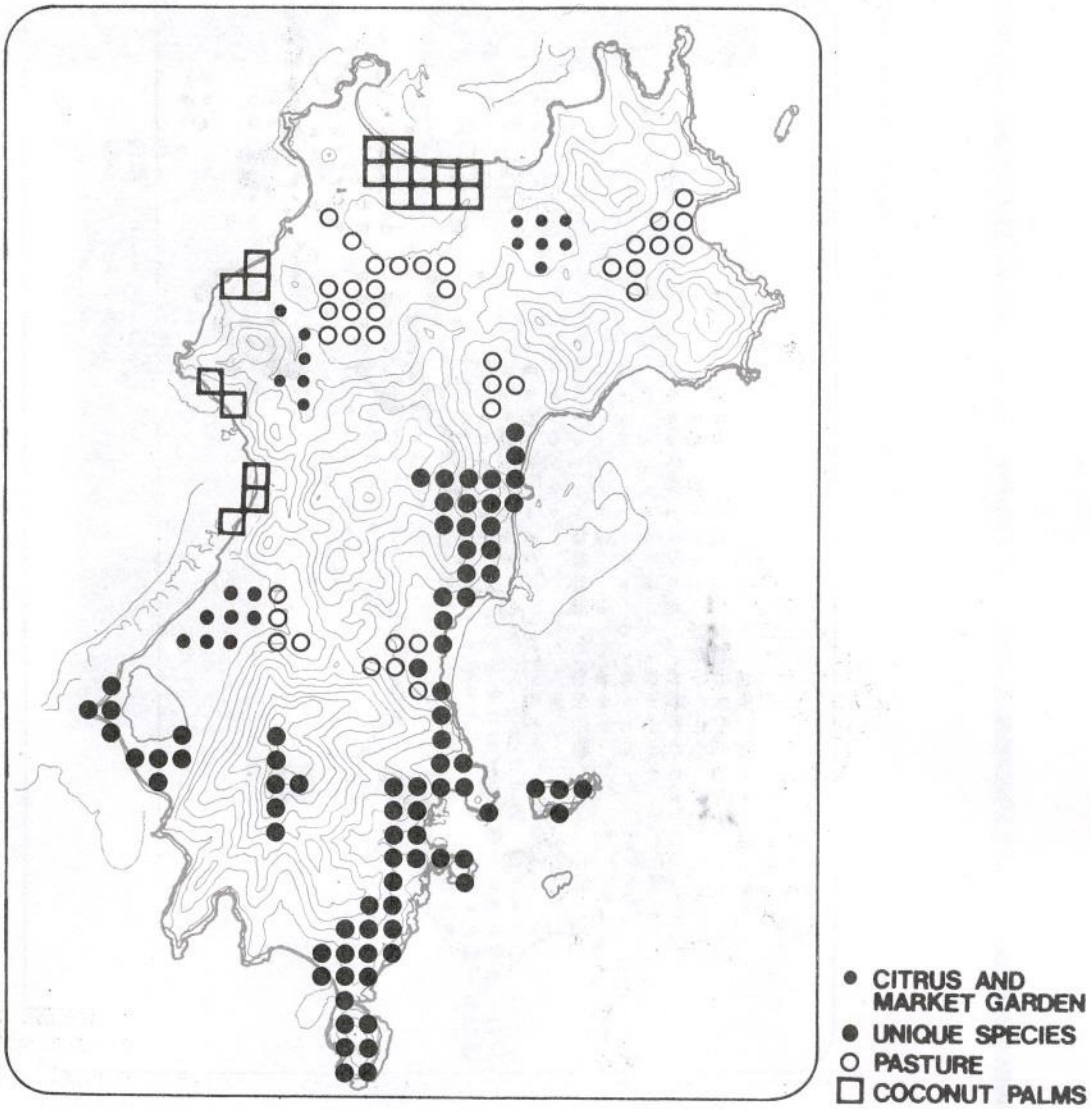


Secondary information was also derived from this map which illustrates areas too saline for even coconut palms, and areas likely to be the habitat of sandflies. (See Appendix 1)

It is necessary to ensure that no unique species or features of outstanding natural beauty are destroyed by development. Similarly the extent and variety of the vegetation on Mustique contributes greatly to the charm of the island, and must be preserved. An idea of this richness is given by the relative number of species compared to nearby islands: Bequia 375, Mustique 160, Union 49, Canouan 30.

Generally sheltered locations with the deepest soil can be expected to contain the most species, although not necessarily the most interesting ones. Basically there are three types of habitat: the recently cultivated land, the Deciduous Seasonal Forest, and the Coastal Communities. The latter are important on the windward side as beach stabilisers.

FIGURE 13: VEGETATION DISTRIBUTION



LANDUSE

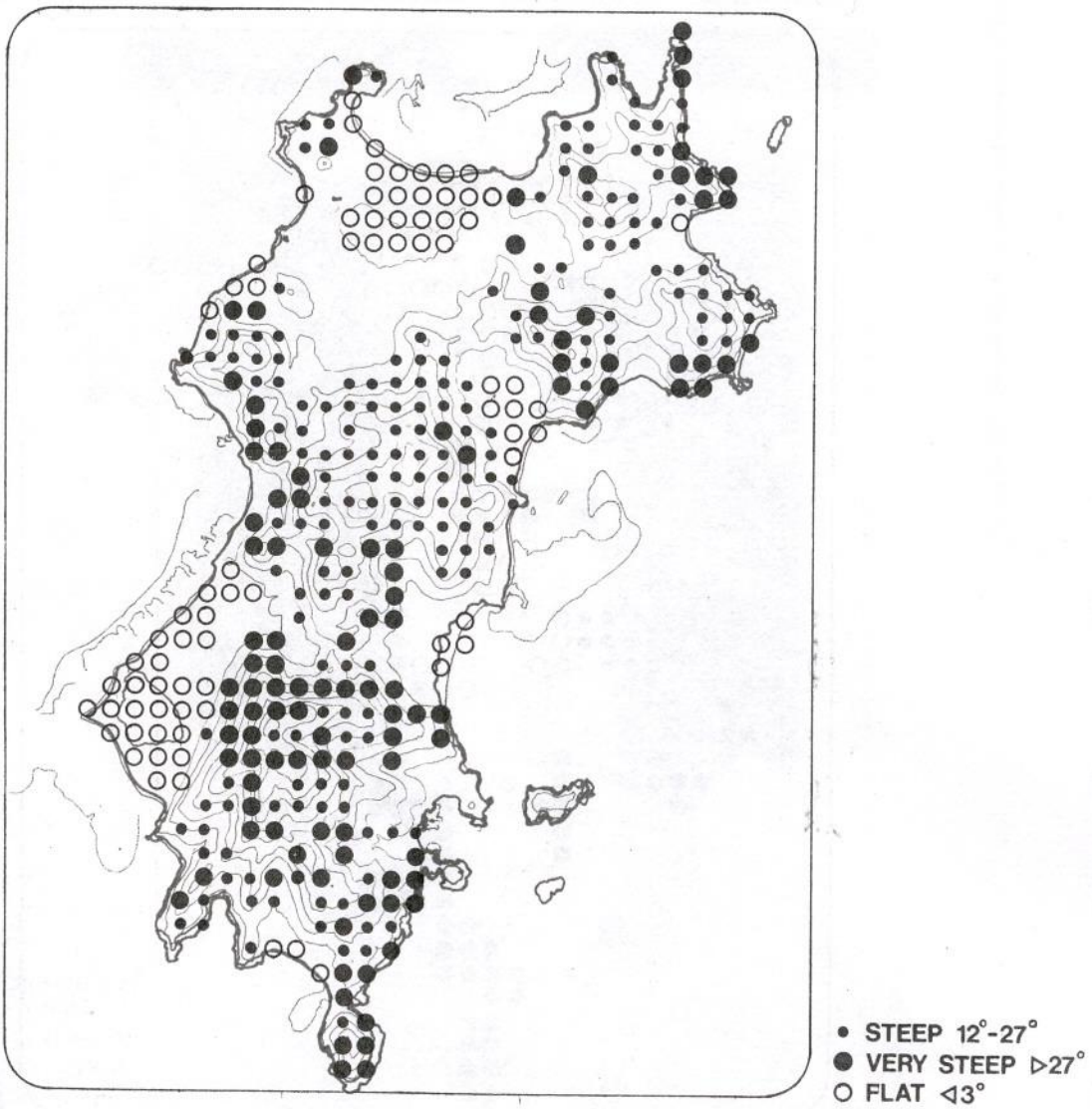
There are basically 4 areas that are recommended for nature reserves, or for very limited development; firstly the south-east corner of the island, which is exposed and liable to erosion; secondly the area above Simplicity Bay, which contains some of the best forest on the island; thirdly the south side of the lagoon and Lagoon Bay; fourthly the top ridge above the lagoon which has the finest gum trees and cedars on the island.

SLOPES

While it is certainly possible to build on even the steepest gradients, the cost of servicing and constructing normal housing on some of the slopes to be found on Mustique would be prohibitive.

Flat land is at a premium on the island for uses other than housing, and where this land is away from a beach, the lack of a view reduces its attraction for residential development.

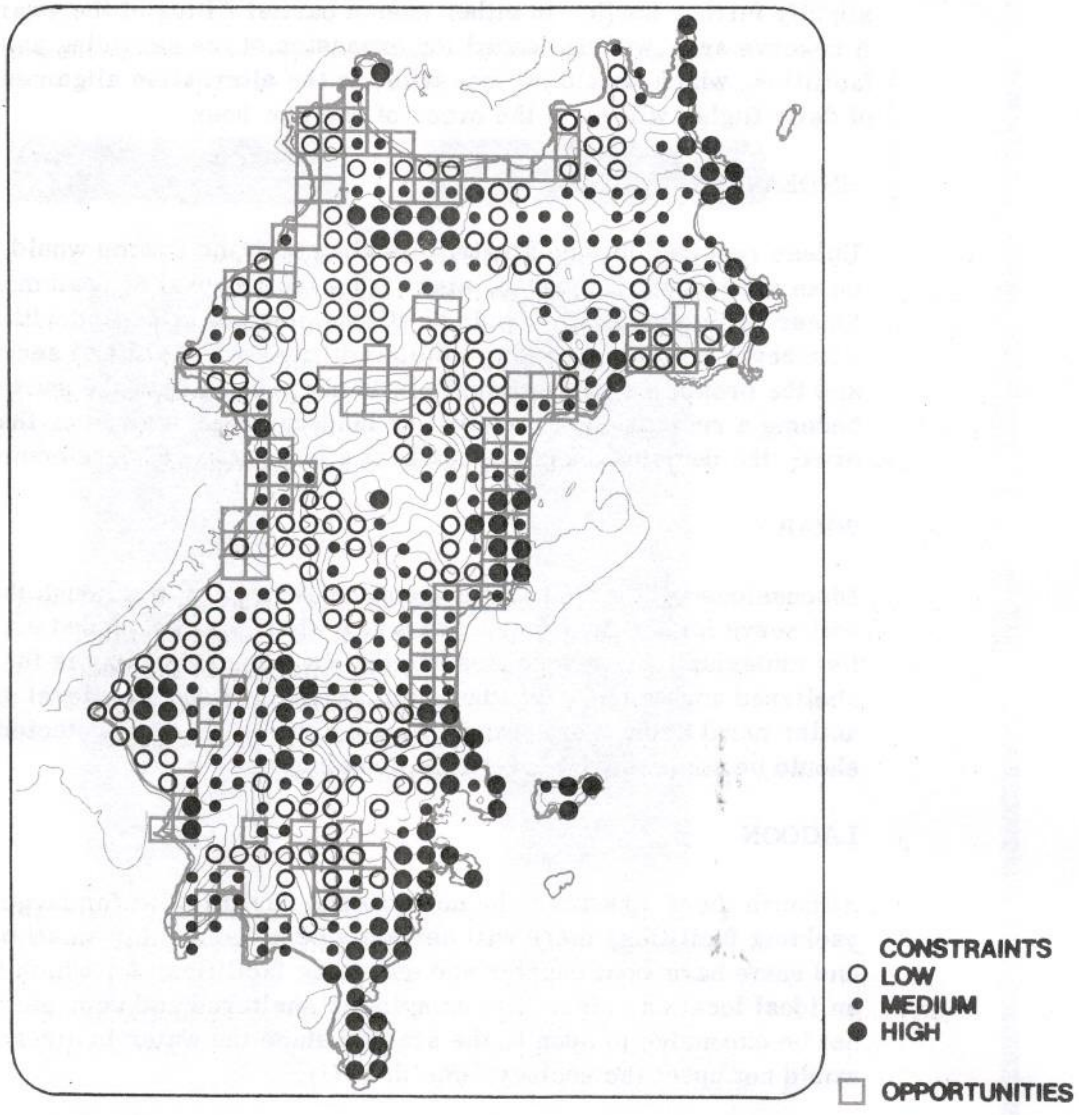
FIGURE 14 : DISTRIBUTION OF RELATIVE SLOPES



Experience both on the island and elsewhere suggests that costs rise sharply on land which slopes above 25% so the unconstrained land for housing is generally that between 5% and 25% gradient, that is less than 14° at which erosion problems become significant. (See Appendix I).

The constraints identified on the previous pages have been summarised in the map below. This does not mean that absolutely no residential development should take place in the constrained areas, but only that the most suitable areas for development are the agglomerations of unconstrained land, and that there will be additional costs and special conditions attached to developing outside these.

FIGURE 15 : RESIDENTIAL SUITABILITY



Also indicated on this map are those areas possessing special attraction for housing, such as especially fine views of the Grenadines to the north and south or over the potential anchorages, proximity to beaches, or sites with special identity such as Fort Shandy.

It is considered that where these areas are constrained the attractions of the site may outweigh the extra costs of development.

CONSTRAINTS AND OPPORTUNITIES FOR OTHER USES

There are a number of land uses that demand combinations of conditions which are rare on Mustique, and a number of features on the island with the potential for special uses. (Figure 16).

AIRSTRIP

The present alignment appears satisfactory for the forseeable future, although this will depend upon continuing discussion with the airlines. Should an alternative become necessary the only options are two alignments in the same area but with the approach slightly further north. In either case a partial filling of the swamp would be required. A reserve area will be needed for expansion of the servicing and passenger handling facilities, which should be accessible to the alternative alignment. The average number of daily flights will be of the order of one per hour.

ENDEAVOUR SWAMP

Unless required for the airstrip, dealing with the swamp would, in the short term, be an unproductive expense, apart from the removal of dead mangrove. In the longer term, the swamp could be filled, or lined and filled with sea water. Whichever course of action is followed, constructional and servicing problems and the proximity of the airstrip is likely to mean that the swamp area should become a recreational, pastoral or landscape feature rather than a residential area: the decision should be made at a later stage of development.

WHARF

Discussions with the Mustique Company suggest that although the existing jetty will serve for the next few years a new wharf will be needed eventually, with a flat hinterland for warehouses and depots. Britannia Bay is the deepest and most sheltered anchorage, Old Plantation the main reserve of level ground. The fine antler coral below Fort Shandy must be preserved and protected, so the wharf should be somewhere between the Fort and the lagoon.

LAGOON

Although there appears to be no economic justification for large scale terminal yachting facilities, there will certainly be a demand for small boat anchorages and some bare-boat charter and servicing facilities, for which the lagoon offers an ideal location, since it is completely sheltered and very picturesque. It will not be expensive to open to the sea and since the water is already saline this would not upset the ecology. (Smith 1971).

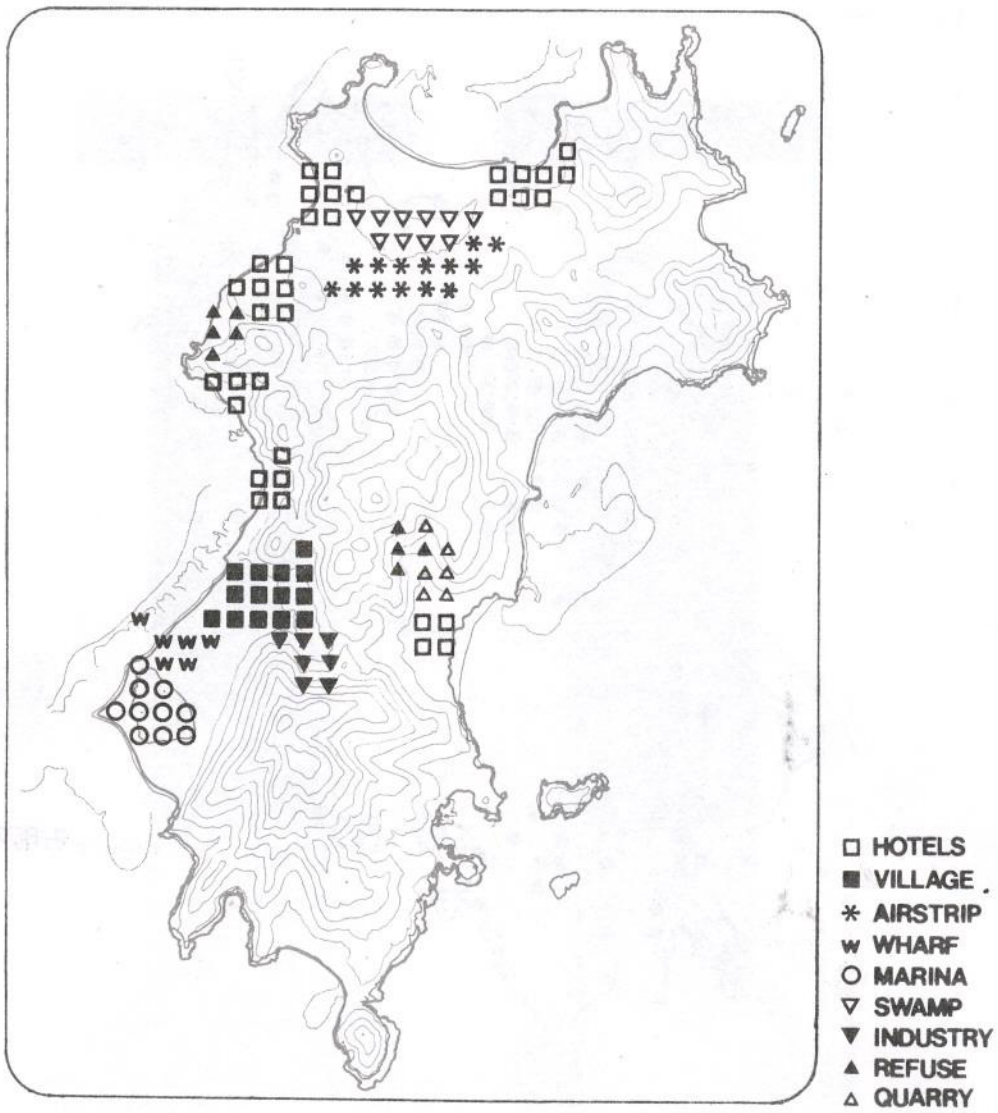
HOTELS

It is considered by the Mustique Company that the hotels on Mustique will be small and mainly of the extensive chalet type, related to beaches in such a way as to create a sense of enclosure. A number of possible sites suitable for this form of development have been located, as well as one for a more intensive hotel/ condominium development at Hermitage.

Historically the settlement has been kept off agricultural land, and the present site of Lovell village is not considered good enough, since the area is restricted, steep and expensive to service, and too exposed for easy domestic gardening. The village should therefore be relocated.

The new location for the village should be the most extensive area of easily serviced land near the centre of the island. Old Plantation has all these advantages, with good soil for domestic produce and tree cover.

FIGURE 16: NON RESIDENTIAL CONSTRAINTS AND OPPORTUNITIES

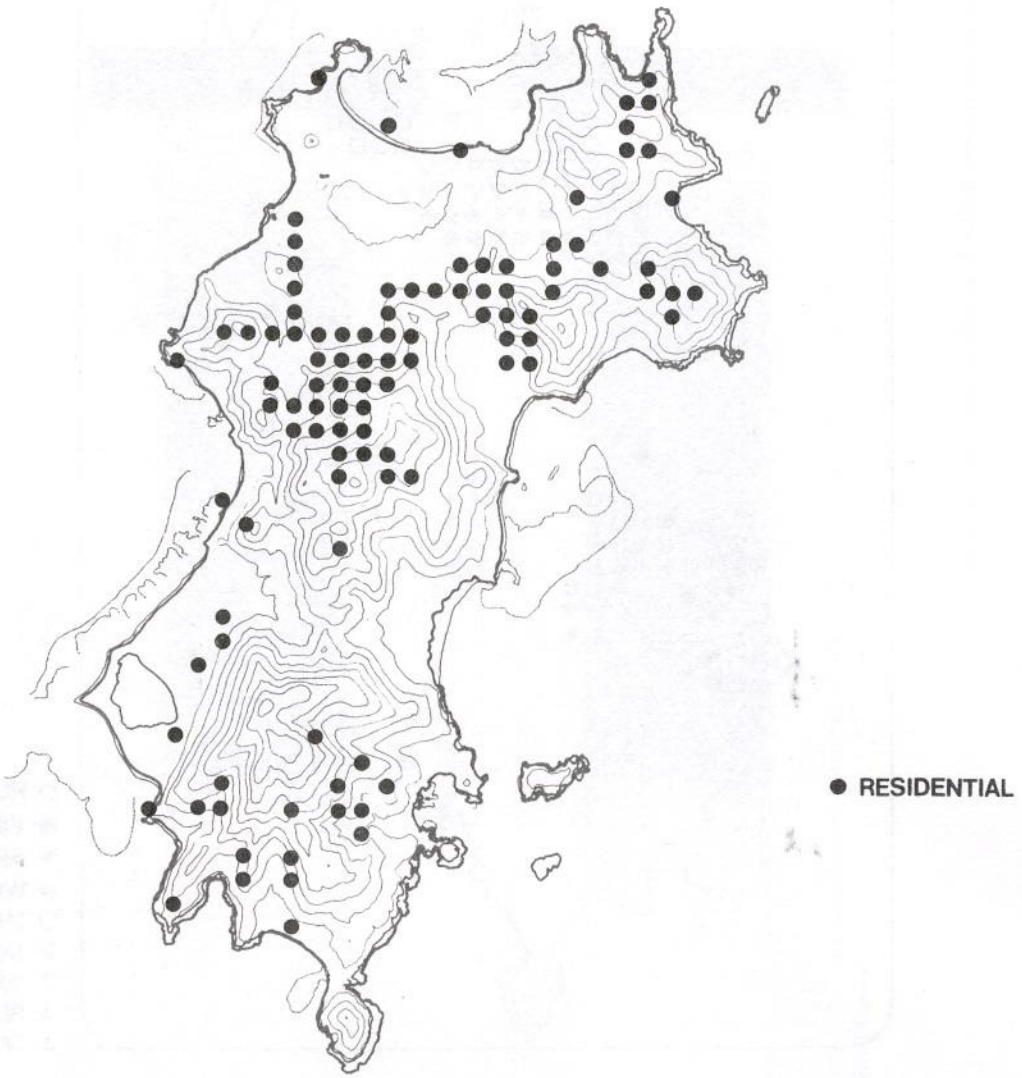


SERVICES

A site will be required for a main aggregate quarry and for refuse treatment. One option is to combine the two in the north re-entrant of Pasture Bay, where the feasibility of a quarry is currently under investigation. The spoil could be used to cover refuse and form terraces. This location is both sheltered and unobtrusive, but should a site be needed for refuse incineration the re-entrant between Plantation Bay and Lovell village offers a more suitable enclosed, leeward location, and despite the cost of road access should be reserved for this, or a similar eventuality.

By superimposing the constraints and opportunities maps a pattern of suitabilities is generated. The area of land indicated as residential on this map is less than that likely to be required for sale, because it does not include all land to be developed at the very lowest density where the size of the sites will be such as to enable the landscape to absorb the houses.

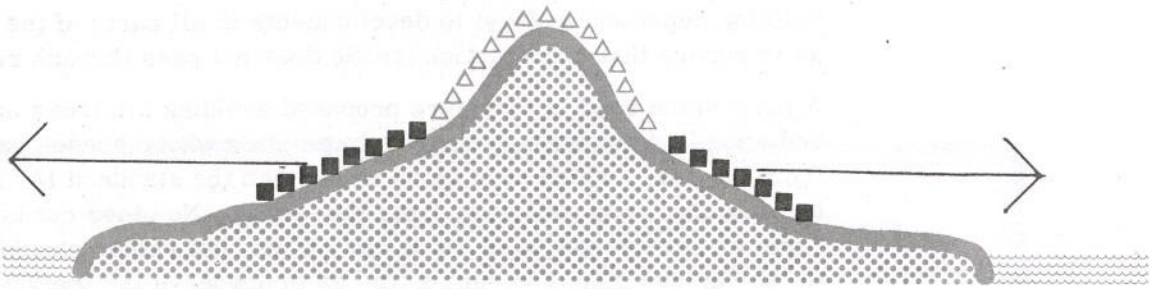
FIGURE 17 : LAND USE SUITABILITY



The manner in which these suitabilities are utilised depends upon the form of the landscape and the road systems, which are discussed in the following pages.

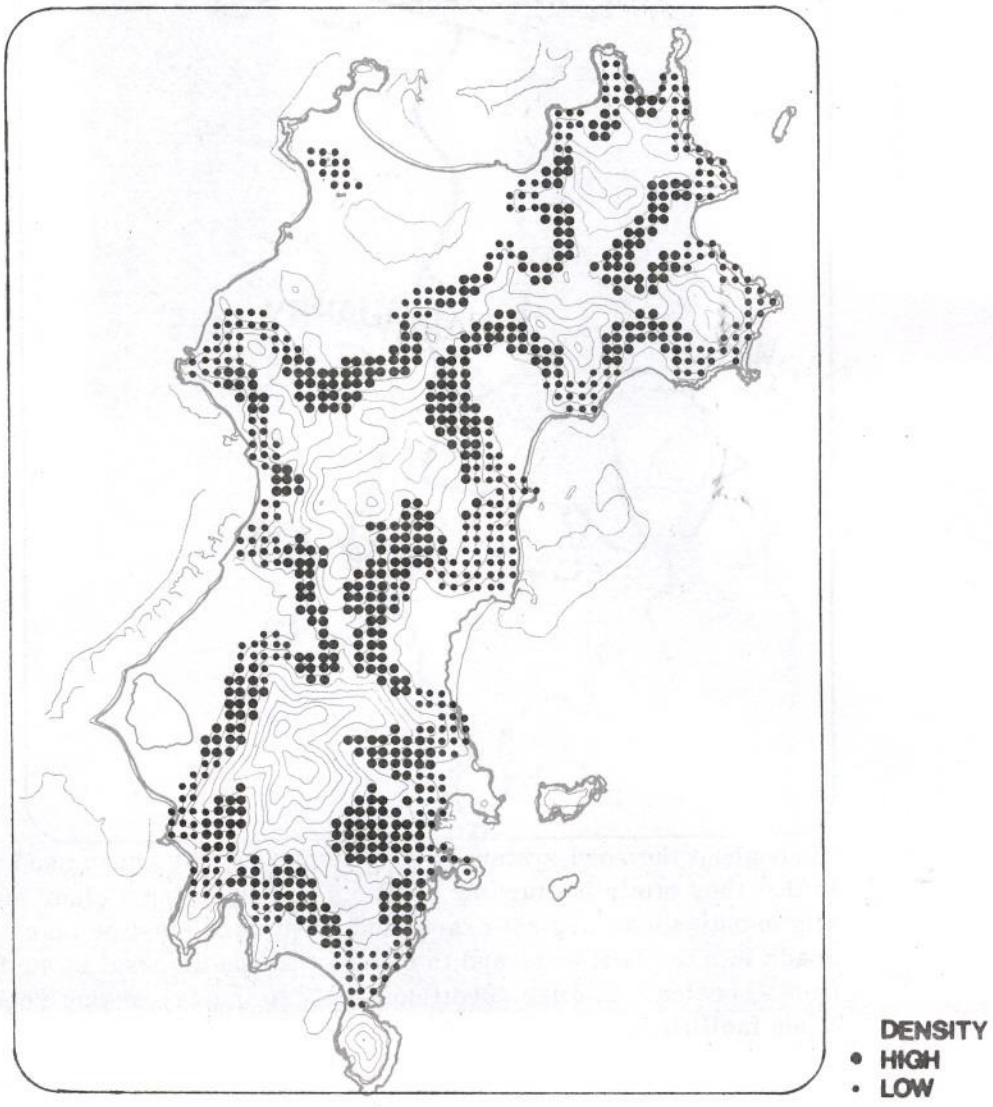
Apart from next to the beaches, the best location for housing is on the gentle lower slopes of the hills, where there is both a breeze and a sea view.

FIGURE 18: TYPICAL SECTION : VERTICAL LOCATION OF HOUSING



But because of the need to preserve enclosure and a sense of the separateness of places not only should the skyline of the hilltops be kept free from buildings, but even on the sideslopes of promontories development should be restricted to the minimum. This principle generates a pattern of development where densities are low with large sites on the headlands, and more intense housing clustered on smaller sites in the re-entrants.

FIGURE 19: HORIZONTAL DISTRIBUTION

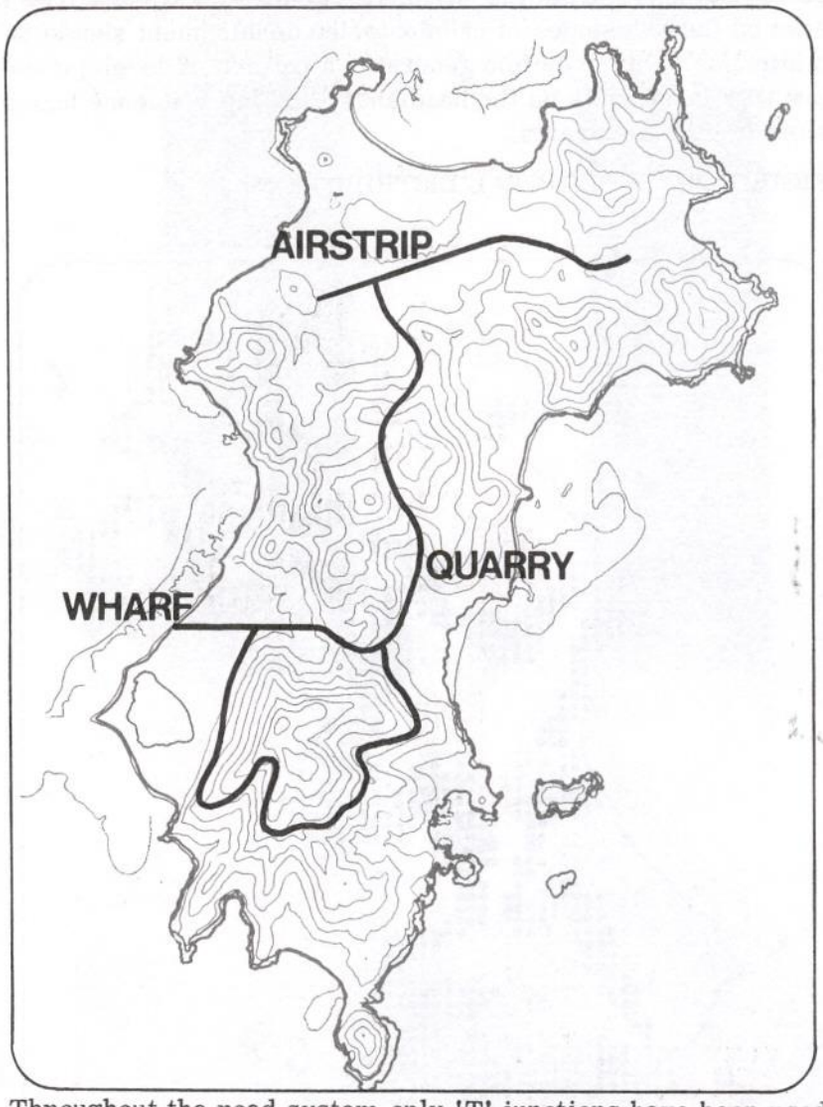


To keep down the costs since development is extensive, all roads will in principle be frontage roads since traffic will be light (15 miles of road carrying only about 800 vehicles) and vehicle size and type can be controlled by keeping large cars off the island and operating an efficient taxi service.

But there will be a need to link major sources of construction materials (wharf, building depot and quarry) to developments in all parts of the island in such a way as to ensure that construction traffic does not pass through residential areas.

A main spine road is therefore proposed avoiding all areas of more intensive use, and affording access only to very large sites where houses can be set well back from the road, which need be no wider than the standard 18 feet. It is proposed to route this road well away from the coast. No other roads should allow a too rapid circumnavigation of the island either, but rather should form culs-de-sac to the various places in such a way as to preserve the feeling of their separateness.

FIGURE 20: MAIN ROAD SYSTEM

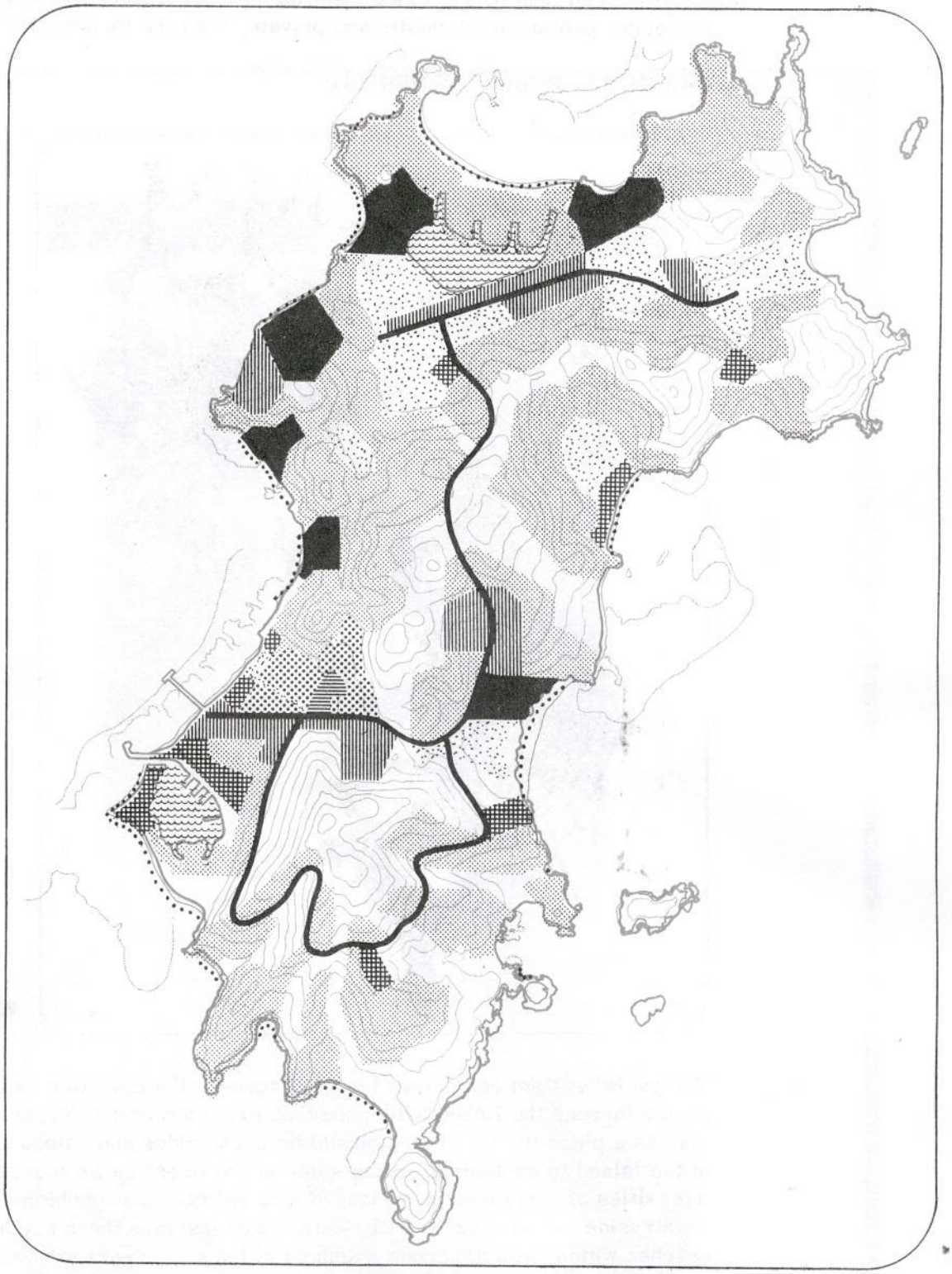


Throughout the road system only 'T' junctions have been used since they are safer in that they minimise turning conflicts and establish a clear right of priority. The alignments shown are not exact, and great care must be taken both to integrate the roads into the landscape and to ensure that the disposal of surface water does not cause erosion. Similar conditions apply to the carparking required at beaches and other facilities.

SECTION 5: LOCATION OF DEVELOPMENT

Careful consideration of the ecological suitability grid, formal constraints and special opportunities described in the preceeding pages has given rise to the physical land use plan below. The main elements of this plan are described in the following pages.

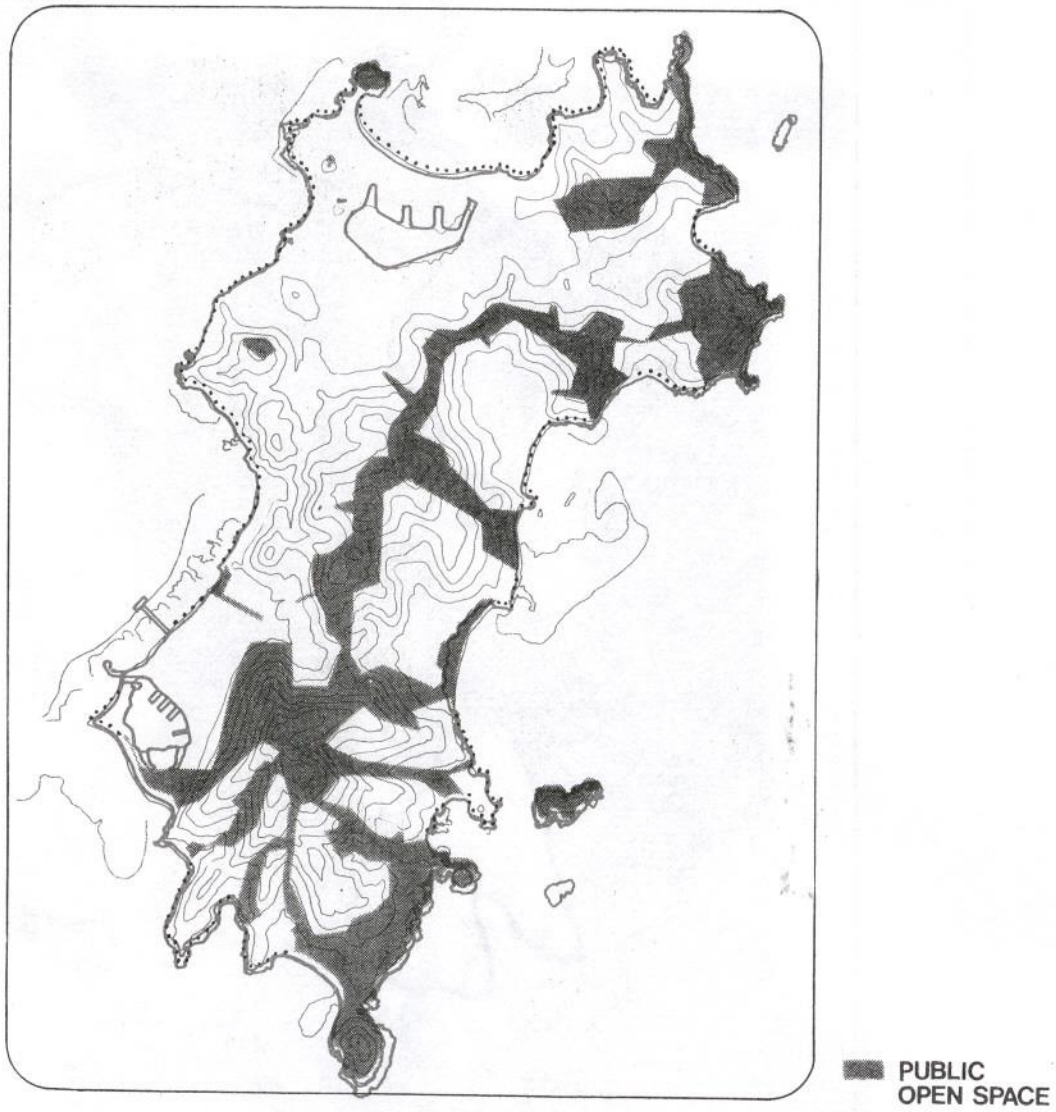
FIGURE 21: LOCATION OF LAND USES 1990



The individual who purchases land will require services that will be in the first instance supplied by the Mustique Company through partly owned subsidiaries, or other agencies, whose land may be considered as semi-public. There will also be a public open space system consisting of beaches and wildscape so that the island can be experienced as a whole by visitors and residents.

The Plan can thus be seen as consisting of three different interlocking ownership systems; public, semi-public and private, with the former two servicing the latter.

FIGURE 22 : PUBLIC OWNERSHIP

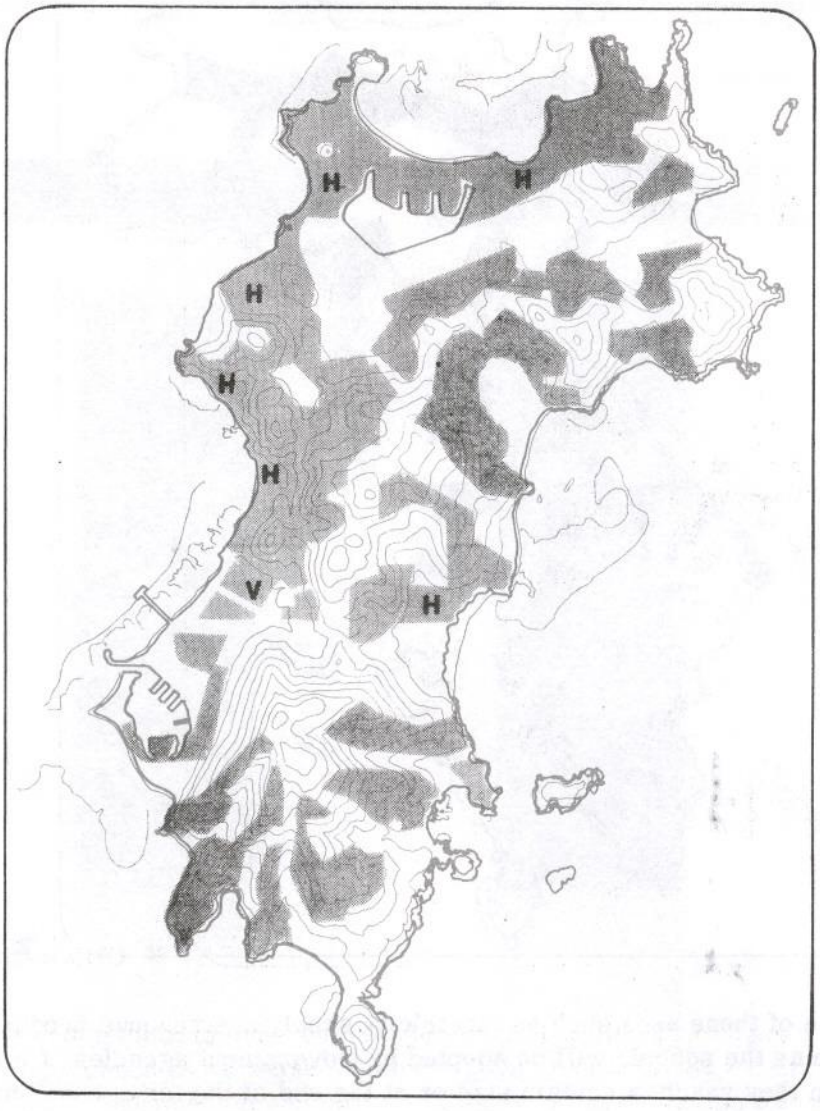


The public system comprises the road access, the coastline, and the environmental routes through the linked wildscape that serves not only to separate other places but also as a place itself. There should be horse rides and nature trails from one end of the island to another affording some of the finest views from the hilltops. At the intensities of development envisaged it is unlikely that problems of overuse of the countryside for recreation will result. For instance there are about 15 acres of beaches which, at a generous standard of $10m^2$ per person* could absorb 6,000 people at a time!

* UN MASTERPLAN FOR HVAR 1968

Residential land offering a range of prices and characteristics should be available at each stage in the growth of the island. The proposed use of housing areas only one road deep, besides having environmental advantages is also extremely flexible since there is tolerance on both sides to develop in greater depth. The question of parcellation is dealt with later in this report.

FIGURE 23 : LAND FOR SALE

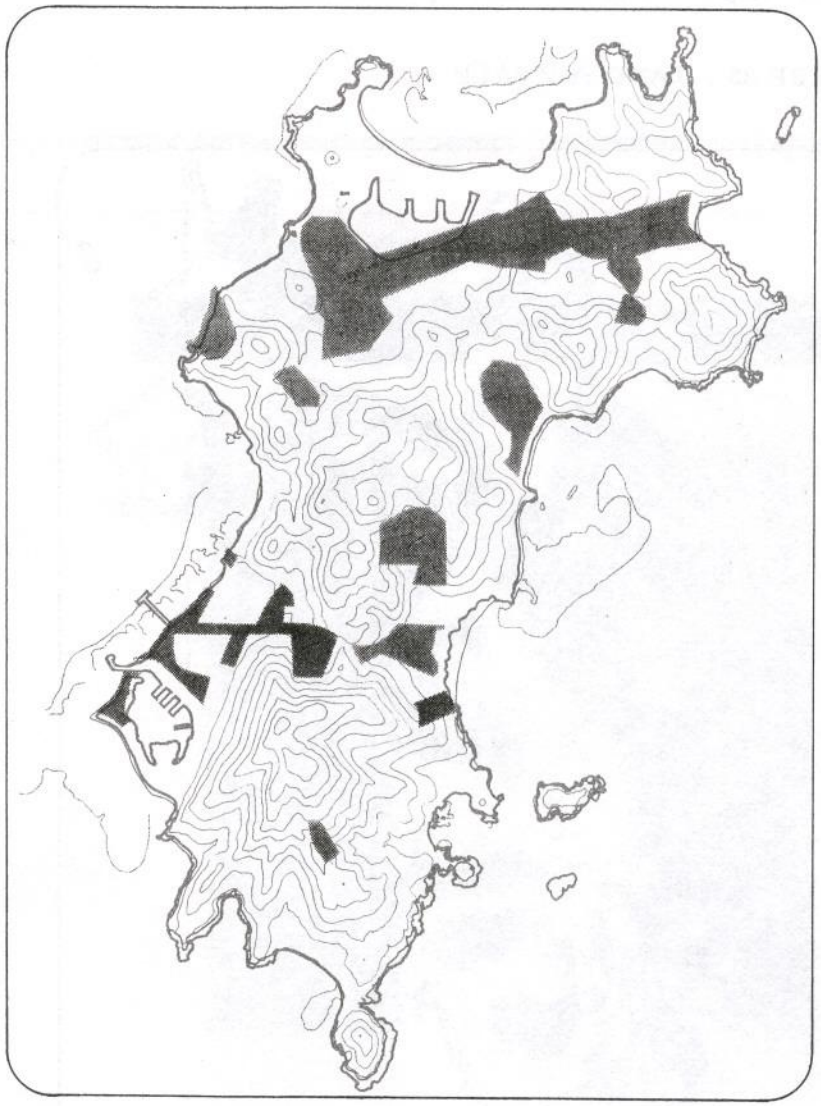


It is proposed that on Mustique there may not be any great formal difference between hotels and housing, since the private rooms of the hotels take the form of clustered short-rent houses, and the public rooms serve as facilities for non-residents of the hotel and visitors from other hotels.

SEMI PUBLIC USES

Land retained by the Mustique Company for the provision of services occupies a good part of the area of the island, about 200 acres.

FIGURE 24 : OTHER USES



Some of these uses, such as electricity supply are, revenue producing and some, such as the school, will be adopted by Government agencies at a later date, either when they reach a certain size or at the end of the tax agreement.

The areas shown have not been precisely calculated. They represent land retained by the company which will allow them to keep their options open until more information is available. For example, the land actually needed alongside the wharf related to the area further up the re-entrant will depend upon handling and storing techniques which cannot be decided at the present time. However, it is clear that both locations may be needed and the plan will serve as a basis for decision making as, for example, in the current discussions with Texaco.

Having looked at the limiting factors in terms of the extent and location of development it is possible to examine the question of intensity of use. Here the two critical parameters are the demands of the market for dwellings and sites of different sizes and costs, which must be balanced against the need for services.

While it is not easy to forecast precisely the demand, it is certainly probable that a good proportion of smaller sites could be sold. However, it is to the more exclusive market that Mustique is best suited and also least likely to be in competition with the neighbouring islands.

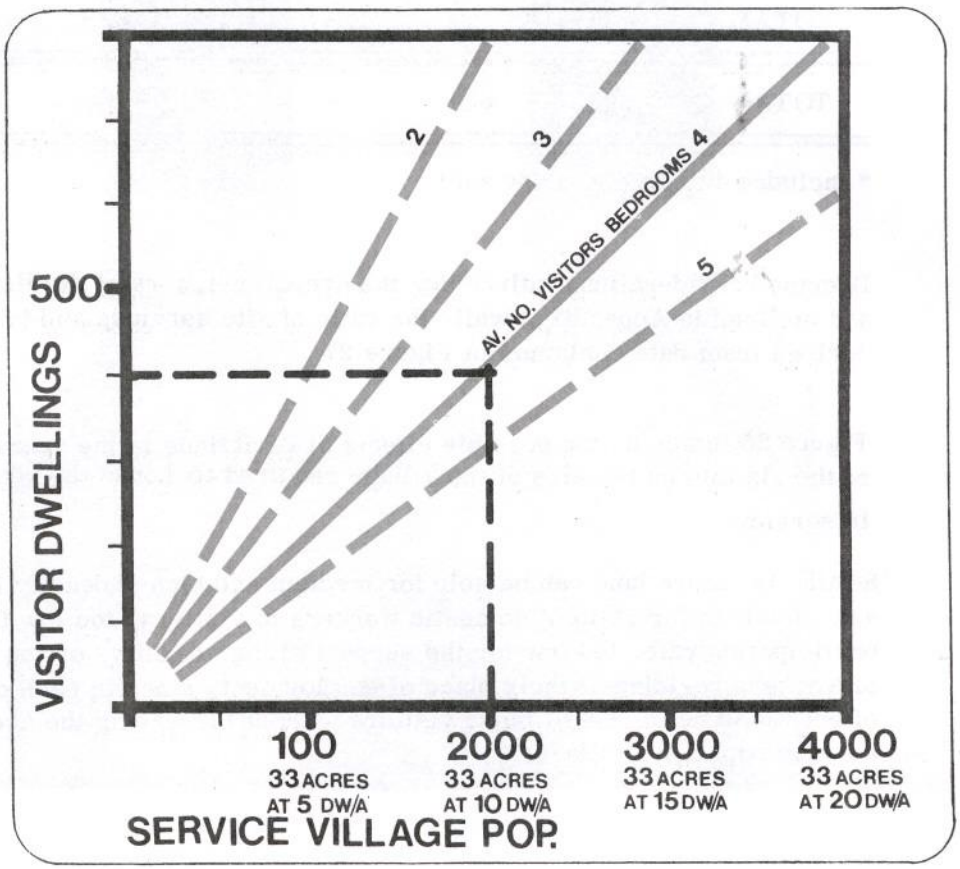
With regard to services, since the cost of providing large catchment dams and storage facilities is as great as that of desalination without a comparable certainty of supply, it is unlikely that water represents a major threshold.

The only factor that increases dramatically in proportion to the quantity of tourist development is the size of the local population employed in services, until a point is reached at which demands for land for the support village begin to cut into either land required for wildscape or for tourist development.

At Old Plantation there are about 33 acres of land suitable for the village. Discussions with CDC suggest that this housing will in general require plots of about 3000 square feet (sites 12 metres by 24) which, at the resulting density of 10 dwellings per acre, would allow 330 dwellings.

At a household size of 6 this would give a village population of about 2000 people, although no precise data is available for this and further study will be needed.

FIGURE 25 : SERVICE VILLAGE AREA RATIOS



The proportion of visitors dwelling types which, coupled with the number of hotel rooms suggested, would give both a balance of housing opportunities and an optimum level of support population, is shown in the following table.

FIGURE 26 : HOUSING MIX 1990

sites	dwellings	area acres	bed rooms	total bed rooms	people per dwelling	people	people per acre net
3 acre	100	300	6	600	9	900	3
1 acre	100	100	4	400	6	600	6
0.5 acre	100	50	3	300	4	400	8
1/16 acre	100	6	2	200	3	300	50
TOTAL	400	456*	(3.75)	1500	(5.5)	2200	4.85
Hotels		90	220		50	315	
Commerce		22	-	-			
TOTAL		568				2515	
Service Population village	330	33	-	-	6	2000	
hostel	-	-	-	-	-	50	
staff in sites	100	-	-	-	6	600	
TOTAL	430	-	-	-	-	2650	
TOTAL	830	600	-	-	-	5165	

* Includes 42 acres already sold.

Demand considerations influencing the overall numbers of dwellings and hotel rooms are outlined in Appendix II while the ratio of site services and bedrooms have been derived from data contained in Figure 27.

Figure 25 indicates the possible effects of variations in the average household size of the visitors on the size of the village required to house the population working in services.

Similarly, more land can be sold for medium and higher density if these estimates are: too high for ratio of domestic workers to visitors, too low for the employment participation rate, too low for the support village density, or too low for the number of workers residing at their place of employment, since in each of these cases the effect would be to permit more visitors without increasing the area needed for the service population village.

The actual build-up of the labour force required for this mix of dwelling types is shown on the table below.

The effects of seasonality have been ignored in this table since they are hard to determine in an economic climate where a seasonal job is currently considered sufficient to provide support for the year, supplemented by casual employment, fishing or growing ones own food.

It is however clearly desirable from everyones point of view to maximise off-season trade, and indeed considerable success has been achieved in Puerto Rico and even Barbados where off-season has reached 66% of on-season. The development of craft industries and the phasing of construction work can also help to even out the employment peak.

FIGURE 27 : SERVICE POPULATION 1990

Residential	1,500 bedrooms @ 0.35 ø	=	525
Hotels	350 bedrooms @ 0.5 *	=	175
Other services	@ 7% pop. (2,410) ¤	=	170
Construction	@ 12.5% LF ¤	=	130
TOTAL			1,000 workers

Housing Demand

Assume 75% of the construction workers at 1990 are settled (50 in hostels) ¤		
So 920 workers @ 35% participation	=	2,600 people
Assume family size of 6 ¤	=	430 dwellings
Area available at Old Plantation	=	33 acres
Assume gross density of 10 dw/acre +	=	330 dwellings

So assume 100 families live in low density residential areas or other places of employment

* Zinder 1969. ø Mustique Company. ¤ Llewelyn-Davies Weeks Forestier-Walker & Bor assumption. + CDC

It will be essential to monitor the accuracy of these assumptions and projections if a suitable balance is to be achieved. As they are presented here they tend to reflect the maximum likely ratio of service population to visitors.

The amount of land available for the various uses has been quantified and is shown on the following table.

FIGURE 28 : LAND USE BUDGET (acres)

	1970	1990		
	Total	Net Acres	Total	%
Residential	42			
3 acre		300		
1 acre		100		
0.5 acres		50		
1/16 acre		6		
Staff	1	4	460	
Hotels	6	88		
Commerce	-	20	108	40
Wildscape				
hills	1197	444		
lake	17	17	461	
Recreation				
lagoon	18	18		
golf		30		
beach	16	16		
horses	23	23	87	39
Agriculture	30			
citrus	3	12		
pasture	20	16		
market gdn.	16	16	44	
Services				
roads		140		
village	5	28		
quarries	1	14		
industry		15		
airstrip	11	18		
wharf		4		
garbage	1	9		
reserve		10	238	21
TOTAL	1400		1400	

These figures are not regarded as absolute fixes but rather as a general guide and as a display of gain and loss as changes occur over time, so that if more land is required for one use the effect on other elements can be seen.

The application of the densities from this budget to the land use location map, taking into account the criteria established on page 20, led to the preliminary outline parcellation strategy for 1990. This is illustrated in the physical proposals map below. The immediate action plan, described later in this report, uses these 1990 proposals as the desirable end state.

FIGURE 29 : PHYSICAL PROPOSALS 1990

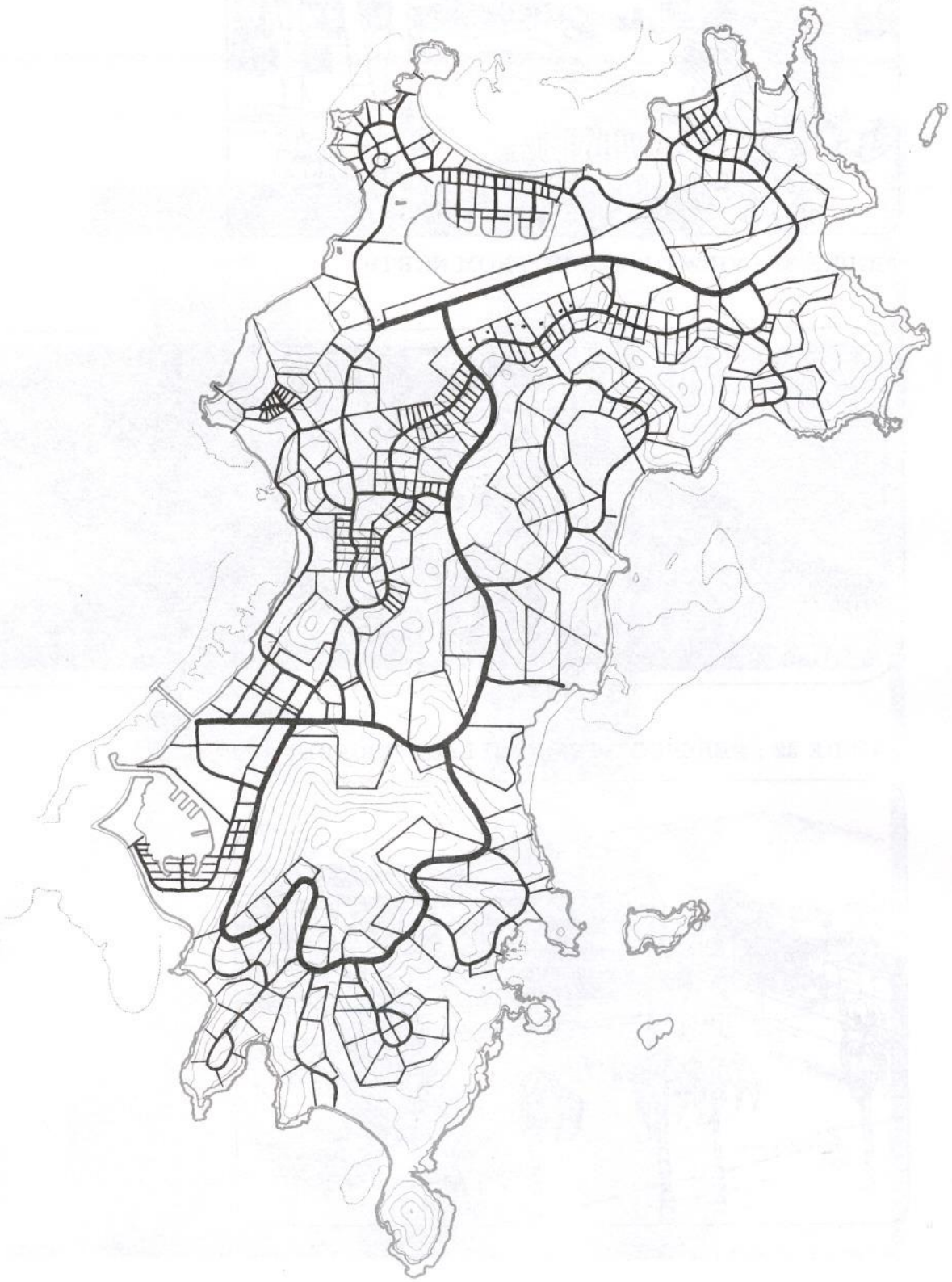


FIGURE 30 : PERSPECTIVE OF MARINA

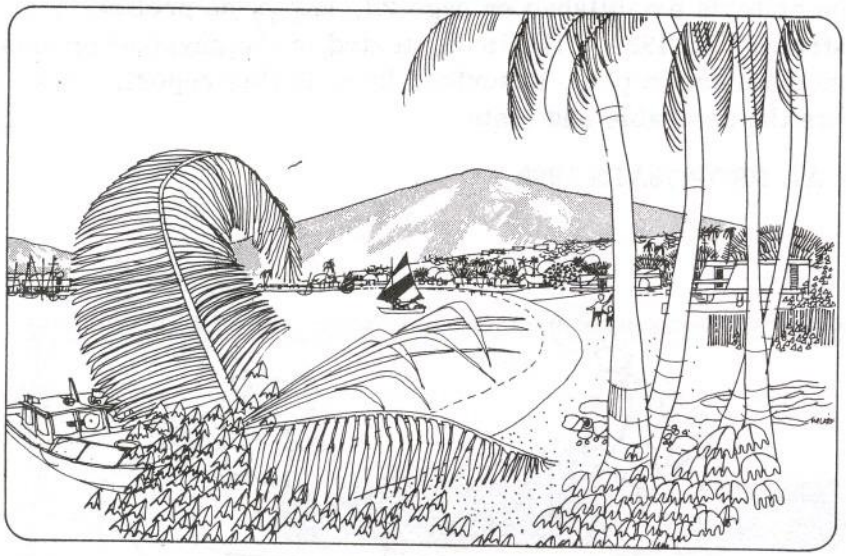


FIGURE 31 : VIEW OF MODEL FROM NORTH

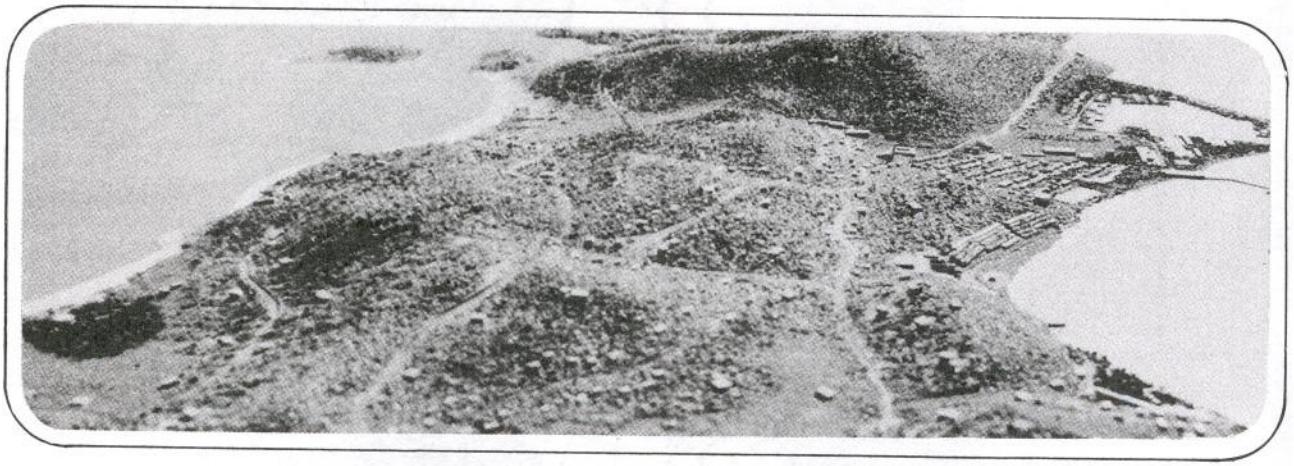
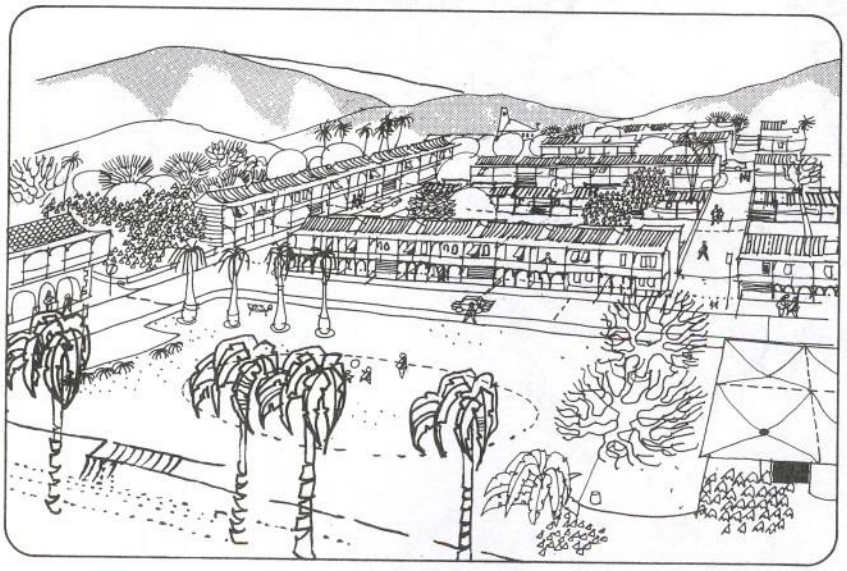


FIGURE 32 : PERSPECTIVE OF VILLAGE SQUARE

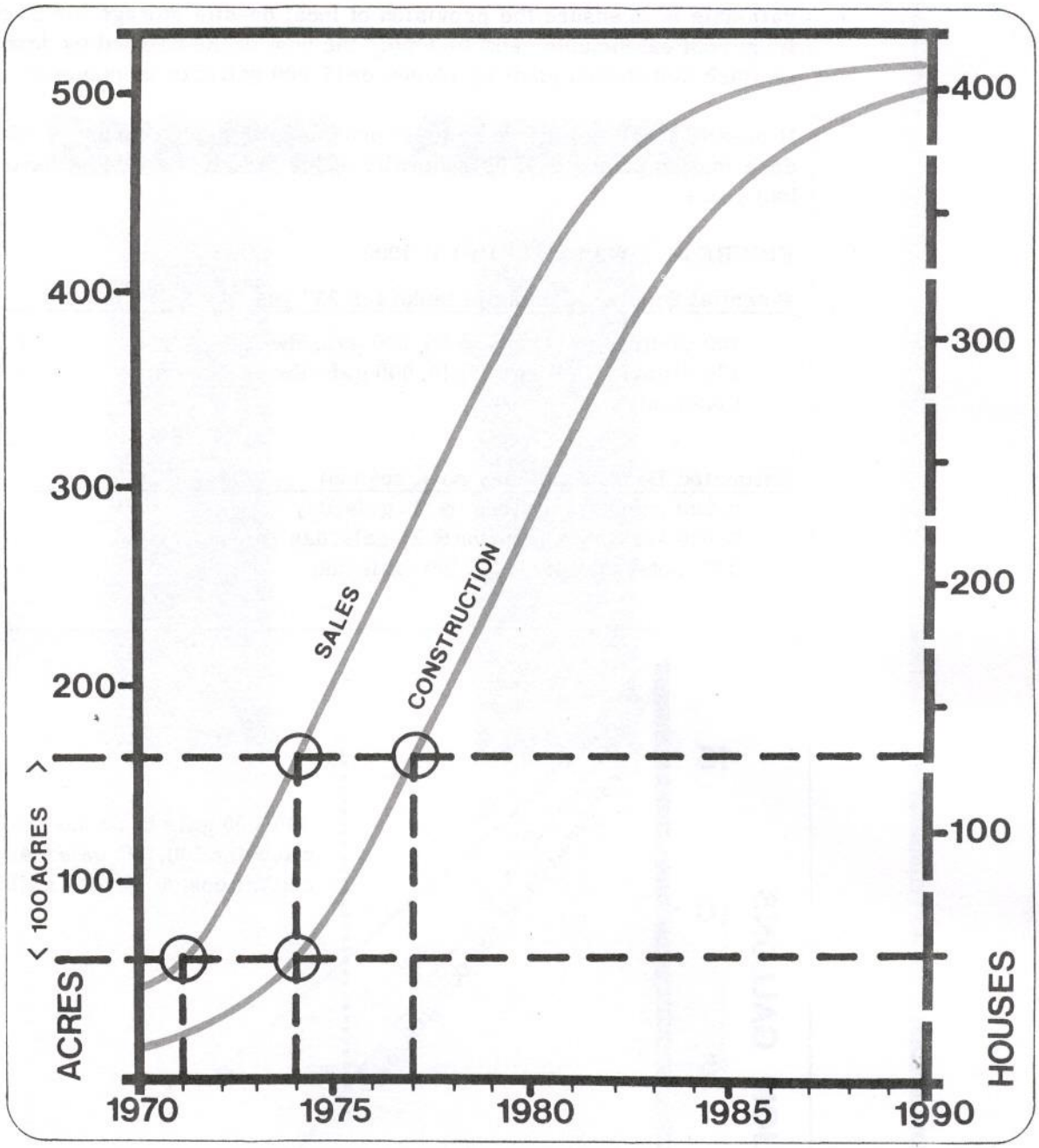


SECTION 6 : COSTS OF DEVELOPMENT

In order to complete the development within the 20 year limit of the tax agreement, the main land sales programme should be implemented by 1985. There will always be a timelag between selling a plot and completion of construction. Demand for services will also be delayed until occupancy.

The following graph shows in principle how these relationships could affect the rates of selling and housebuilding when allowance is made for a period of run-up to the programme and phasing out at the end.

FIGURE 33 : RATE OF DEVELOPMENT



The inflow of capital will depend upon the rate of sale, which must average 30 acres per year with a maximum of about 40 per year from 1974 to 1982. The monitoring of the sales programme is crucial to the success of the resulting cash flow.

The demand for services will depend upon the rate of construction, which must average 20 dwellings per year, with a maximum of 30 per year from about 1976 to 1986.

One of the main development costs will be that of providing for an adequate supply of fresh water. A number of studies have been carried out (see Appendix I), and the consensus of expert opinion is that covered reservoirs to store run-off from large catchments are not a practical proposition, that boreholes would be abortive, and that wells have only a very limited application. It is also clear that the danger of contamination to drinking water from septic tanks limits the areas that can be used for catchment.

In the long term desalination appears to be the only safe alternative, and capital costs compare favourably with those for provision of storage. The most fruitful rationale is to ensure the provision of local on-site storage for 25 inch/year run-off from roof catchments, and to supply the rest of the demand by desalination, building up flash distillation plant by 10,000 or 15,000 gall/day increments.

If on-site local storage were to be provided for the maximum rainfall years the desalination plant would be generally under used since it must have the capacity for bad years.

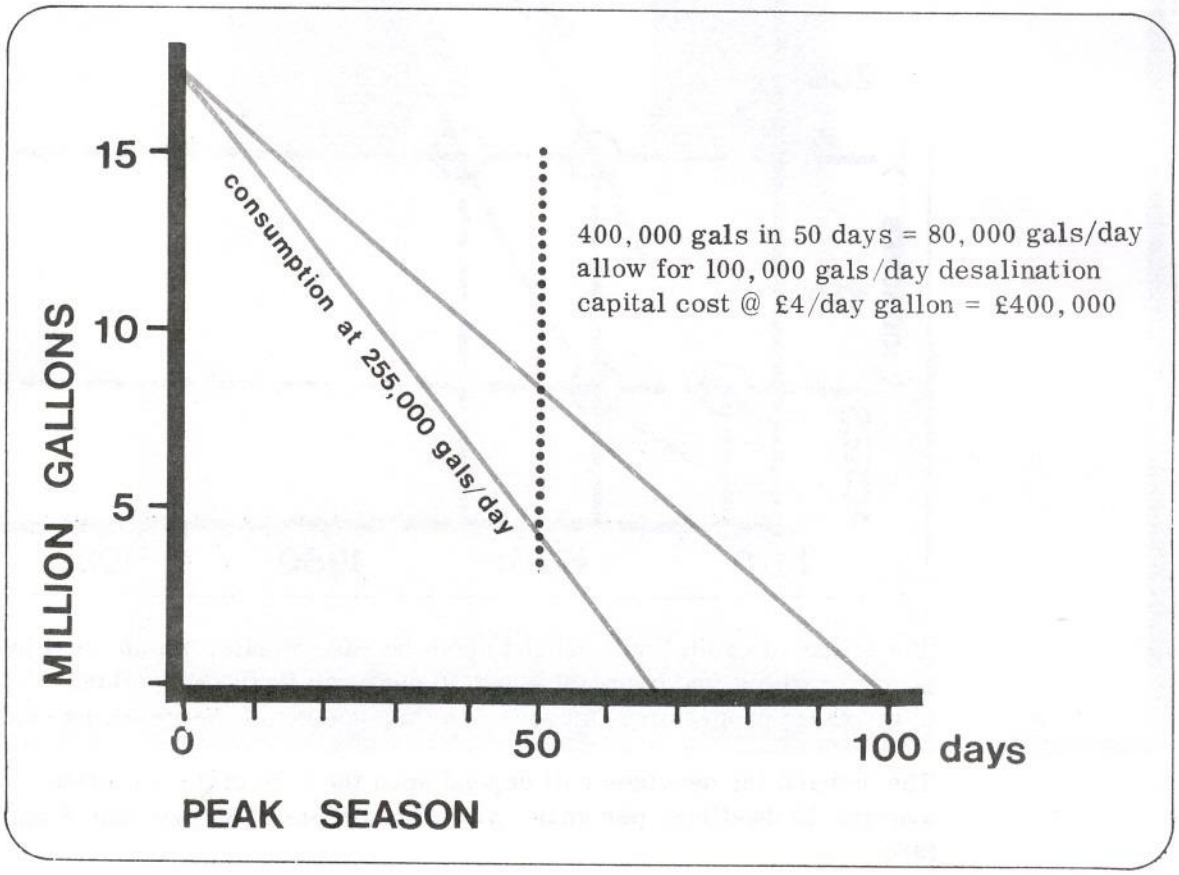
FIGURE 34 : WATER SUPPLY 1990

Potential Supply : Domestic tanks for 25" year

400 visitors dwellings @ 30,000 gals/dw	= 12,000,000
430 village dwellings @ 10,000 gals/dw	= 4,000,000
Reservoirs	1,000,000
	17,000,000

Estimated Demand (100 day peak season)

2,200 resident visitors @ 75 gals/day	=	165,000
2,680 service population @ 25 gals/day	=	67,000
220 hotel visitors @ 100 gals/day	=	22,000
		255,000 gals/day



Those costs that increase gradually in proportion to the quantity of development are usefully dealt with separately from special projects with costs that are indivisible and thus cause jumps on thresholds in the growth process.

FIGURE 35 : GRADUAL COSTS 1990 ø (Source: Archibald Shaw)

Item	Units	Unit Cost £	Total Cost
Roads	163,800 sq yds	2.5/sq.yd	400,000
Sewage	4,850 people	26/person	120,000
Electricity	200 Kva*	50/kva	10,000
Water	100,000 gals/day	4/gal/day	400,000
TOTAL			930,000

ø at 1970 prices *handed over to CDC at this stage

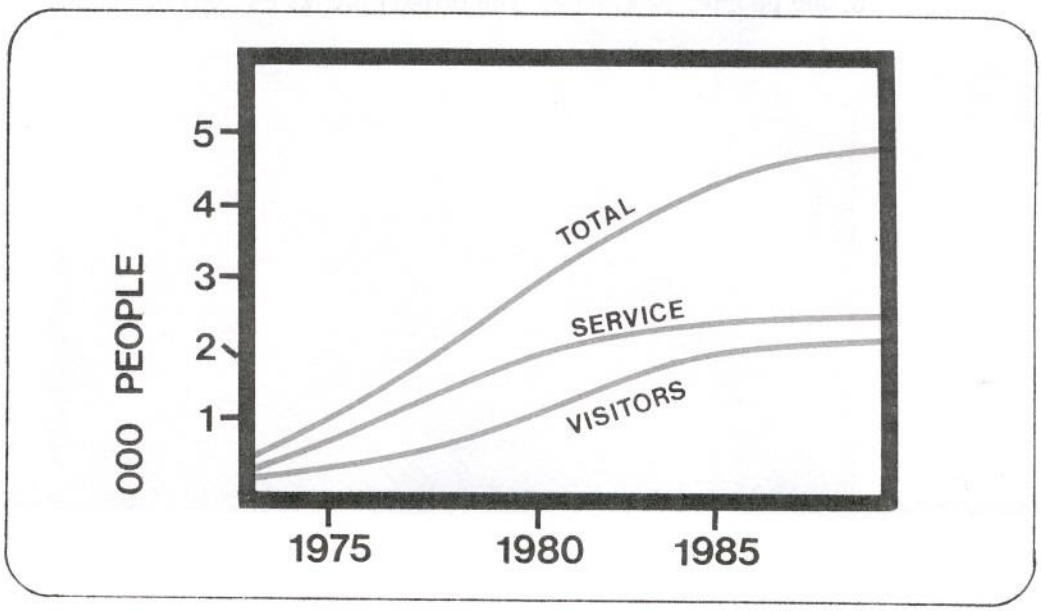
There is however the possibility that the cost of sewage provision can be passed on to the purchaser by not providing septic tanks on the low density sites and hotels, although this may reduce the market price by more than is saved. (The low lying area in L'ansecoy will, however, need a collective system installed, and this has suggested the omission of this area from the immediate action plan).

Capital costs, without sewage, would thus average about £55,000 per year (over 15 years) on general infrastructure, excluding maintenance and tactical mosquito control.

The costs of housing the service population will be considerable, amounting at £1,000 per dwelling (CDC "SAKI" type) for 330 dwellings to some £330,000. It is hoped that mortgages can be made available by CDC for this item, which will otherwise increase the gradual costs by about a third.

There are two further items to be taken into account under this heading, firstly that of servicing loans already made to the Company (£250,000 at 8% per annum, assuming the remaining £500,000 to be paid back shortly under the indivisibles), and secondly that of the sales programme at 20% of the sale price. (See figure 41).

FIGURE 36 : POPULATION GROWTH



There are a number of projects considered necessary but about which decisions on the timing and order of priorities have not yet become completely clear.

The table below represents a tentative estimate of the chronological order of priorities and is not intended to be a firm recommendation but has been used in Figure 38 as an illustration of method, although it is clear that the first stage of this garbage disposal plant will be needed by 1974, and that the building of church and school in the new location of the village will help to encourage relocation there.

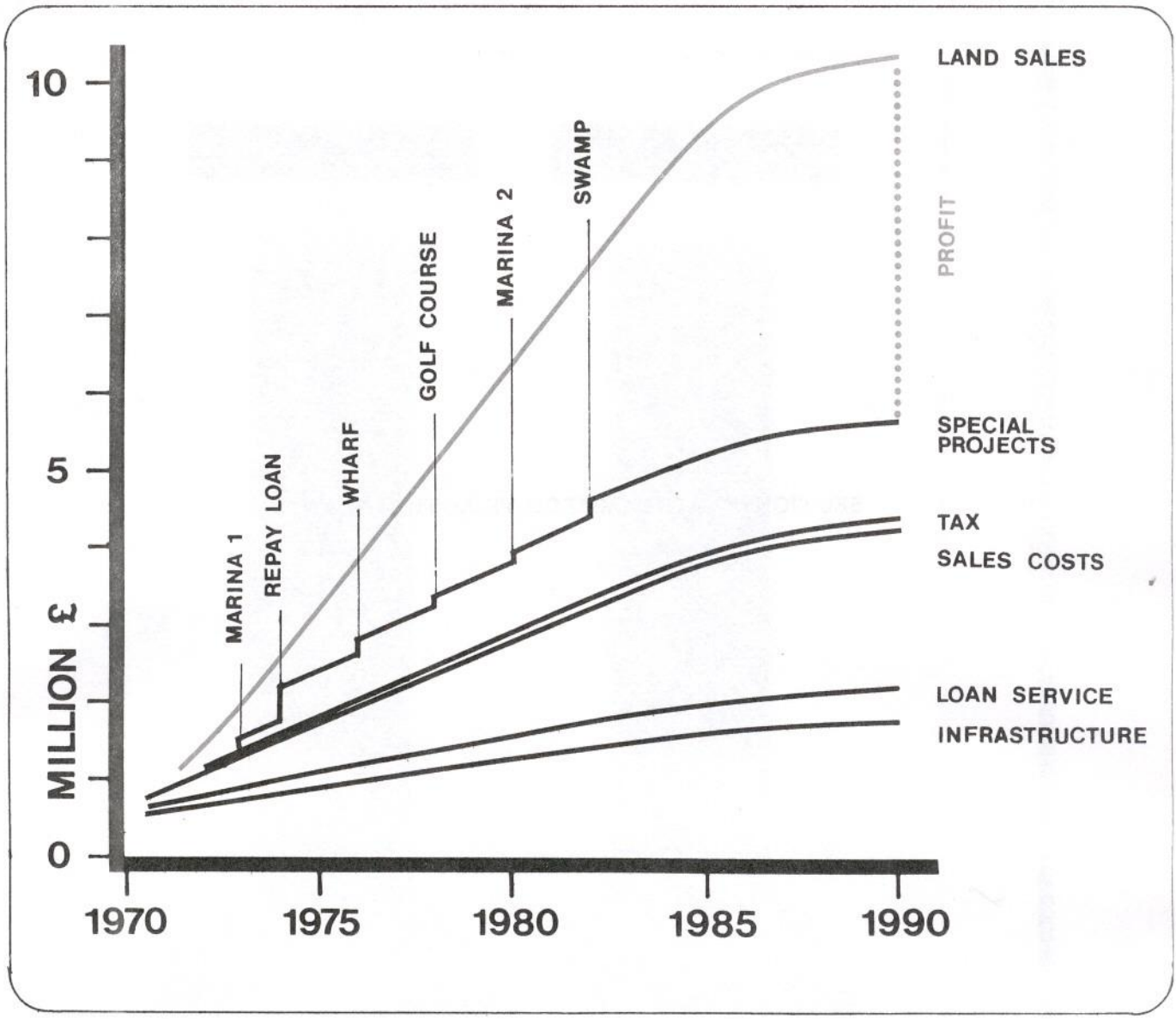
FIGURE 37 : INDIVISIBLE COSTS 1990 (Source: Archibald Shaw)

Item	Description	Cost £
Garbage disposal 1	Incinerator at quarry site *	15,000
Public Buildings	School and Church etc.	50,000
Marina: Stage I	Opening lagoon, dredging (approx. 130,000 cu. yds) and consolidating banks.	80,000
Wharf	30ft wide rip rap causeway to 50 x 200ft floating berth	100,000
Garbage disposal 2		15,000
Golf Course	9 holes	150,000
Marina: Stage II	Develop to capacity for 150 boats	80,000
Garbage disposal 3		15,000
Swamp	Either: to fill with excavated material to 2'0" above mean sea level: or to excavate, line and create sea water lake	120,000
Runway	On filled swamp	30,000
Garbage disposal 4		15,000
TOTAL		640,000

* Garbage incinerators for 10 cu. yds / day per 1,000 persons for 5,000 people, @ £15,000 (installed) per 12 cu. yd/day plant.

The relationship between profit and divisible costs will determine the availability of capital to finance expenditure on indivisible type projects. Obviously this will depend upon the income deriving from sales, but the effect of delaying the provision of the special projects upon the rate of sales is difficult to quantify and can only be assessed by future experience.

FIGURE 38 : DEVELOPMENT ECONOMICS



If the rate of sales can be achieved it will be possible to repay loans of £500,000 as desired by the Mustique Company, by 1974, although the margin for error is not large and the effects of running costs will need careful study and management.

SECTION 7 : THE IMMEDIATE ACTION PLAN

In the first part of this report we have tried to formulate strategic "end state" proposals for 1990 that display the relationship between short term and long term costs and benefits in such a way as to indicate which options need to be kept open. But strategic proposals are only useful insofar as they help to identify the most fruitful course of action in the immediate future.

It is estimated by the Mustique Company that in order to mount an economic sales campaign a programme is now needed for at least 100 acres. The projected rate of sales and construction implied by Figure 33 suggests that this must be achieved by 1974.

The primary aim will be to structure this development so that maximum use is made of existing infrastructure with a minimum input of new development capital.

The present pattern of applications for land on the island, arising without a sales campaign aimed at a particular sector of the market, is shown below.

FIGURE 39 : PROSPECTIVE PURCHASERS 1970/71 (Source: Previews Ltd)

Approx Acres	House Price £	Bed-rooms	People (at 1.6)	To Sublet	Staff In	Staff Out	Months Stay	Serious Offers No.	Serious Offers %
4	40,000	6	9.5	No	2	3	2 +	3	25
1	20,000	4	6.5	Possibly	1	2	2 +	4	33
3/4	12,500	3	4.75	Yes		2	1	5	42
1/16	-								
1.6		4	6					12	100

The planned sales campaign would thus seem to need not only to increase the rate but also to focus on the upper end of the market to increase the sale of very large sites. This it should do without relying solely on the North American market, and consideration should be given to establishing a quota ratio to ensure a mix of nationalities as has been successfully practicedat the Calabash Hotel, Grenada.

The other essential need is to find a buyer for the Cotton House and a developer for at least one other hotel, so that there are about 50 bedrooms by 1974.

The projected rate of sales and completion of construction (Figure 33) if applied pro rata to the housing mix suggested for 1990 (Figure 26) would give the following pattern of development by 1974.

FIGURE 40 : TOURIST HOUSING MIX 1974

Acres	Potential Dwellings	Area	Price £/acre	Total Price
3	22	66	18,000	
1	20	20	18,000	
0.5	28	14	18,000	
Total	70	100		1,800,000
sold pre 1971		42		
TOTAL		142		

If by this time some 50 dwellings are built and occupied the tourist population, of an average family size of 5.5 would be about 275. The number of bedrooms, at 3.75 per dwelling, would be 188. The number of people engaged in service activities generated by these visitors is shown in the following table.

FIGURE 41 : SERVICE POPULATION 1974 (Source: See Figure 27)

188 bedrooms at 0.35 workers/bedroom	= 65
50 hotel bedrooms at 0.5	= 25
other services at 7% of 275	= 20
	110 workers
plus construction workers, say	160
TOTAL	270

If by this stage only 25% of construction workers are settled on Mustique,

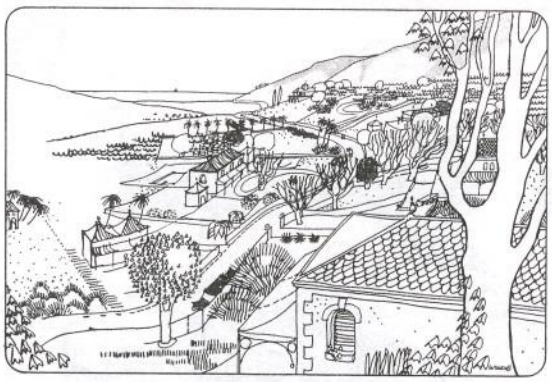
Hostels	= 120 people
Service population at 30% participation rate $= \frac{150 \times 100}{30}$	= 500 people
With an average household size of 6	= 83 dwellings
Assuming that about 20 dwellings locate at places of work, then the village	= 60 dwellings
Total service population 500 + 120	= 620
Visitors in houses	= 275
in hotels	= 50
TOTAL 1974 population	= 945 people

In order to minimise costs, development in the immediate future should not be over extended. There is already a demand for development at both ends of the island (Endeavour and Gelliceaux) as well as the need for the new village and for services at the middle (Old Plantation and the quarry). Improvements to roads and services should therefore concentrate in these areas and on linkages between them.

FIGURE 42: PHYSICAL PROPOSALS 1974

It is proposed that by 1974 Endeavour should be well developed, with housing land sold from Hermitage through to Rutland, the Cotton House extended to Landing Bay and a new hotel at either Plantation or Hermitage. This implies that the stone-crusher and refuse dump should move shortly to the new quarry site, and that by the end of this period land must be made available for the building yard to move to Old Plantation, where the new wharf will be built early in the next stage of growth.

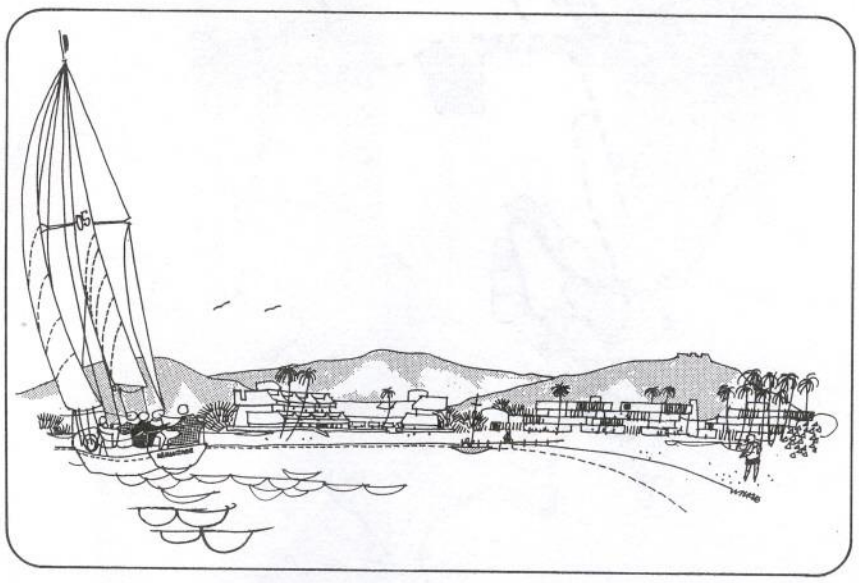
FIGURE 43 : PERSPECTIVE OF ENDEAVOUR HILLS



Also at Old Plantation land will be needed for some 60 dwellings for the service population. This housing should be available at a range of prices, with only nominal land costs and with mortgages arranged through CDC or a similar source. It is very much in the interest of the Mustique Company to ensure that this village is attractive both for the local population to live in and for visitors to visit.

At the lagoon, which it is proposed should be opened to the sea and dredged to provide an anchorage for residents' boats, there will probably be a yacht servicing station, with bar, general store, showers and some chalets.

FIGURE 44 : PERSPECTIVE OF HERMITAGE



The most exclusive development during this period will focus around Gelliceaux Bay where about 20 large sites will be availabe.

Despite the lag between sales and construction, the demand for water will build up fast over this period as houses built on land already sold begin to be occupied. Certainly it seems necessary to improve immediately the quality of water entering the Baobab reservoir by putting down a catchment lined with polythene or corrugated aluminium, the extent of which can be varied to ensure that the bag fills even during a dry year.

But as can be seen from the following table it will also be necessary to introduce desalination during this period, locating plant, generator and fuel storage at Old Plantation.

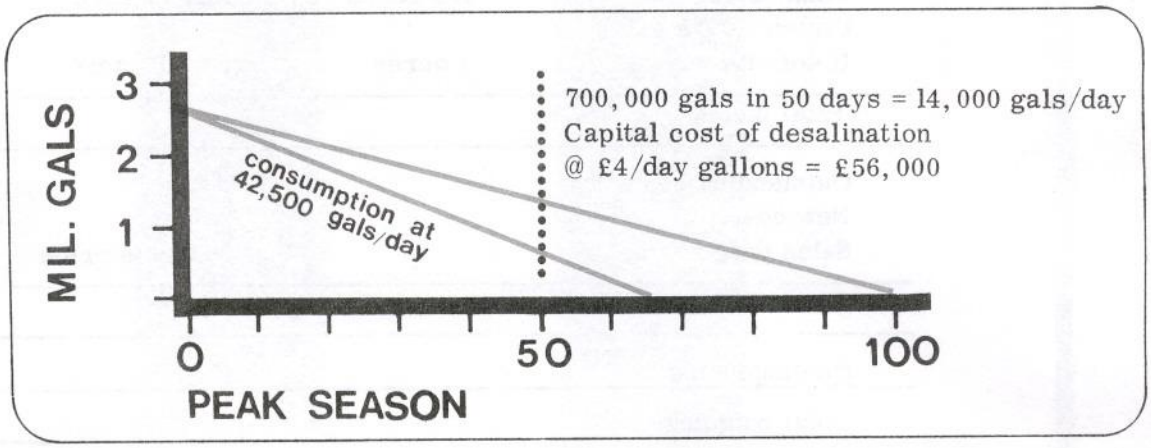
FIGURE 45: WATER SUPPLY 1974

Potential Supply : domestic tanks for 25" year

50 visitors dwellings @ 30,000 gals/dw.	= 1,500,000
60 village dwellings @ 10,000 gals/dw.	= 600,000
Reservoirs	500,000
	2,600,000 gals

Estimated Demand (100day peak season)

300 resident visitors @ 75 gals/day	= 22,500
600 service population @ 25 gals/day	= 15,000
50 hotel visitors @ 100 gals/day	5,000
	42,500 gals/day



Roads

Although new surfaced roads will only be required in the development areas, it is important that in future where construction roads are required they are not simply bulldozed through the vegetation, but are correctly aligned and graded so that erosion does not result, with provision for run-off channels at suitable intervals. A sum has therefore been allowed in the costs for both new construction roads and the regrading of existing tracks. (See figure 46)

Insect Control

The mosquito and sandfly nuisance must be further reduced. Opening the lagoon is expected to go some way towards this, but there should be also a continuing programme of local spraying, beach cleaning and crab-hole filling. A sum has been included in the costs for this and for the filling of secondary swamp areas at L'ansecoy Bay, but expert advice must be sought at once (possibly from the Mosquito Research and Control Unit on Grand Cayman) to ensure that the species are identified so that measures taken are ecologically and economically suitable. This is a serious problem and the costs of solving it are likely to be relatively small and very well worthwhile.

Based on the programme outlined in this section of the report the following table of costs has been prepared, estimated on the basis of 1970 prices.

FIGURE 46 : 1974 COSTS (Archibald Shaw)

Item	Description	Unit Cost	Cost £	Total £
Regrade existing roads	25,200 sq.yds	0.25/sq.yd	6,500	
New construction roads	33,000	0.25	8,000	
New frontage roads	28,000	2.50	70,600	94,000
Garbage incinerators	12 cu yds/day			15,000
Electricity	200 kva	50/kva		10,000
Water supply	Desalination			
	14,000 gals/day	4/day gal.		56,000
Mosquito control	spraying	5000/year		15,000
	fill at L'ansecoy	1.5/cu.yd		24,000
Marina	Stage I			80,000
Total Cost				556,000
Land sales	100 acres	18,000/acre		1,800,000
Cotton House sale				250,000
Hotel site	7 acres	20,000/acre		140,000
Total income				2,190,000
Outstanding costs				400,000
New cost				556,000
Sales programme		20% sale price		360,000
Total				1,316,000
Contingencies		10%		130,000
Total outgoing				1,446,000
Trading profit				744,000

It is possible that the school and church should be built by 1974, which would increase the outgoing by about £50,000, but allowing for 3 years loan service repayments at 8% on £750,000 (£180,000) this gives the possibility of paying back £500,000 in 1974, leaving the Company at break-even point for the next stage of growth as indicated on Figure 38. There is, of course, a measure of tolerance since there is the option of not repaying the whole £500,000 in 1974.

Further major costs not borne by the Mustique Company include:

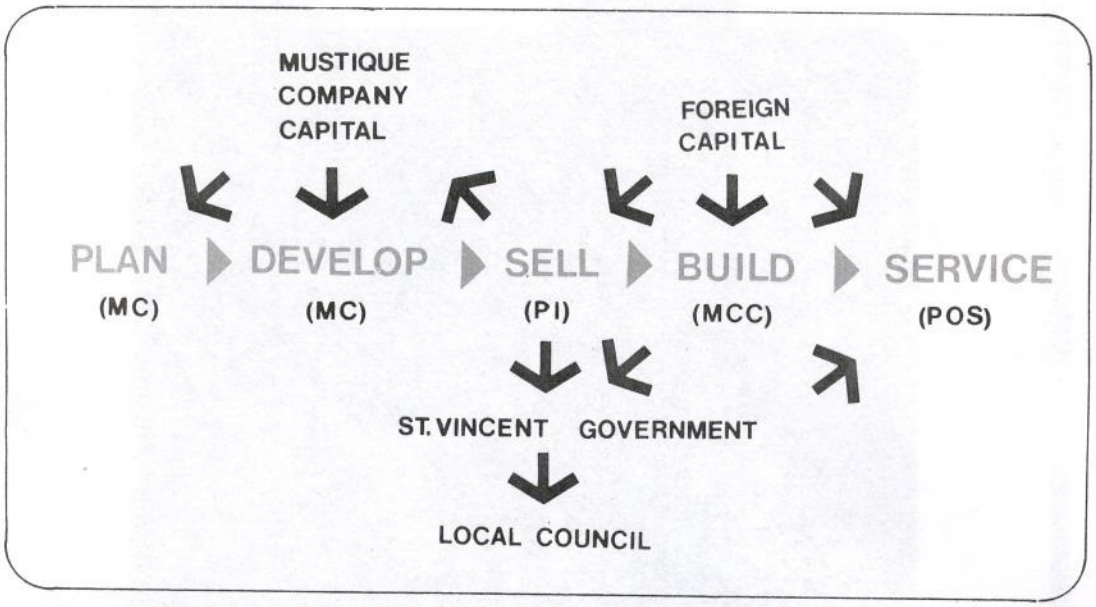
Sewage disposal for 900 people at £25/person	=	£ 22,500
and Service village of 60 dwellings (CDC SAKI type)@ £1,000/dw	=	£ 60,000
		82,500

In order to achieve the 1974 programme successfully the company must clarify its roles regarding supply, development and servicing, possibly by setting up separate departments for these functions. With regard to the latter the aim should be to have municipal and national government services adopted by government agencies as soon as is feasible. Mustique is an official port of entry, but although the company will operate the customs and immigration in the immediate future this arrangement is unlikely to continue.

Other income producing functions such as motor repairs, petrol supply, etc. could be run by partly owned subsidiaries in conjunction with local firms.

Consideration must also be given to the mechanisms by which a representative local council can give expression to the needs of the local population. For example, the adoption of the reefs and open space as a national nature reserve would ease relationships with islanders forbidden to spearfish or hunt, as they would not thus feel resentment against the Mustique Company.

FIGURE 47 : ORGANISATION STRUCTURE (Simplified)



MC = Mustique Company
Pl = Previews International
MCC = Mustique Construction Company
POS = Partly Owned Subsidiaries

It is essential to monitor all activities in such a way that income and outgoings can be identified separately for each over a period of time, and projections made of the differential costs and benefits.

It is also essential to test the accuracy over time of the various assumptions on which the projections in this report are based so that adjustments can be made accordingly.

A number of further detailed studies are required in the immediate future, with special emphasis on the following:

a) survey and layouts for 1974 proposals
b) economics of construction methods
c) design of typical dwellings
d) control of biting insects
e) landscaping techniques

CONCLUSION

Mustique is a special and unusual place. The natural resources of this beautiful island must be safeguarded, and all development carefully designed to complement the landscape. We have tried in this report to create a planning framework of which the principles are comprehensible as a kind of language of "the way things are done here".

In this report we have particularly concerned ourselves with the relationship between peoples and places. We feel that for the charm of the present day Mustique to grow into a special identity that can be comprehended by people arriving on the island, the development of tourism must be seen to enhance the landscape and benefit the local islanders. Only if the planning framework is administered by people who care about this, will visitors wish to belong there and participate in the island's plan for growth. For when people belong to a place and feel that they can interact with it, the place will grow fruitfully. We hope that the principles outlined in this report, both physical and methodological, will help ensure a harmonious and profitable future for Mustique.

FIGURE 48 : MODEL OF PROPOSALS

APPENDIX 1: ECOLOGY

Summary

SUMMARY:

Four maps were prepared as a basis for assessing the relative suitability of different areas for development and they should be interpreted in the light of the discussion presented in this appendix.

1. Vegetation map. Based on aerial photographs and ground observation. Each category indicates an area with a different sensitivity, capacity and potential for development.

2. Exposure map. Based on the degree and direction of distortion of tree canopies. Exposure class 1 is completely unsuitable for development, classes 2 and 5 will offer difficulties and classes 3 and 4 are the most equitable areas.

3. Soils map. Based on descriptions of soil pits and other exposures as well as vegetation/land-use boundaries and topography. Several of the soil types owe their characteristics to their topographic position and are segments of a catena (soil continuum) from ridge crest to valley bottom.

4. Drainage-basins and water bodies. This map should be interpreted in conjunction with the report by Ian de Verteuil. The conductivity and sodium determinations made on water-bodies and soils (Table 10) are important in estimating water quality.

The report contains a summary of the physical and ecological features of the island as an essential background for planning and development. The information is presented under the headings: climate, geology, soils, vegetation, fauna, exposure, and water resources. There are also notes on the probable consequences of certain projected developments such as opening the lagoon and swamp to the sea, providing golf courses, erosion and insect control.

While it is possible, at this stage to envisage the problems and consequences of certain kinds of development in a general way, there will be a continuing need to consider the ecological implications of specific development proposals at each stage in the evolution of a development plan.

1 INTRODUCTION

1.1 Aims and approach:

The Ecological Basis: Mustique is an extremely beautiful island and one which is very rich biologically. At the same time, the natural resources of the island are in limited supply or extremely sensitive to development. The challenge that must be met by the developers is to utilise its charm and habitat richness whilst maintaining its delicately balanced ecosystems in as natural a state as possible.

Several primary physical features of the island combine to determine the range of possibilities for development. These are, most notably, the availability of water, the pronounced alternation of wet and dry season, the physical make-up of soils, wind velocity, salt spray and soil salinity. These same features also determine the kind and distribution of the naturally renewable resources of plant and animal communities and, at the same time, determine their response to various kinds of development. Careful exploitation and management will be required to ensure that the biological habitat-types represented in the island's ecosystems continue to contribute to the beauty and interest of the environment. The main habitat types represented may be classified as follows:- coastal sand, littoral woodland, xeric grassland and scrub, exposed forest, sheltered forest, rough pasture, arable land, mangrove swamp, lagoon, and coral reef. Data about these habitats and their physical, chemical and biotic control is essential for planning their development or use. An assessment of their history and ecology, based on maps of the major vegetation/land-use classes and soils, provides background data for considering alternative forms of land-use.

1.2 Sources of information and The Survey Programme:

Preliminary investigations were based on a survey of the literature and the enclosed bibliography indicates the range of published material relevant to the area. Much of this however, is not easily available and it was supplemented by discussion with members of the staff of University College London, some of whom are involved in the Co-operative Investigations in the Caribbean (CICAR). Our biological colleagues have also contributed advice from their tropical experience, whilst others have been responsible for conducting the water and soil analyses.

Aerial photographs, flown in July 1966 by Fairey Surveys, were used to produce the preliminary vegetation/land-use map and to identify areas whose trees have distorted canopies, the degree and direction of which was mapped to indicate classes of exposure.

A visit to Mustique was made by Dr. F. B. Goldsmith between 15th and 25th January 1971 in order to collect water and soil samples for subsequent analysis, to characterise the habitat types and assess their sensitivity.

The final phase of the programme produced maps of vegetation, exposure, soils and water catchments from the initial photographic interpretation, field experience and the results of laboratory chemical and physical analyses. This appendix aims to serve as a guide to the maps and to discuss the relationship between past and current environmental factors, the existing habitat types and their capacity for development.

2 THE PRIMARY ENVIRONMENTAL DETERMINANTS

2.1 Climate:

Fentem (1961) in his Commercial Geography of St. Vincent, states that that island shares with the other islands in the Lesser Antilles a simple annual regime of rainfall, a mean annual temperature of just under 80°F on lowlands, and an annual temperature range of 2 or 3°F. (Table 1) About two-thirds of the annual rain falls during the wet season, from mid-May to mid-December. Throughout this portion of the Caribbean, differences in precipitation are almost entirely the result of relief. Fentem estimates the rainfall on the coasts of St. Vincent to be 60 inches. Estimates for Mustique vary but average 45 inches.

In the driest conditions on St. Vincent, four months or more have less than four inches of rain per month and, during this period, the sub-soil dries out and drought becomes a problem. Drought conditions on the lowlands are accentuated during dry years and the mean annual variation in rainfall at Kingstown is 11 percent. Rainfall on Mustique may vary between as much as 25 and 75 inches. Fentem also states that St. Vincent is physiologically much drier than its rainfall suggests because of the porosity of her soils.

Kingsbury (1960) states that the Grenadines lie on the fringe of the West Indies hurricane belt and, in the past, severe tropical storms have seldom lashed their shores. However, on September 22, 1955, with scant warning, hurricane 'Janet' of very considerable intensity, swept directly across them. Several islands suffered badly in loss of life, homes, boats, crops, trees and other property. Several of the old massive stone plantation homes on Carriacou which were in good condition and never previously bothered by storms were ripped apart by this hurricane.

2.2 Geology and Geomorphology:

No publication dealing specifically with the geology of Mustique is available but a short section on the island is included in Martin-Kaye (1969). He states that Mustique consists of a tilted, faulted and partly thermally metamorphosed series of volcanic rocks which include some calcareous tuffs. At one locality at least, fossils have been preserved including Lepidocyclinas of undetermined species. Unless the fossils have been re-worked the rocks are thus Oligocene or Eocene. The general direction of dip of the stratified formations is southward.

TABLE 1 : CLIMATE

	Jan	Feb	Mar.	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual total
Mean temp. ^{o}F.	76.5	76.8	77.5	78.8	80.1	80.3	80.0	80.2	80.0	79.5	78.8	77.4	
Mean daily max.	83.0	83.5	84.7	85.8	86.7	86.4	86.0	86.5	86.3	85.8	84.8	83.4	
Mean daily min.	70.0	70.0	70.3	71.8	73.5	74.3	73.9	73.8	73.6	73.1	72.7	71.4	
Mean monthly rainfall cm.	5.70	3.68	3.25	3.55	5.38	11.05	13.58	16.43	17.78	17.80	17.75	8.73	124.68
Number of rain days	16	11	12	10	12	17	21	19	18	19	18	17	190
Mean wind velocity (1903-50) m.p.h.	11.5	11.7	12.0	11.9	12.2	13.1	11.8	9.2	7.7	7.4	8.4	10.4	

Evidence of shearing, with minor quartz weining, is to be seen in various parts of the island but most intense disturbance appears to have occurred in the north-west where intrusive activity was accompanied by metamorphism and marked epidotisation. Massive silicified zones up to 40 ft. wide extend approximately NE-SW. Certain hilltops and hillflanks up to perhaps 400 ft. are liberally scattered with hard igneous 'granitic' pebbles which may perhaps be remnant from water-laid agglomerates in which such pebbles do occur, but they rather give the impression of a patchy superficial formation.

It is significant that there is no limestone on the island and hence the presence of acquifers is unlikely. The bulk of the island, being a metamorphosed volcanic rock, is likely to have a very low water holding capacity.

Martin-Kaye identifies two types of undifferentiated volcanic rock. One which includes metavolcanics, lies to the north-west of a line from the beach of Sandy Bay to Rutland Bay; and the other, to the south of the boundary consists mainly of pyroclastic rocks. Neither are suitable as a building material.

The superficial deposits are of greater interest for some are of considerable depth (<20 ft.) They form the flatter land of the north-west and south-west corners of the island and small area behind Pasture Bay.

Martin-Kay (1969) identifies Mustique as belonging to the outer older arc of Lesser Antillean islands. These islands are believed to be of Eocene age and have not experienced any volcanic activity within historic times. The inner arc, which is of late Miocene and Pliocene age is still volcanically active and includes St. Vincent and Martinique. The significance of this distinction is that it affects the length of time during which soils have developed as well as the probability of volcanic activity. Unfortunately soils derived from this type of volcanic rock under this type of climate are reported to deteriorate with time becoming more 'cemented', less pervious, and less fertile (see soils section). It is important to realise that for these reasons practices which are successful on St. Vincent may not be so on Mustique.

Bequia, Mustique's nearest neighbour, is also different being composed in part of rather basic lava flows and is consequently likely to be inherently slightly more fertile than Mustique.

2.3 Soils

No description of soils of Mustique is available but Hardy (1941) has published a Classification of Soil Types of the Volcanic Lesser Antilles which is summarised and discussed by Beard, 1949. The classification is as follows:-

I Azonal soils (drainage very free or variably impeded).

1. Lithosols
2. Alluvial soils

II Intrazonal soils
(a) Calcimorphic (Tropical Pedocals) (drainage free).
3. 'Yellow Earth' soil
4. 'Brown Earth' soil
(b) Hydromorphic (drainage variably impeded).
*5. 'Terras' soil
*6. 'Shoal' soil
7. 'Terre Grasse' soil

III Zonal soils (drainage impeded).
8. 'Red Earth' soil

Two of these (shown*) are related to soil types on Mustique. A soil continuum or catena exists between the shallowest soils on steep slopes and the alluvial soils on flat land and in valleys. Hill soils have characteristics in common with Hardy's 'Terras' and 'Shoal' type and gradually intergrade with the deeper alluvial soils. There follows a brief description of the rel evant types described by Hardy:

Shoal soils are characteristic of coastlands. They are more mature than types 3, 4 and 5 and have a 'cemented 'B' horizon'. The shoal soil is a chocolate to brownish-green, hard, horny clay, stoneless, cloddy, porous, compact, sharply overlaying a solidly cemented rock stratum generally at a depth of about 2 ft. The clays formed are typically waxy, slippery when wet, hard and horny when dry; their structure is coarsely cloddy, developing deep cracks in dry weather. Agriculturally these soils are intractable and difficult to cultivate and dry out badly and crack in dry weather. Under forest they provide too little root room and the tearing effect of dry-weather cracking is probably harmful to roots. In wet weather they are badly aerated.

Terras soils are intermediate in nature between brown-earths and shoal types. The 'A' horizon is more loamy than that of shoal soils and the 'B' horizon is less cemented. An average profile shows a pepper-and-salt coloured, sandy clay, sharply overlying cemented but still somewhat brashy and pervious, bleached, grey, gravelly ash.

Alluvial soils These are described as fine-textured, deep, and permeable but drainage may be poor where there is low relief, this being the case on parts of Mustique. The particle size of these soils is extremely small being principally in the clay size class. This means that water permeability is low and that rates of lateral movement to wells will be slow.

The soil map Soil pits were dug at about forty sites and the depth, texture and colour of profile described. Samples were collected and brought back to London for analysis of moisture content, loss on ignition (organic matter), pH, conductivity, and particle size.

Apart from small areas with soils of marine origin (see below), the soil variation on Mustique is controlled principally by position in relation to topography. Soil depth is the most obvious variable feature and it increases progressively from the crests of ridges to valley bottoms, from a few inches on steep slopes and on ridges to several feet in the valleys.

The soft volcanic bedrock weathers rapidly to give a soil of very fine particle size and low porosity which becomes sticky and intractible when wet, and shows cracking and becomes dusty when dry. Material is fairly rapidly moved downslope by run-off and it accumulates on flat land. Thus soil variation is continuous and forms a catena but it is convenient to draw boundaries dividing up such a continuum even if the position of the boundaries are somewhat arbitrary. Soil types have been recognised principally on the basis of soil depth and pH but lines have been drawn on the maps using break of slope and type of vegetation or land-use.

Nowhere does the soil show any obvious differentiation into horizons. This is presumably due partly to the fact that processes leading to soil formation are extremely rapid and also to the recent cultivation of much of the island. The appreciable quantities of salt-spray deposited on much of the windward side of the island affect the chemical properties of the soil and raise the sodium, potassium, chloride and pH levels of the surface layers.

Three soil divisions were recognised for the purposes of mapping on Mustique, although the first two represent the two ends of the catena.

(1) Hill soil (shoal): Intermediate in character between Hardy's (1941) Shoal type and Terras type which are reported to be common on other Windward Islands.

Site characteristics. These soils occur between 25' and 475' altitude on convex to plane slopes of variable aspect and gradient. Surface run-off exceeds the amount of water reaching sites (shedding sites). Parent material is a crumbly, weathered, metamorphosed volcanic rock of Oligocene age dipping to the south-east and is frequently penetrated by tree roots. The vegetation is a secondary semi-deciduous seasonal forest which has grown up on land once used for growing cotton, for pasture or for sugar-cane.

Profile description (see description sheet) Soil profiles consist of two or three indistinct gradually merging horizons. The soil surface has undecomposed and decomposing litter, with occasional worm casts and often numerous, very large, (granitic) rounded or sub-angular stones on the surface or shallowly embedded. There are no apparent alluvial horizons and no zones of deposition.

The soils are a clay-loam of weakly developed structure. They were generally moist (3-16%) when examined at the end of the wet season (January) but, being shallow and better-drained, will dry out rapidly. They are dark grayish brown at the surface (loss on ignition 5-9%), becoming slightly paler deeper (below 5 cm, loss on ignition 1-4%) shallow (10-50cm), sticky when moistened, glazed by the spade, slightly humose, sub-soil, often with a pepper-and-salt appearance, resulting from hard fragments in a softer matrix.

Hill soils exhibit the unusual feature of pH values decreasing with depth. Soil directly above weathered volcanic rock has a pH of 5.6-6.3 but surface horizons have values up to 7.2. This is almost certainly the result of salt-deposition.

(2) Valley soils These are soils derived from material moved downslope and deposited on flat land or in valleys and occur principally in the north-west and south-west of the island. They are the deepest and most fertile on the island and are, or have been, intensively cultivated.

Site characteristics. These soils occur on concave to plane, flat ground near sea-level (to 50 ft) of variable aspect and slight gradient ($< 10^{o}$). Most areas are either actively cultivated, grazed or have recently been abandoned.

Profile description (see description sheet) Soils are deep, (often > 1 metre), not differentiated into distinct horizons, generally slightly darker than hill (shoal) soils with a higher moisture (6-23%) and clay content. Stones when present, are usually small (<5cm), sub-angular to rounded. Soil texture varies from a loam to a medium clay, with a moderately developed blocky structure. Their consistence is sticky when wet but loose and powdery when dry. The permeability is low due to the high clay content and fine pore diameters.

These soils have slightly lower loss on ignition values ranging from 4-6% for surface horizons to 1-3% at 30cm. The pH values increase with depth from about 7.5 in the surface layers to 8.0 at 25cm.

(3) Soils of marine origin These are of two kinds, either a wind deposited sand or a gray silt or clay.

Site characteristics These soils occupy flat land more-or-less at sea-level, sometimes the sand overlies an alluvial soil or silty clay and forms coastal dunes and such areas naturally carry a sea-grape association. These soils when not too saline are used as coconut plantations. The silts and clays are subjected to regular long-term flooding by sea-water or at least brackish water. Naturally they carry mangrove or machineel vegetation but in places this has been cleared and now supports sedge-dominated or sea samphire communities. Because of their salinity these areas are extremely inhospitable and of no agricultural potential.

Profile description (see description sheet) An upper horizon containing organic matter can sometimes be distinguished, the amount of which varies from a shallow peat (12 cm) to just sufficient to slightly darken the colour. The former is more characteristic of undisturbed flooded areas (e.g. behind Macaroni Bay) and was probably once more widespread (e.g. around the main swamp). This overlies a structureless blue-gray silty clay. These are the wettest soils with moisture values of 10-30%.

Profiles on sandy areas vary from a structureless pure-sand at the surface to a clayey-loam at depth (e.g. Plantain Bay).

Soils of marine origin, behind beaches (pH = 8.8) around the swamp (pH = 7.9) beside lagoon (pH = 8.2, 7.6) have much higher pH values, which reflect their saline character (sea-water, pH = 8.3).

TABLE 2

GENERALISED SOIL PROFILE DESCRIPTION SHEET FOR HILL SOILS

No. e.g. 16 — LOCALITY: Mustique — G.R. — Height: 25' - 475'

Major Soil group: Hill soils (shoal)

Rainfall: 45" (132 cm)

Site:
Slope: 10^{o}-30^{o}
Aspect: Various
Drainage: Shedding sites

Parent material: Weathered, metamorphosed volcanic rock

Profile drainage: Poor

Moisture	% loss on Ignition	pH	Depth cm	Horizon	Description	Colour
			<5	L/F	Undecomposed and decomposing litter. Large, basic igneous 'granitic' pebbles.	
3-16	5-9	-7.2	5-20	A	Mixed mineral organic surface layer	10YR4/3
	1-4	5.6-6.3	5-30	(B)	Sub-soil - no appreciable depletion of, or enrichment in colloidal material.	10YR4/4
				(B)/C	Weathered metavolcanic parent rock.	

Vegetation or system of agriculture: Deciduous seasonal forest

General Notes: Many sites receive salt-spray
Note: pH decreases with depth

Recorded by F.B.G.
Date 20.1.71

TABLE 3

GENERALISED SOIL PROFILE DESCRIPTION SHEET FOR ALLUVIAL SOILS

No.	LOCALITY	G.R.	Height
e.g. 9	Mustique		5-50'

Major Soil Group

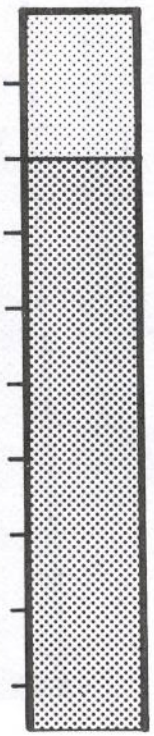
Alluvial (valley) soils

Rainfall

45" (132 cm)

Site		Parent Material	Profile drainage
Slope	0-10°	Weathered	Poor
Aspect	Various	metamorphosed	
Drainage	Receiving sites	volcanic rock	

% Moisture	% loss on ignition	pH	Depth	Horizon	Description	Colour
					No surface organic matter.	
	4-6	6.5	10-30	A	Mixed mineral	
6-23					organic surface layer.	10YR3/3
	1-3	8.0	30-?	(B)	Sub-soil	10YR4/3



Vegetation or system of agriculture: Actively cultivated, grazed or recently abandoned.

General Notes:

Recorded by: F.B.C.
Date: 20.1.71

TABLE 4

GENERALISED SOIL PROFILE DESCRIPTION SHEET FOR SOILS OF MARINE ORIGIN

No.	LOCALITY	G.R.	Height
e.g. 11.5	Mustique		0-5'

Major soil group
Soils of marine origin

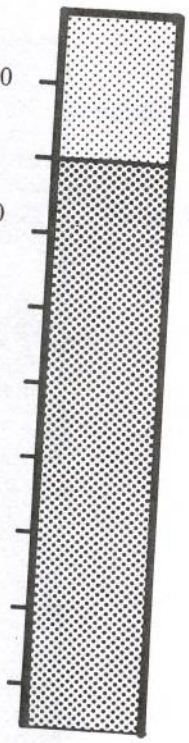
Rainfall
45" (132 cm)

Site:
Slope 0^{o}
Aspect -
Drainage Impeded

Parent material
Sand and silt
of marine origin

Profile drainage
Impeded

Moisure	% loss on ignition	pH	Depth	Horizon	Description	Colour
38	12	8.2	10	L/F	Highly organic surface layer	2.5Y 5/2
21	2	8.2	60	C	Blue-grey silty-clay	5Y 6/1



Vegetation or system of agriculture: Machineel, mangrove, sea grape, seaside, samphire coconut (planted) if not too saline.

General Notes: Around lagoon, swamp, or at heads of beaches. Variable, pure sand to silty clay.

Recorded by F.B.G.
Date: 20/71

The principal problems offered by the soils of Mustique result from their high clay content. They are extremely sticky when wet, dusty when dry and become impermeable during wet weather so that most of the precipitation runs-off or evaporates. It would be interesting to attempt to flocculate the clay by applying coral-sand or lime. Some of the soils on flat ground appear very compacted and their condition might be improved by ploughing.

The sand-dunes have potential for the artificial storage of rain-water as ground water using vertical polythene sheeting and extraction from well-points (see Ian de Verteuil's report). Soils of marine origin have a special problem in that they are the habitat of land-crabs, the holes of which may be the breeding places of mosquitos. These may be filled or sprayed and so achieve some degree of temporary control but the only long-term solution is to build up the level of this type of land and provide drains. Such treatment would also reduce the number of sand-flies.

Soil Types Identified for Mapping Within the three major soil types identified above, soil divisions can be made according to topographic position, vegetation cover/land use and exposure. The sub-divisions used in mapping the soils are indicated below.

(1) Sedimentary soils in valleys and on flatter land. Receiving sites.
   a. Deepest, most fertile soils, usually on flat land or valley bottoms.
   b. Deep fertile soils, gradual slopes (10^{o}).
   c. Similar to b. but on steeper slopes, in exposed situation, higher salinities, variable depth, suitable for pasture or cotton.

(2) Hill soils (Shoal type). Shedding sites.
   d. Shallow soil, under forest.
   e. Very shallow, on ridges, frequent rock outcrops.
   f. Eroded or saline, restricted to headlands.

(3) Soils of marine origin
   g. Wind-blown sand.
   h. Silt or clay.

Summary:

The significance of these results to the problem of erosion is that:
   a. hill soils are most vulnerable;
   b. of these, those on the windard side receiving large quantities of salt-spray are likely to revegetate most slowly after clearance and so present the most serious difficulties.
   c. whenever possible, a vegetation cover should be maintained;
   d. if the vegetation is cleared, the soil should be damaged as little as possible as this facilitates subsequent revegetation;
   e. when land is cleared run-off should be led into contour drains;
   f. the activity of heavy equipment such as bulldozers should be kept to a minimum.

Figure 1

LOCATION OF SOIL PITS:

TABLE 5

SUMMARY OF RESULTS OF SOIL ANALYSES

Pit number	Horizon	pH values			% loss on ignition			% soil moisture		
		A	B	C	A	B	C	A	B	C
Hill Soils										
2	A B C	7.1	6.2	5.6	8.5	4.2	4.4	14.5	9.5	15.1
3	A B C	7.2	6.0	6.0	6.6	3.8	2.5	6.8	10.0	7.0
31	A	7.3			4.5			4.4		
34	A	7.1			4.7			7.7		
4	A B	7.2	6.8		5.8	3.7		11.6	15.2	
19	A B	6.9	6.7		4.8	1.9		14.0	16.3	
14	A B	6.3			8.7	3.4		14.6	8.9	
16	A B	7.5	6.7		4.8	2.5		13.2	10.7	
20	A B	6.9	7.0		5.0	3.5		14.0	15.3	
24	A	6.5			4.7			4.9		
26	A	7.5			2.5			11.6		
13	A	6.0			3.7			10.6		
* 33	A	6.8			5.8			9.6		
Valley Soils										
1	A B C	6.5	7.0	8.0	4.0	3.0	1.0	12.4	12.2	21.5
21	A B	6.6	7.7		6.2	2.0		1.5	2.4	
6	A B	6.7	7.6		4.5	2.1		13.7		
27	A	6.9			1.8			1.4		
9	A B	6.6	7.0		4.0	2.7		16.0	15.0	
10	A B	6.6	8.2		5.0	4.8		12.4	20.4	
15	A B	6.3	7.3		5.7	3.5		13.5	16.9	
17	A B	6.8	7.1		4.2	2.5		1.8	2.1	
25	A B C	7.8			5.2	2.3		1.7	1.5	
30	A	6.0			4.6			1.4		
35	A	6.8			4.6			1.7		
* 50	A	7.9			5.0			1.4		
* 51	A	7.7			6.4			1.1		
Marine soils										
5	A B	7.3	7.6		12.2	2.4		2.8	2.2	
28	A	7.8			3.1			2.6		
7	A	6.9			2.1			2.2		
8	A	8.8			2.1			2.0		
11	A	8.2			2.2			1.5		
12	A	7.6			2.5			2.9		
22	A	8.2			2.6			2.9		
23	A	7.9	7.8		1.5	2.5		1.6	2.9	
* 29	A B	8.3	8.3		5.0	3.2		2.1	1.6	
* 18	A B	6.7	7.4		6.4	3.0		1.3	0.8	

* Soils of transitional character

TABLE 6

SOIL PARTICLE SIZE DISTRIBUTION*

Hill Soils

Pit No. & Horizon	% Sand	% Clay	% Silt
2A+3A	59.6	23.2	17.2
2B+3B	67.6	36.0	0
2C+3C	43.6	41.6	14.8
31) 34)	46.4	13.6	40.0
4A+19A	60.0	26.4	13.6
4B+19B	67.6	21.2	11.2
14	68.0	18.4	13.0
16A+20A	57.8	26.8	15.4
16B+20B	67.6	16.4	16.0
24) 26)	60.0	25.2	14.8
13) 33)	68.8	18.0	13.2

Valley Soils

1A	68.4	20.4	11.2
1B	62.0	26.4	11.6
1C	52.0	40.0	8.0
21A	44.0	40.0	16.0
21B	45.6	44.4	10.0
6) 27)	57.2	27.2	15.6
9A+10A	57.6	28.8	13.6
9B+10B	63.2	20.4	16.4
15A+17A	60.8	37.6	1.6
15B+17B	55.6	33.6	10.8
25	66.4	20.8	12.8
30) 35)	69.2	17.2	13.6
50) 51)	65.2	23.2	17.2

Marine Soils

5) 28)	52.4	8.0	39.6
7	78.0	13.6	8.4
8	84.4	8.4	7.2
11) 12)	88.8	5.2	6.0
22	46.4	47.2	6.4
23	67.6	24.4	8.0
29A	49.2	34.4	16.4
29B	58.0	27.2	14.8
18A	87.6	6.4	6.0

* Because of the large quantity of soil required for this analysis it was necessary to combine some of the samples.

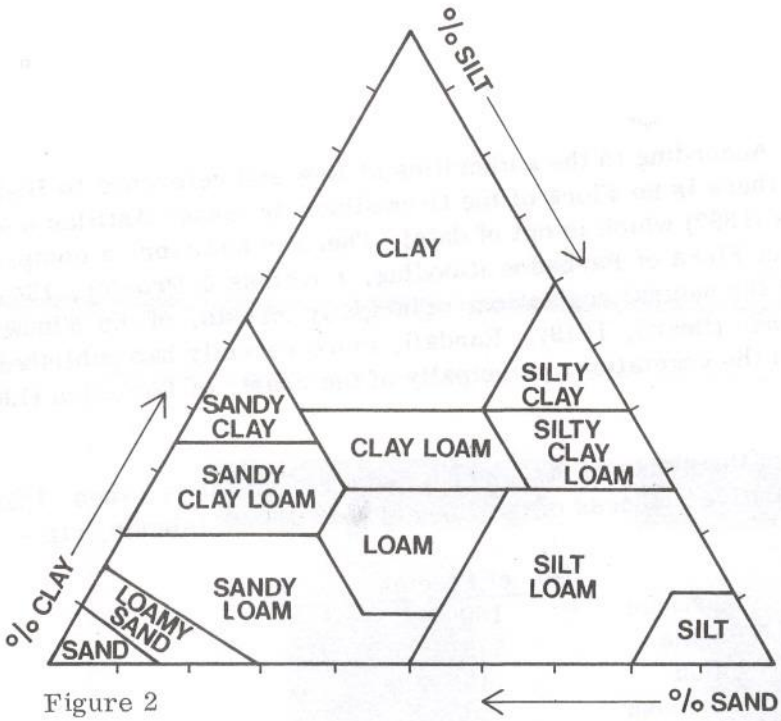


Figure 2
Key

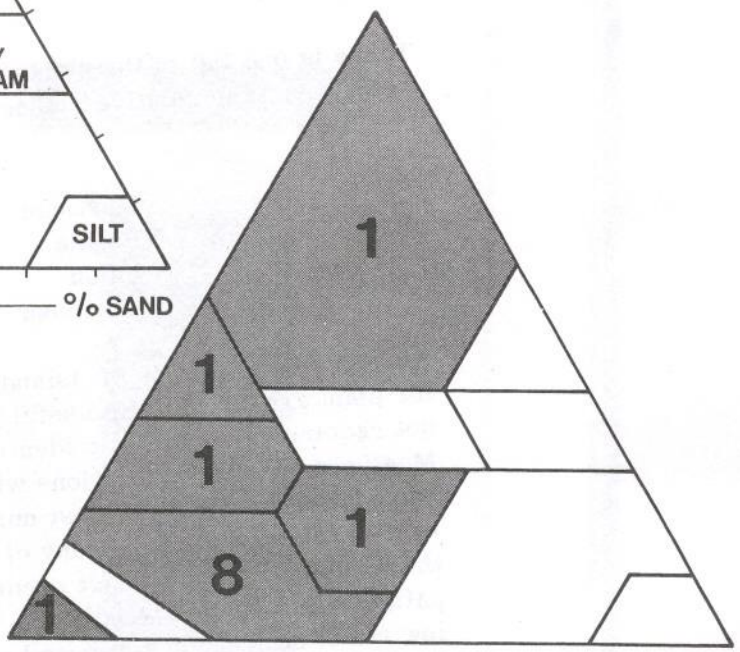


Figure 4
Hill Soils

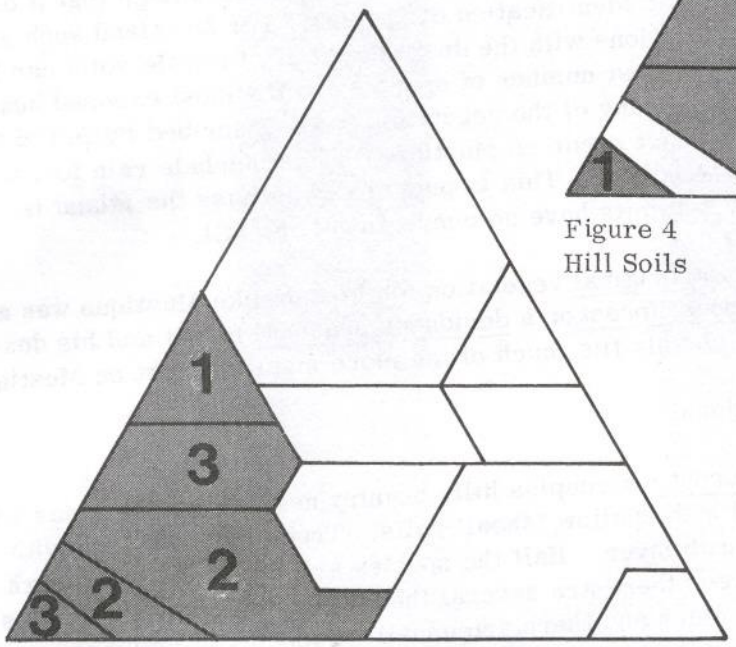


Figure 3
Soils of marine origin

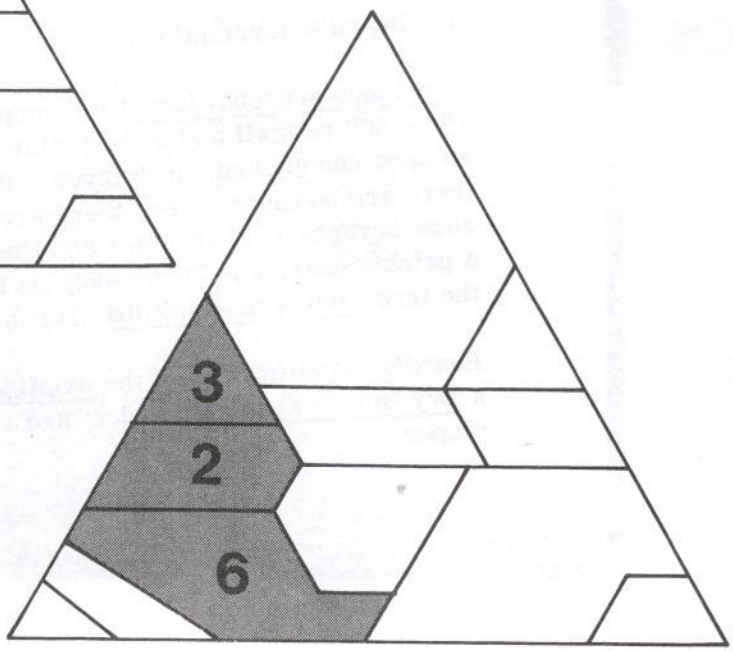


Figure 5
Valley Soils

3 BIOLOGICAL FACTORS

3.1 Vegetation

(a) Background: According to the authorities at Kew and reference to Blake & Atwood (1942) there is no Flora of the Grenadines or lesser Antilles other than that by Duss (1897) which is out of date! There is however, a comprehensive and recent Flora of Barbados (Gooding, Loveless & Proctor, 1965) and an account of the natural vegetation, principally forests, of the Windward and Leeward Islands (Beard, 1949). Randall, more recently has published several papers on the vegetation, principally of the coast, of Barbados (1968, 1969, 1970).

There is one list of the plants of St. Vincent and adjacent islets (Anon, 1893) which gives the relative richness of the flora of the various islands, viz:-

	No. of Species
Mustique	160
Bequia	375
Union	49
Cannouan	30

Richness is a function of island size, diversity of habitats and suitability for plant growth. It is a useful parameter and has the advantage that it does not require any taxonomic identification of species. For an island such as Mustique, sheltered locations with the deepest and most fertile soils can be expected to have the greatest number of species and the most exposed headland to have the least. Many of the vegetation types described by Beard for the Windward Islands do not occur on Mustique. These include rain forest, palm brake and elfin woodland. This is principally because the island is low relief so that the summits have no convectional rainfall.

Beard supposes that the original vegetation for islands like Mustique was a semi-evergreen seasonal forest or a deciduous seasonal forest and his description of the latter closely fits much of the more mature forest on Mustique.

(b) Beard's descriptions:

Deciduous seasonal forest : Occupies hilly country near the sea in areas with 40" - 60" rainfall and with shallow 'shoal' soils. Trees 30' - 40' high with an open canopy and shrub layer. Half the species are deciduous and though there are no thorny trees there are several thorny shrubs. Several species show xerophytic characters and there are usually a species of columnar cactus a prickly pear, and bromeliads on the ground. 90% of such areas consists of the trees Bursera simaruba (Birch Gum) and Pisonia subcordata .

Beard's classification of the existing vegetation of many of the Grenadines is a Dry-scrub-woodland on leeward slopes and a type of Bushland on windward slopes.

Dry-scrub woodland: Woods with a poor structure due to recent interference and no definite canopy. The dominant species listed by Beard include the following which occur on Mustique:

Bursera simaruba	Birch Gum, Turpentine
Hymenaea courbaril	Locust tree
Pisonia fragrans	Beefwood
Tabebuia pallida	Whitewood, White Cedar

However Beard states that epiphytes are rare which is definitely not the case on Mustique.

Bushland: Beard describes this type as being very dense and consisting of crowded, small (12-20'), gnarled trees and the description fits much of the forest on the windward side of Mustique. Common species listed by him include the following found on Mustique:

Tabebuia pallida	
Pisonia fragrans	
Jacquinia arborea	Torchwood
Plumeria alba	Frangipani

(c) Natural Vegetation of Mustique:

(i) Forest Types : The forest on Mustique has characteristics intermediate between Beard's descriptions of Deciduous Seasonal Forest, Dry-scrub woodland and Bushland and is itself divisible into two physiognomically distinct classes, viz. sheltered forest (mapping unit 1A) on the leeward side of the island, and windswept forest (1B) on the exposed side. These are both dominated by Tabebuia pallida but have other species which distinguish them (see key to the vegetation mapping units). The probable interrelationships of Beard's types and Mustique's forests is shown in Fig. 1 and this interpretation is supported by the fact that much of Mustique's forest has been little modified by man for a number of years and consequently is intermediate in character between Beard's types subjected to regular disturbance and his conjectural virgin type.

We know from Billinghurst's 1804 map that the whole island was intensively farmed for either sugar-cane, cotton or pasture. If, as is debated in section 5.1, the oldest parts of the forest have regenerated since about 1840 then it can hardly be considered climax in character and hence has not yet come into complete equilibrium with its environment. Parts of the forest occupy areas which have been abandoned much more recently and these are shown on the vegetation map.

(ii) Coastal communities: There are three types of coastal vegetation on Mustique:

(a) Littoral woodland (mapping unit 1D) This is an evergreen formation which occupies a narrow and restricted zone under the influence of the salt-laden

Figure 6

SCHEMATIC INTERPRETATION OF THE RELATIONSHIP BETWEEN BEARD'S FOREST TYPES AND THOSE ON MUSTIQUE

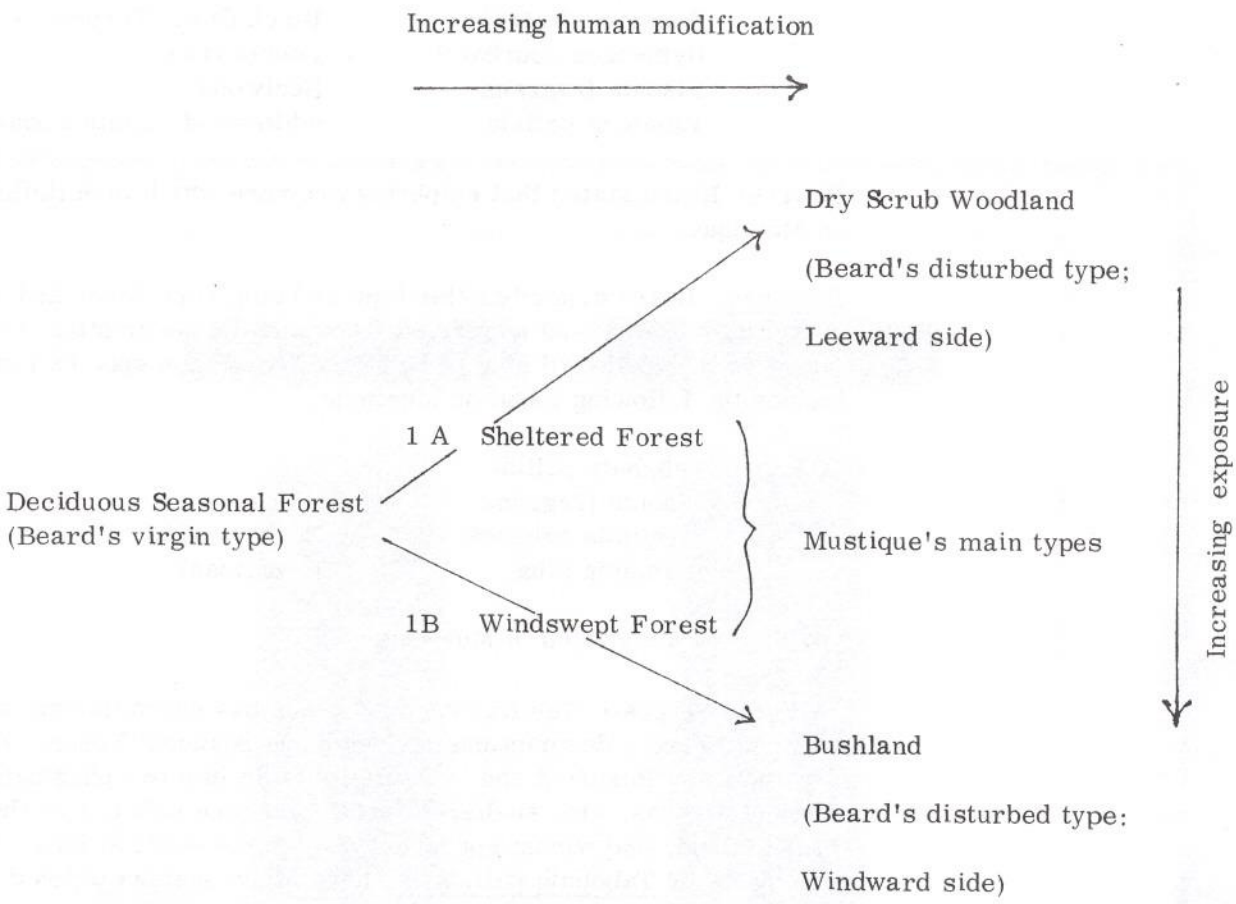


Figure 7

LOCATION OF THE VEGETATION TRANSECTS

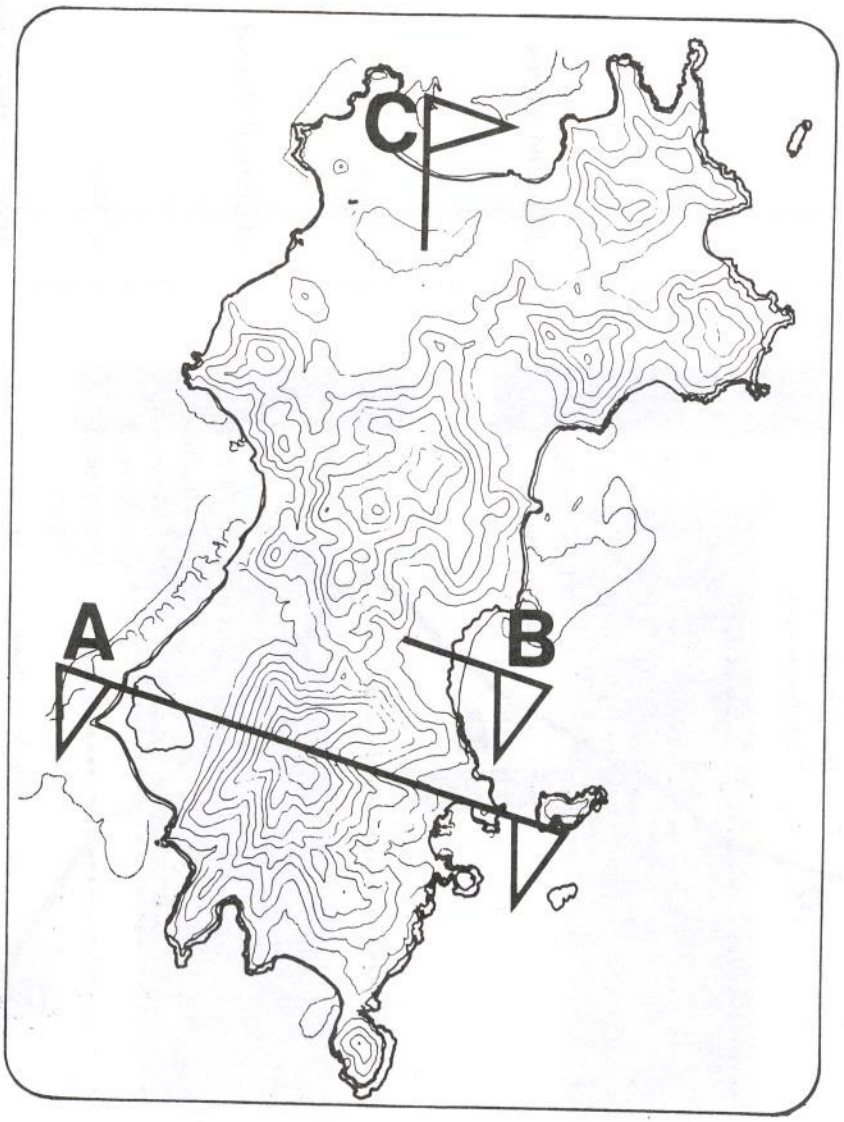
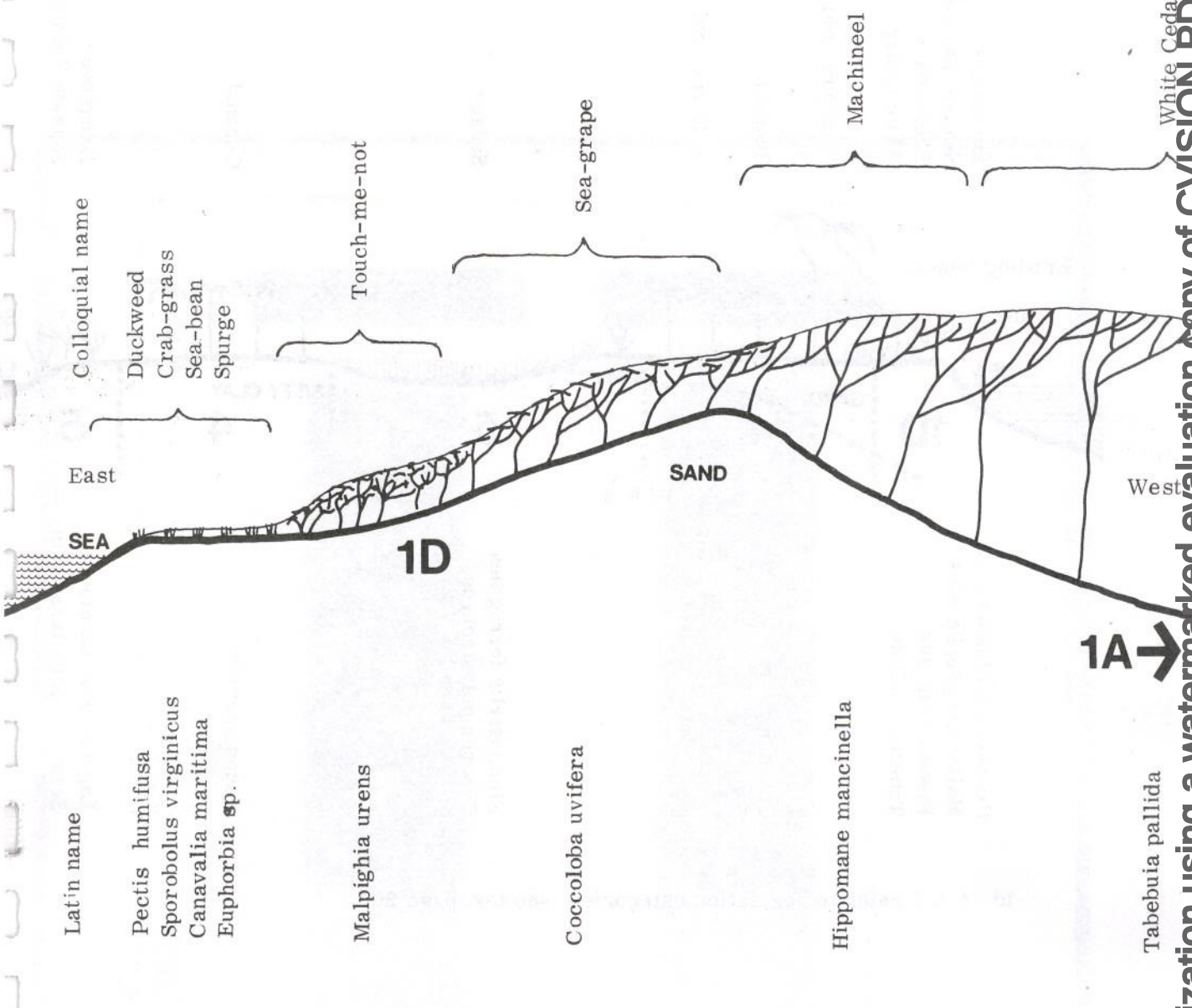


Figure 8
A. Generalised East-West Section across Mustique

1A, 1B, 1C, 2 & 5 refer to vegetation categories see text page 26

Figure 9

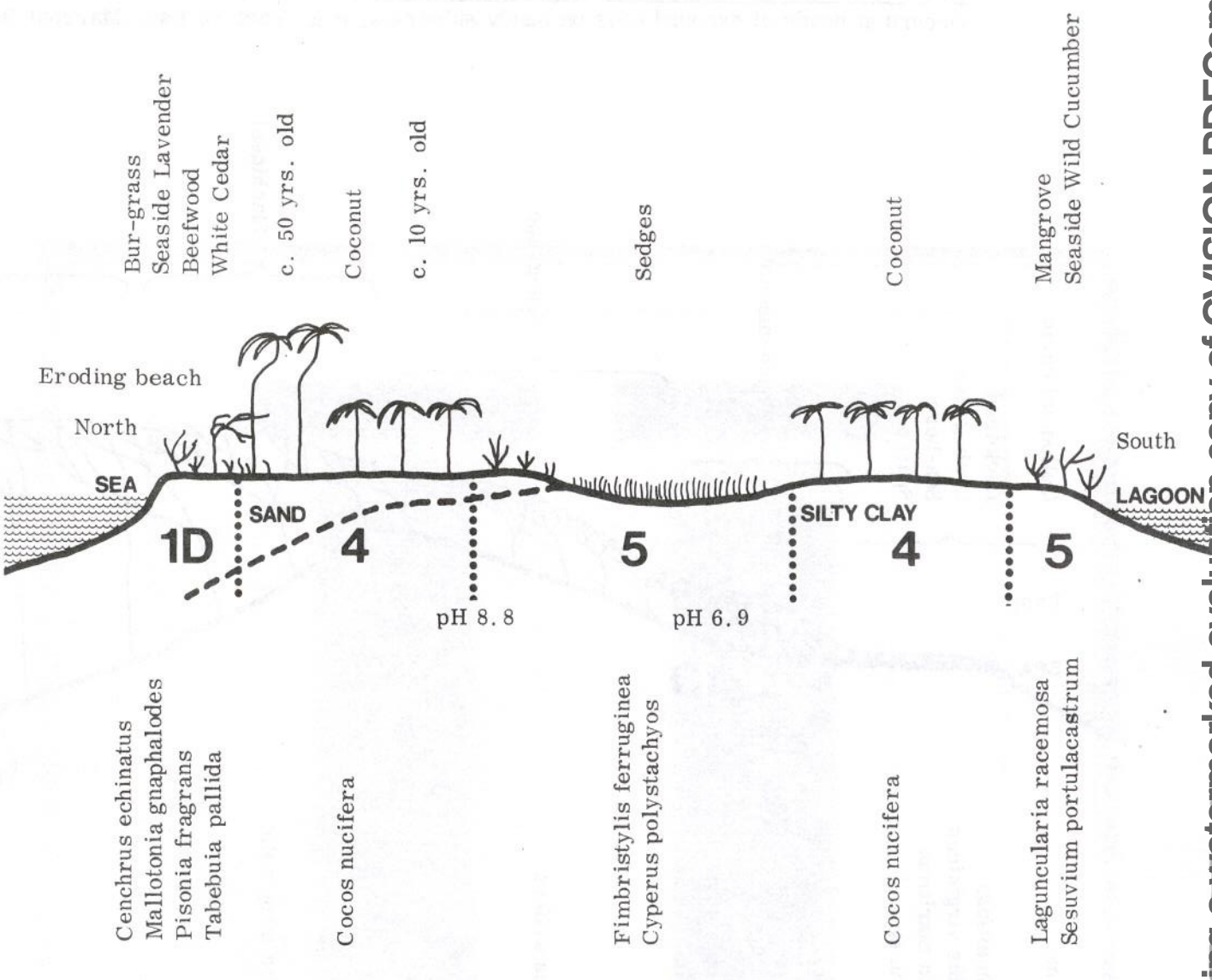
B "Sandy bushland" Association (Coccoloba urifera dominant).
Occurs at heads of exposed bays on sandy substrata, e.g. Pasture Bay, Marconi Bay.



1D and 1A refer to vegetation categories see text page 26

Figure 10

G Section through the Coconut Plantation on the North Coast



1d, 4 & 5 refer to vegetation categories see text page 26

wind, on headlands and on the landward side of dunes. It is of variable height, from a few inches to a few feet, and the crowns of the trees fit together into smooth domes or tables. Leaves are usually stiffened and thickly cutinised to protect them from the desiccating and mechanically destructive wind and salt-spray. The trees are often distorted, sometimes stag-headed and without epiphytes. This vegetation type has been described by Beard (1949) Hodge (1943) and Stehle (1945-6). On Mustique the dominant species are Hippomane mancinella, Tabebuia pallida, and Coccoloba uvifera.

(b) Coastal grassland/scrub (mapping unit 2) The most exposed rocky slopes of Mustique and according to Beard, the other Grenadine islands, are swept by salt-spray and have a large proportion of bare ground. Scattered individual Cacti are conspicuous and widespread. Some areas are covered by grass, Andropogon others have a dwarf scrub with Beefwood, Pisonia fragrans. Rock sage, Lantana involucrate, and Duckweed, Pectis humifusa, are also common.

(c) Sand-dunes (mapping unit 1D) Wind-borne sand is trapped principally by Sea-Grape, Coccoloba uvifera, and consolidated by its root systems which are more extensive than the aerial parts and spread below the zone dominated by Duckweed and Crab-grass (Sporobolus virginicus) and Sea-spurge (Euphorbia). The stolons of Crab-grass are effective in stabilizing the sand of the fore-dunes.

The spatial interrelationships of these vegetation types are illustrated schematically in three diagrams showing sections across Mustique.

(d) The Vegetation/Land-Use Map Vegetational variation on Mustique, as elsewhere, is essentially continuous and the drawing of boundaries is a matter of convenience. Systems of classifying vegetation may be based on physiognomy or detailed, sometimes mathematical, analyses of species composition. The latter approach, though intellectually satisfying is too academic and too time-consuming for our requirements and the map presented here is based on physiognomic categories identified initially from aerial photographs and subsequently confirmed and characterised from the ground. No attempt has been made to produce exhaustive species lists but particular attention has been paid to species that may indicate important environmental variables, such as exposure to wind,

amount of salt-spray, soil type and depth, and time elapsed since cultivation.

The two major vegetation/land-use categories are cultivated land and White Cedar (Tabebuia pallida) dominated deciduous seasonal forest. However, reference to Billinghurst's 1804 map clearly shows that all the forest is secondary and that all the land was then used for sugar-cane, cotton or pasture. It is probably that the sugar cane was grown principally on deeper soils on the leeward side of the island and cotton or pasture on the windward side.

The following vegetation categories have been identified (see map):-

1. Forest. *Tabebuia pallida (White Cedar) dominant. Secondary. Numerous epiphytes, two species of orchid and a Bromeliad, no mosses.

A. Windswept situations. Distorted canopies. Pisonia fragrans (Beefwood) is a good indicator.

B. Sheltered situations. Bursera simaruba (Birch Gum) is a good indicator species, Haematoxylum campechianum (Logwood) also present.

C. Mangrove/machineel association

D. Littoral woodland. Coccoloba uvifera (Sea-grape) association.

2. Dwarf coastal scrub, grassland or bare ground. On very exposed coasts receiving large quantities of salt-spray; plants with xerophytic characters, includes four cacti.

3. Cultivated land. Usually in more sheltered situations and/or on deeper soils on flat land or in valleys.

A. Recently or at present intensively cultivated land.

B. Pasture or very recently abandoned land. Usually on a shallower or less fertile soil.

4. Coconut plantations. Usually on moist, sandy, coastal areas.

5. Swamp, lagoon or sedge-dominated brackish land.

*Land superimposed with a check pattern has been recently cultivated (usually within the last 10 years), consisting of smaller trees often forming a spiny thicket.

3.2 Fauna

Some of the zoological interest of the island could be a useful selling point. Other features, like the mosquitos and sand flies, will have the opposite effect.

(a) Mammals: There are few species of mammals due presumably to the island's small size. Opossum, armadillo, agouti, and rats possibly occur (Anthony, 1925) or could be introduced if desired. The bats are very interesting and the Lesser Antilles have an estimated 23 species, many of which are endemic, some are however rabies carriers. The number of these species which occur on Mustique is not known.

(b) Birds: There are brown and red-footed Boobies, Pelicans, Frigates and Terns around the coast, and waders include Sanderling, Lesser Yellowlegs and the Grey and Golden Plover. The Little Blue Heron sometimes frequents the swamp and lagoon and Stints and Sandpipers have also been reported. Crackils are numerous and have probably increased in numbers as a consequence of an increase in human activity. Humming-birds (West Indian Purple Throated) are quite frequently seen and could be encouraged by providing sugar-water feeding tubes.

Davis (1926) quoting Bangs and Peters of the Museum of Comparitive Zoology at Harvard University claims that the avifauna of the Grenadines presents some striking peculiarities. He claims that a number of birds that are common to Bequia and several of the little Grenadines are unknown on St. Vincent which is but a short distance away. This is explained as being due to the different physiographic histories of the two banks. However, no further information on this point is available.

(c) Reptiles: Large iguanas (Iguana iguana) occur on Mustique but the numbers must be small and it is claimed that some were recently collected on Rabbit Island. Turtles use the beaches for breeding and are at present protected. Lizards (Lacerta) are extremely numerous and there are two species of snake (both harmless), one of which is quite common. According to Darlington (pers. comm.) an arboreal lizard (Anolis) may occur.

(d) Amphibia: No native amphibians occur but there are a few introduced tree-frogs.

(e) Coral reefs: These are of the fringing-reef type and occur on all sides of the island but are better-developed on the windward coast. Their distribution is not regular, being found principally of rocky shores and headlands. All the reefs appear to be actively growing. They are of course of considerable biological interest and will provide an attraction for sub-aqua enthusiasts. The marine life associated with the reefs includes sponges (Porozoa), starfish (Asteroids), sea-urchins (Echinoids), sea-cucumbers (Holothurians), corals and sea-anemones (Coelenterates, Zoantharians and Alcyonarians), sea-fans (Corgonians), hermit crabs (Crustaceans) and a variety of fish (Lewis, 1960).

There are two threats to the coral reefs. These are from sewage and from excessive collecting. The latter must be prevented by repeated requests and the passing and enforcement of local laws. Collecting rapidly depletes the fauna of shallow areas and reduces its interest for others. There would be no objection to the designation of a small collecting zone for those visitors suffering from cleptomania.

3.3 A Biological Assessment:

The biotic component of the island's ecosystems is seen as a resource in its own right. It contributes to the quality of the landscape and contains plants and animals in a little-disturbed, semi-natural environment which justify conserving in their own right. It is difficult to make an assessment of the conservation status of Mustique from a scientific point of view without a more extensive survey of neighbouring islands and literature. However, it is clear that some individual species obviously deserve protection and these include the turtles and iguana. More important, in the context of the proposed future development, and as an important contribution to the island's character, is the conservation of a range of habitat types and these should include more mature areas of forest, coastal scrub, sea-grape communities, and mangrove swamp.

While the overall management of the island should take account of the habitat diversity (section 4.2) there are some areas where the combination of low development potential and high biological interest make them suitable for establishment of nature reserves.

These must be seen as an additional amenity for residents and visitors and not as a somewhat negative policy of protection. It is also important to provide interpretative facilities such as an information centre and nature trails and to view these as a positive asset which will be increasingly demanded.

3.3.1. Nature reserves/Wilderness areas

There are three areas which because of their exposure, vulnerability to erosion, shortage of water, quality of forest or scenery are recommended as reserves to be excluded from development or to be developed in a very restricted manner:-

1. The south-east corner of the island including Black Sand Bay, Adelphi and South Point. This area is so exposed and liable to erosion that almost any kind of development would be unwise.

2. The area between Macaroni Bay and Pasture Bay, extending up to the main ridge, containing some of the best forest on the island.

3. The lagoon in the south-east of the island and the surrounding mangrove, machineel and beaches. This does not mean that it should not be opened to the sea but that it should not be cleared and rendered unsightly like the swamp at the north end of the island. The coral and shallow water at Lagoon Bay would provide a superb semi-natural aquarium.

Features of interest for a Nature Trail:

Origin of the island.
Geology
Soils
Lagoon
Swamp
Mangrove
Machineel
Forest: structure, wind patterns, variability
Lianas
Orchids
Bromeliads
Charcoal hearths
Xeric scrub and grassland, cacti
Effects of grazing, effects of salt deposition
Coconut palms
Sea-island cotton
Fauna
Turtles, Iguanas and Tortoises
Birds
Bats
Coral reefs: formation, types, marine life

3.3.2. Problem Plants

An inevitable consequence of maintaining a vegetation cover of high biological diversity is that both desirable and undesirable species are protected alike. However, it is essential to maintain a continuous vegetation cover (see section 5.3.4.), and modification of the vegetation will in general increase the proportions of some of the "problem species", particularly the spiny species and burrs.

Problem Plant Species:

The following is a list of the plants found on Mustique which may cause danger, discomfort or inconvenience, and is followed by some recommendations for their management.

Colloquial Name	Latin Name	Family
Touch-me-not	Malpighia urens	Malpighiaceae
Machineel	Hippomane mancinella	Euphorbiaceae
Burr Grass	Cenchrus echinatus	Gramineae (Grass)
Spanish Needle	Bidens pilosa	Compositae
Tank Epiphytes	Bromelia karatas	Bromeliaceae (Monocot)
(Spiny shrubs and trees):		
Black Cashew	Acacia macrantha	Leguminosae
Bitter-ash	Picrasma antillana	Simaroubaceae

(Cacti):	(Cephalocereus-	
Columnar cactus	(barbadensis	Cactaceae
	(Hylocereus trigonus	"
Prickly Pear	Opuntia dillenii	"
	Melocactus intortus	"
Love-vine	Cuscuta americana	Convolaceae

Touch-me-not has particularly vicious needle-like hairs on the undersides of the leaves. It is easily mistaken for other opposite-leaved glabrous shrubs and if brushed against can produce serious irritation. However, it is restricted to coastal scrub, principally on the windward side of the island, and if paths are cleared to the beaches and along cliff-top walks only the more adventurous will experience its protective devices. It is however, the most unpleasant of all plants on Mustique and warning notices showing a sketch of the plant should be placed at Pasture Bay as soon as more extensive development commences.

Machineel is famous for its caustic latex and there is no doubt that if people with sensitive skins come into contact with the latex they may develop blisters and other kinds of skin reaction which can be extremely painful. Stories about the dangers of sheltering under this tree during rain are probably wildly exaggerated but warning notices about the causticity of the latex will help protect those responsible from liability for any personal damage.

Anyone that walks across waste ground on Mustique picks up a variety of burrs and prickly seeds. Of these one is a legume with a black fragmenting pod which is quite harmless but Burr Grass and Spanish Needle can both cause discomfort and slight damage to clothing. These species are restricted to recently cleared forest or recently abandoned cultivated land and demand a habitat with a low intensity of competition. Fortunately, most visitors are unlikely to walk through this type of vegetation. If required, these species can be temporarily eliminated by repeated cutting, herbicidal spraying or maintaining any kind of vegetation cover, for example cut grass.

Tank epiphytes are only a problem in so far as their sheathing leaf bases act as water-reservoirs. Such an ingenious device, now being mimicked by man, is exploited by mosquitos for breeding sites. Elimination of the bromeliads is no easy task for they are extremely numerous throughout the island's forest. It is worth conducting a simple experiment to determine where and at what height the mosquitos breed (use sections of bamboo pole) and then to use chemical methods to eliminate bromeliads from near sites of human habitation. Copper sulphate solution has been employed in some Tropical American countries (Bromeliads do not occur in Africa) but its use is inadvisable if the area is also used for water catchment due to the cumulative toxicity of copper. Bromeliads are monocots and so long as there is no risk of contact with palms, grasses, maize, etc. it would be better to use a selective herbicidal spray (for monocots only) which breaks down rapidly and to apply it to individual Bromeliads. Even so, the expense of spraying the whole island would be extremely high and initial trials should concentrate around existing or proposed habitations.

The prickly and spiny shrubs and trees are all characteristic of once cultivated land which has been abandoned very recently. When such land is cleared it is essential to dig out the root stocks of these plants as well as to cut them down. Alternatively the application of herbicides such as Paraquat to the cut stems would be effective and because this chemical breaks down on contact with the soil within 24 hours there are unlikely to be any side effects. It is however, expensive.

Cacti are both beautiful and interesting and are so easily identified and their dangers recognised that they offer no serious inconvenience to the visitor. In fact they may be considered an asset to the landscape.

The love vine, Cuscuta americana, occurs locally, principally on abandoned land. If kept under control it does little harm and provides a feature of interest for visitors.

3.3.3. Insect control: Mosquitos - Mustique has a serious mosquito problem. Aerial spraying has been attempted but without long-term success. This kind of operation is fairly expensive, only achieves effective control for a short period and is extremely dangerous for catchments used for the supply of drinking water. Unfortunately mosquitos are not restricted for breeding to large obvious bodies of water. They utilise small pockets of water under forest and often in water in the axils of plant leaves. Bromeliads provide a suitable microhabitat and are abundant in Mustique's forests. Such niches are protected from aerial spraying by the tree canopy and maintain a small population which rapidly increases in numbers and spreads out to occupy former breeding sites that may have been effectively cleared. The proximity of Mustique to other islands means that they possess a reservoir of the pest from which Mustique, if cleared completely, would be re-colonised.

Detailed advice is available from the Commonwealth Institute of Biological Control, Trinidad, and perhaps individuals such as M.W. Service of the Nature Conservancy, Monks Wood, Hunts, and G. Surtees of the Medical Research Establishment, Porton.

We recommend a policy of local control through the draining or filling of known breeding localities and spraying of vegetation around inhabited parts of the island. It is important to ensure that water-bodies have near-vertical sides separating well-drained land from permanent water. This treatment will not, however, totally eradicate the mosquito and it will probably be necessary to fit the windows of houses with mosquito-proof screens, and to make available insect-repellant aerosols, creams and netting.

Sandflies - The breeding places of these is similarly a local problem, being restricted to a zone of the beach between the high-water mark of the tide and areas with a complete cover of vegetation or a change of substrate from sand to rock. Sandflies require a moist environment and the presence of organic matter. The moisture content of the sand can usually be reduced by draining above the high water mark of the tide. Sandflies are inactive when air velocities exceed about 20 knots and are usually only a serious nuisance on the leeward side of the island.

4.1 Exposure:

On the basis of the foregoing account some important deductions can be made about the relative suitability of different areas for development. One such consideration, exposure, should be considered as the combined effects of wind and salt-spray. Wind itself can be extremely damaging due to its mechanical effects but it is even more serious when it carries sea-salt which has a desiccatory and corrosive effect on a wide range of natural and man-made materials.

Wind has two components: velocity and direction. Although both are easy to measure at selected instants in time we require information about cumulative effects as well as the most extreme circumstances. Fortunately much of Mustique supports a semi-natural forest and, though it has been disturbed by man, its structure indicates the degree of exposure to wind and information about the velocity and direction of the wind. The aerial photographs clearly show distortion of the canopies of individual trees growing in exposed situations and the degree of distortion is a function of both cumulative wind velocities and the most extreme conditions during an individual tree's life-history. These photographs, together with ground observation, show quite clearly that much of the windward-facing slopes are highly exposed. It is tempting to suggest that small clearings might be made to provide shelter for one or a few chalets. There is however, a slight risk that any such practice in exposed positions is likely to result in windthrow of the trees around the margin of the clearing which would itself endanger both buildings and occupants. It is however, recommended that such practice be carried out in more sheltered situations. This is suggested to reduce soil erosion, increase shelter and generally improve the appearance of developed areas.

Salt spray is carried inland from the windward coast. The quantity in the air depends on the roughness of the sea and degree of wave-breaking on reefs or rocky shores and is not uniform even over an area as small as Mustique. The salt has a desiccatory effect on vegetation and salt-determined zones of natural vegetation are conspicuous (see vegetation map; littoral woodland and xeric scrubland) indicating local areas with high rates of deposition. It can similarly affect crops by directly burning their foliage and shoot apices. A saline soil solution results in water being physiologically unavailable to mesophytic plants even from a moist soil due to difficulties of uptake against an osmotic gradient.

Salt is corrosive to a range of man-made materials including some alloys, especially aluminium, paints (although special marine paints may be used), cement and rubber.

Collections of salt-spray in other parts of the world have however, indicated that the quantities deposited decline rapidly with increasing distance from the coast. Thus salt is only likely to be a limiting factor close to the windward shore or in valleys or on headlands which are extremely wind-swept. Areas

with high levels of salt-deposition are characterised by the presence of littoral species, such as sea-grape, or the presence of xeric scrublands. Other species, such as Beefwood, indicate lower rates of deposition.

The Exposure Map:

This map presents information about wind velocity, direction and salt-deposition. It has been drawn using information from a combination of three sources. First, by plotting the direction of distortion of tree canopies, principally white cedar (Tabebuia pallida), on aerial photographs which clearly show the areas that are more-or-less continually windwept. Secondly from topographical characteristics such as water-sheds, local shelter and aspect of hillsides. These features were especially useful for areas carrying cultivated or very disturbed land which have no natural indicators and for identifying the most sheltered situations. Thirdly, information has been drawn from the distribution of indicator species. One, variously known as the Gum Tree, Birch Gum, Turpentine or The Naked Indian Tree (Bursera simaruba), is restricted to spray-free situations. It is characteristic of sheltered, leeward hillsides and because of its completely deciduous habit and reddish brown, flaking bark can be instantly recognised both from a distance and on the ground (see photos).

Another, Beefwood (Pisonia fragrans) is a characteristic shrub/small tree of exposed headlands, and an understorey species of forest on the windward side of the island (see photo). Incidently, it has handsome foliage and a fragrant smell and will be useful for screening buildings or gardens in exposed sites. A black encrusting lichen which occurs on rocks also indicates fairly large amounts of salt deposition. It occurs on one aspect (E.N.E.) of the windmill near the Cotton House, all around the rocky coast on the windward side of the island, and on some of the rocks not protected by trees on the crest of the main ridge of the island. This distribution indicates the geographical extent of salt, deposition and the importance of aspect.

A less common powdery reddish-brown lichen occurs on the trunks of trees in exposed situations, for example on white cedars on the wooded cliffs above Macaroni Bay. Being more restricted in its distribution this species is of limited use as an indicator.

Five classes of exposure have been identified. 1 and 2 are sites that are windswept - the kinds of places which will be well-ventilated but are liable to mechanical wind-damage and salt-deposition. It is true that by closing the shutters it is possible to exclude the wind but the noise of rattling shutters for long periods would be found annoying by most people. However, such sites are more likely to be free of insect annoyance and would not need air-conditioning. Class 1 exposure sites are likely to experience winds of about the same strengths as class 2 sites but the amounts of salt spray deposited would be much greater. Houses in class 1 sites are likely to have sticky linen and clothing due to the hydroscopic properties of salt, and are liable to wind damage and are therefore considered least suitable for development.

Table 7 SUMMARY OF COMPATIBILITIES

Proposed development	Existing vegetation	Exposure class	Soil	Other considerations
1	5	4 5	C E	Slope, Screening
2	5 6	3 4	B D	Slope
3	4 5 6	2 3 4	D E	
4	4	3	B E	Scenic quality
5	6	2	C D E	
6	5 6 7 8	4	A B	Water Supplies
7	1 2 3 4 5	1 5	G H	Biological interest scenic quality
8	2 4 6	2	C F	Biting insects near beach

(Key on following page)

Table 8 KEY TO CLASSES OF DEVELOPMENT VEGETATION, EXPOSURE & SOILS

Proposed Land-uses/developments

1. 'Industry', services, refuse treatment
2. Housing, high density
3. Housing, low density
4. Hotels, restaurant, entertainments
5. Grazing and parkland.
6. Intensively cultivated land - kitchen vegetables, citrus, coconut.
7. Nature reserves, wilderness areas.
8. Camping, Club Mediterranee

Exposure

1. Very windy + salt
2. Very windy
3. Sheltered sites on windward side or exposed sites of leeward
4. Sheltered
5. Excessively sheltered

Vegetation

1. Coastal grassland and scrub
2. Littoral woodland
3. Mangrove/machineel
4. Exposed forest
5. Sheltered forest
6. Rough grazing, recently abandoned land.
7. Cultivated land
8. Coconut plantation.

Soils

A		Deepest and most fertile; flat sites
B	Valley	Deep soils; slopes 10^{o}
C		Variable depth; more exposed situations
D		Deepest; under forest
E	Hill	Shallowest; on ridges
F		Eroded coastal situations
G	Sands	of marine origin

Class 5 sites are the most sheltered. Unfortunately no biological indicator is available and the boundaries have been drawn on the basis of topographical characteristics. These sites are the safest from the point of view of wind damage but are likely to be extremely oppressive and buildings will require air-conditioning.

Sites in exposure classes 3 and 4 are considered the premier sites for development being well-ventilated yet unlikely to suffer from wind damage or from salt spray deposition.

Mustique offers a wide range of exposure classes. Both extremes of the range have serious disadvantages for development and it is important that consideration be paid to the susceptibility of areas in exposure classes 1, 2, or 5.

4.2 Summary of compatibilities:

The maps of eight vegetation/land-use classes, eight soil divisions, and five exposure classes can be collectively assessed to indicate the suitability of various areas for development. In order to do this it is necessary to identify the intercompatibility of the major categories of proposed development and the ecological features mapped. This information is summ rised in Table 7 and the key on the following page.

5 HUMAN FACTORS

5.1 Past:

Even before the days of Columbus, man was exerting an impact on Mustique. Scattered pieces of Carib pottery present abundant and indisputable evidence of indian occupation. In fact it is possible that Arawaks inhabited the island even before the Caribs. However, we cannot estimate the numbers of these people nor their effect on forest or soils. The 16th, 17th and 18th centuries saw increasing agricultural development, principally as a result of the suitability of the area for growing sugar-cane.

We know, from Billinghurst's 1804 map, that the whole island was then either under sugar-cane, cotton or rough grazing. Individual trees along the boundaries between estates and/or near the main ridge are marked and identified and the ratios of the various species are of interest:-

Turpentine	7	(= Birch Gum)
Cedar	6	(= White Cedar)
Francaispon	6	(= Frangipani)
Fig	2	
Mangrove	-	Around lagoon and the nearby salt-pond.
Palms	-	Lining the track from the quay to Fort Shandy.

Other interesting features are:-

1. The Park at East Point (Rutland Estate) which was probably rough grazing with scattered individual Cedar trees.

2. The six hedges on the Old Plantation. They are unlikely to have been for shelter as this area is one of the least exposed and they run east-west. Presumably they served as stock-fences to keep cattle out of the sugar plantations.

3. Although the swamp at Mackeyrooney (= Macaroni) and the lagoon and salt-pond in the south-west corner are shown, there is no indication of water, swamp or mangrove in the position of the present Endeavour swamp. It is highly improbable that this land has sunk since 1804 and because of the accuracy of marking other features it is difficult to believe that it was overlooked. The reason for this omission remains a mystery. Possibly the swamp has formed since, from increased run-off due to the clearing of climax forest in Endeavour.

We can assume that intensive cultivation continued until about 1830 to 1840 when sugar cultivation ceased to be an economic proposition. It is probable that other crops were grown on the flatter land and that the hill-land went out of production fairly rapidly. However, the island continued to be occupied, cotton continued to be grown on some hillsides; Kingsbury's map shows the extent of its cultivation in 1959. These areas included The Old Plantation, Pasture Bay, Rutland, and a very large part of the north-east of the island including the present coconut plantation. Much of this is still cultivated land; but it includes areas now forest which can be identified as recently cultivated on the aerial photographs and have been marked on the vegetation map.

The numerous relicts of the island's long and varied history would provide features of considerable interest for visitors exploring the island. Information could be incorporated in nature trials or made the subject of displays in an interpretation centre. The interrelationships between history, changes in land-use and the present variety of vegetation types, would provide interest for the visitor and would serve as additional tourist attraction.

5.2 Present:

There is no point in presenting here a detailed review of the range of constructional, agricultural and related activities at present taking place on Mustique. The majority of these raise no ecological queries or objections. There are, however, a few that may be considered as the abuse of a resource or which are likely to result in erosion or at least some kind of environmental disfiguation and should be terminated:-

1. Construction of roads close to water-courses in the bottoms of valleys without any means of diverting run-off. Such roads will inevitably carry the run-off for almost half each such catchment. Roads should be graded so that water runs off along their whole length or at least at regular intervals and, wherever practical, run-off should be led into contour graded diversion drains. Roads should be surfaced with either concrete or tarmacadam.

2. Use of the hardest large igneous 'granitic' pebbles for internal walls, foundations and as aggregate for concrete. These materials represent a precious resource because of their limited distribution and should be conserved for use as a facing stone (See section 5.3.3.).

3. Extraction of large quantities of sand from the seaward face of dunes (e.g. Pasture Bay) and unnecessary damage to the vegetation. Beach sand is a very limited resource and should be taken as sparingly as possible from the backs of beaches and dunes.

4. Many of the valley soils appear to be excessively compacted (e.g. horses field at Rutland). This is probably due to over-grazing or cultivation without mulching so that both sun and rain compact the soil. This problem can be overcome by contour ploughing and then by introducing rotational grazing.

On the positive side one development of the present agricultural activities will result in a more diversified and attractive landscape. If pasture, preferably with standard trees, could be re-established on parts of the windward coast both the island's productivity and its scenic quality would be improved. We recommend the continued development of this aspect of the island's activities for aesthetic rather than economic reasons.

5.3 Future demands, determinants of carrying capacity:

5.3.1. Water, resources and quality. The amount of water available for extraction is of critical importance. Demands vary according to the country of origin of the visitor. British people consume an average of about 40 Imp. gallons per day, and Americans about 100 Imp gallons per day. Tourists demand the same standards on a holiday as at home, even when visiting small, dry Caribbean islands. In fact it is probable that they will bath or shower more frequently than when at home.

The water available is the difference between the amount deposited by precipitation, less than that lost by run-off, drainage and evapor-transpiration. Although records of precipitation have not until very recently been taken on the island it is possible to extrapolate from records for neighbouring islands. Estimates which have been published (Fentem 1961, Beard 1949) vary and probably reflect the real year by year fluctuation. 45 inches per annum is an average figure.

Losses of water from the island are even less well documented and most published values for other islands are based on inference. Harris (1965) considers the evapotranspiration on the windward side of the islands he studied to be 150% greater than that on the leeward side. We can assume that completely vegetated slopes transpire more water than bare ones but that this is counterbalanced by the fact that vegetated slopes usually lose less water as a result of run-off. Estimates of evapotranspiration in the region have been given as 4 inches (10 cm) per month (Harris, 1965). Thus evaporative water

Table 9

RAINFALL STATISTICS FOR MUSTIQUE
1964 to 1970

Month	1964	1965	1966	1967	1968	1969	1970	Average
January	0.43	6.51	0.29	4.10	0.76	10.39	1.88	3.48
February	0.04	1.84	2.79	1.94	0.80	0.82	1.06	1.33
March	-	2.23	2.38	2.41	1.17	-	2.63	1.87
April	3.15	1.75	5.16	2.41	-	1.34	0.08	1.99
May	1.76	0.42	4.91	5.00	3.65	4.11	1.25	3.01
June	7.05	2.63	11.31	1.03	4.76	4.86	8.36	5.72
July	6.52	5.46	7.21	5.63	1.52	6.54	7.13	5.72
August	5.08	5.80	6.14	5.21	5.31	8.20	6.57	6.78
September	3.93	6.81	17.37	8.85	8.15	6.72	10.89	8.97
October	7.78	9.52	10.70	7.86	4.13	6.56		7.77
November	2.39	7.06	8.28	4.74	6.64	5.89		5.83
December	0.86	10.95	5.25	2.29	2.56	7.72		4.94
TOTAL	38.99	60.98	81.79	51.47	39.45	63.15		55.97

losses exceed rainfall inputs in the six months January to June. In the other months when rainfall exceeds evapotranspiration water must either penetrate the soil or run-off. Hardy (1941) and Beard (1949) have described Shoal-type soils (see soils section) for comparable islands and indicate that the shallowness, physical structure and high clay content of the soils is such that penetration water-holding capacities are low. Much of the rainfall occurs during short sharp showers and consquently during the few wet months much of the rainfall is lost to temporary water-courses. The vegetation is effective in holding such soil as exists and is also important because it intercepts rainfall and spreads the period over which percolation and storage take place. The root systems of the vegetation also bind and hold the soil, the plants contribute organic matter which increases its water-holding capacity, but on the other hand, the vegetation transpires more water than would be evaporated from bare ground. On balance, however, the existing vegetation has a desirable effect on the water balance and should so far as is possible be maintained.

The geology of most of Mustique is such that the volume of underground water is likely to be quite small. Only the areas with sedimentary deposits in the north-west, south-west and behind Pasture Bay on the east coast have formations that can be expected to contain water. The survey carried out by Archibald Shaw and Partners indicated that they were of considerable depth (215 ft) and according to the Ghyben-Herzberg formula (Martin-Kaye, 1956), water lenses are usually assymmetrical in shape so that for every foot of fresh water above sea-level there are likely to be 40 feet below. These sedimentary deposits are, however, of small area, and the particle size of the material is so small that the porosity and permeability are low and consequently the water-capacity and movement are severely restricted. Moreover some areas are flat and little higher than sea-level and consequently there is contamination by sea-water (see table of water conductivities). Whilst water from these areas may support or supplement local 'native' requirements it appears that it is inadequate and unsuitable for the much heavier demands generated by tourists.

Run-off may be reduced by terracing water-courses but any advantage would be offset by problems arising as a result of impounding reservoirs providing possible breeding sites for mosquitos. Moreover most of the water courses occur on the windward side of the island and, if development is to take place principally on the leeward side, water would have to be pumped over the watershed. However, separation of areas of habitation from areas of water collection is generally considered good practice.

In considering the water resources of Mustique reference should be made to the reports by specialists Martin-Kaye and Ian de Verteuil, to the enclosed map of drainage basins and existing sources of supply and to the information available about precipitation, salinity and sulphate content of water bodies as well as to the depth, porosity and permeability of soils.

The following features of Mustique create serious difficulties when water supplies are considered:-

1. Although the average rainfall is quite high (45"/115cm) it is highly variable and a bad year may produce as little as 25"/63cm .

2. Rainfall is concentrated in a few months (May - Dec.) which unfortunately do not correspond with the peak tourist season.

3. Due to the more or less continuously high wind velocities and sunshine levels the evapotranspiration is extremely high (at least 4"/10 cm per month).

4. Due to the very fine particle size of the soils their porosity (10-15% pore space) and permeability are low so that percolation is low (10% of rainfall).

5. For the same reason, the specific yield is low (2%).

6. Slopes are fairly steep and run-off high.

7. Soil depth is generally shallow on the hillsides (3"-3ft.) which occupy most of the island but valleys have soils up to 20ft. in depth.

8. The bedding-plane of the volcanic rock dips towards the south-east so that slopes are more gradual and water-courses longer on the east side of the island.

9. The large quantities of salt deposition will result in water collected on the windward side of the island being slightly saline.

10. The volcanic origin of rock and soil may result in some catchments yielding water with a high sulphate content.

11. There are several (15) very small drainage basins. The largest being about 50 acres.

Three types of water source are at present exploited:

(i) Collection on roofs
(ii) Dug wells
(iii) Dammed water-courses

A combination of all three will be required for the initial stages of development and storage capacity will have to be increased. Ultimately a desalination plant will be required. Until that time the provision of water for gardens, washing of cars, etc. must be discouraged and a small golf course with 9 greens would demand a large part of the supply from an average-sized catchment (section 6.2).

Table 10 CONDUCTIVITY DETERMINATION

Electrical conductivity or resistivity (ohms -1 or mhos) is a measure of the total ions in solution. For water-bodies in maritime situations it is sufficiently well correlated with the total concentration of sodium, potassium and chloride ions to be used as a measure of salinity. The condutivities and sodium levels of all water-bodies on the island were analysed:

	Conductivity	Nett ppm*	Turbidity	Volume
Sterasylled water, frozen and thawed	120		Low	
Coutt's house water	130		Low	
Boabab Pond	245	26	High (organic matter)	150,000 galls
Outside Bag	260	44	High (sediment)	
Inside Bag	270	48	High (sediment)	250,000 galls
Tank in Arne's House (taken from dam)	300	56	High (sediment)	
Horses Pond at Rutland	340	52	Very high (sediment and organic matter)	50,000 galls
Dam Water	375	76	Low	200,000 galls
Cotton House Pond	475	80	Low	150,000 galls
Plantain Well	510	68	Low	Yield 250 galls/day in wet season
Swimming Pool Swamp	630	96	High (organic matter)	small volumes when dry
Pasture Bay Well	1100	184	Low	800 galls
Rutland Well	1100	174	Low	
Cotton House Well	1500	200	High (organic matter)	5,000 galls
Swamp - west end	3750	640	Low	
Swamp - east end	4000	760	Low	2×10^6 galls
Old Plantation Well	5000	1140	Low	2,000 galls
Swamp at Rutland	5000	980	High (sediment	
Lagoon	41000	7800	Low	23×10^6 galls
Sea	52000	9800	Low	

* Values should be multiplied by 3.5 to give p.p.m. Salinity.

Reference to the Drainage Basin map indicates some of the possible sites for new sources of water supply. They fall into the following categories:

(i) Collection on roofs of all buildings and from paved catchments.

(ii) Drainage basins with deep soils in their valleys should exploit dug wells or well points, see map, locations 3, 4, 6, 8, 9, 14, 15, 16. Water available during the wet season should be siphoned into reservoirs or pumped into storage reservoirs on high ground for use during the dry season. It may be possible to use wind pumps for this purpose.

(iii) Drainage basins with temporary watercourses should be dammed and the water siphoned or pumped into storage reservoirs. Large yield locations 1, (enlarged with additional storage capacity, 2), 7, 10, 11. Small yield locations, 5, 8, 12, 13.

(iv) A large storage reservoir on high ground central to several catchments and yet with good road access (location 17).

The water-bodies with low conductivity values (<650 metres) (up to and including the swimming pool swamp) are suitable from the point of view of salinity for drinking-water supplies. The wells at Pasture Bay and Rutland have rather high values which might be reduced by regular pumping. Other water-bodies are unsuitable.

The conductivity and sodium values of the Cotton House Well are surprisingly high when compared with the Cotton House Pond and Swimming Pool Swamp and the reason for this is not understood.

5.3.2. Waste Disposal: The depth of soil is insufficient over parts of the island to recommend individual disposal units such as septic tanks. Moreover there are obvious health hazards if the catchments are also used for collecting water for drinking purposes. However, where septic tanks are employed the supernatant liquid may be used for irrigation. If detergent levels are expected to be high it would be advisable to separate such contaminated water and treat it separately.

If development areas are connected to a common system it is essential that the outfall(s) be sited after considering the strength and direction of currents.

Hydrographic charts show that the prevailing current is from the east and passes to both north and south of the island at about 2km/hr. but there is no indication of any north-south currents. However, the shape of the sand-spit off the south-west point of the island indicates that there is a prevailing current from the north. This discrepancy is extremely important to a consideration of the siting of sewage outfalls because sewage must not get washed back on-shore as it renders beaches unpleasant. However, contrary to popular belief there is unlikely to be a risk to bathers' health.

Sewage can prevent the growth of coral and consequently it is important that a continuous assessment of its ecological effect be made.

Prior to the siting of an outfall it would be a good idea to release several markers and then observe whether or not they are washed ashore (rotten oranges have been used for this purpose!

It is imperative that no outfall be sited on the windward coast of the island.

Domestic refuse should be burnt, obviously on the leeward coast of the island, and the residual material buried or dumped at sea in deep water.

5.3.3. Building materials: The only good building stone is the igneous, granite-like, boulders scattered over the surface of the island. These are very hard and make a good facing stone. At present, in spite of their limited supply, they are used for foundations and internal walls and are being passed through a crusher to make chippings for roads and for concrete. This represents a serious wasteage of a precious resource and should be stopped.

Sand is being excavated from L'Ansecoy Bay and Pasture Bay. Coastal dune systems are extremely sensitive to damage. That at L'Ansecoy Bay is without doubt eroding at present. This may be the result of the destruction of foreshore/embryo dune vegetation (Duckweed, Crab-grass, Sea-grape, etc.) which stabilized these unstable substrata. Such vegetation is still intact at Pasture Bay and if left undamaged will stabilize the sand. However, sand excavation has just commenced and concern must be expressed for this area.

5.3.4. Erosion: Steep slopes, $> 14^{o}$, with shallow soil and stripped of vegetation are always susceptible to erosion problems and these have been encountered in neighbouring islands such as Bequia. Kingsbury (1960) states that "Such standard, necessary practices of slope farming as cover-cropping and contouring are not followed and everywhere gullying and severe erosion are evident."

Two areas on Mustique, still have the scars of serious erosion which bear witness to bad land management in the recent past. These are the desert-like headland adjacent to South Point and the area around the site of the old village at Rutland.

There is a considerable amount of evidence to show that the area near South Point once supported both soil and vegetation. In fact in 1804 it was almost certainly part of the Adelphi cotton plantation. Today dead root systems persist and provide evidence of a more fruitful past. Presumably excessive cultivation and trampling led to the destruction of the vegetation and the initiation of erosion.

Similarly the bare eroded hillsides at Rutland were probably caused by excessive trampling and grazing around the old, now abandoned village. However, the old village near Fort Shandy now supports what is probably the best developed forest on the island. Certainly, it has some of the largest trees with fine Tamarinds, Gums and Logwood. Only the bases of houses (they probably had wooden superstructures), occasional pieces of pottery, a gourd tree and Billingshurst's map indicate the history of this site.

The moral of the comparison between Rutland, South Point and the site near Fort Shandy lies in the fact that the two which have not recovered receive large amounts of salt-spray. This reduces the rate of plant growth due to the high osmotic potential of the soil. Some people refer to this phenomenon as "physiological drought". Such sites are more prone to erosion problems and require more careful manipulation than sites on the windward side of the island which revegetate within a few months.

Some water-courses show erosion features, for example the northernmost stream-bed at Pasture Bay. At one point five feet of soil has been cut away (see photo 13). It is probable that this was initiated as a result of over-stocking when the area was pasture. This type of erosion may be overcome by providing silt-traps to slow the water and reduce its sediment load.

During the forthcoming proposed development it is important to maintain a vegetation cover and to return the surface soil layer after mechanical operations to carry out all mechanical operations parallel to the contours, to terrace steep slopes which are denuded of vegetation and run surface water into drains that parallel the contours. Roads should be graded and surfaced and provision made for the dispersal of surface run-off. The Lands and Surveys Department of the Department of Agriculture on St. Vincent will probably be able to give further advice if required.

6 FINAL SUMMARY - AN ECOLOGICAL VIEWPOINT

6.1 Main assets:

There appears to be universal agreement that the scenery on Mustique is superb and this beauty is derived from an interplay of forest, rocky headland, sandy bay and turquoise sea. The quality is partly the result of the small scale of this heterogeneity and the feeling of being on a small, secluded island and yet one so little exploited that an excursion to any beach or headland requires a half-day expedition. This sensation of being on both a very small and a very big and varied island is important to preserve.

Secondly there is a smaller scale of beauty and interest. This is totally attributable to biological components of the environment such as the widely distributed solitary cacti, the palm plantations, epiphytic plants, windswept distorted trees, and the occasional tortoise, humming-bird or butterfly.

Thirdly there is interest that derives from past and present forms of land-use. Relics of the past include an abandoned village, Fort Shandy, Carib remains, a solitary cannon, a sugar-cane press, old wells and water-tanks. Present day activites also contribute to the interest of the landscape and most visitors will appreciate seeing cattle and ponies, fields of pigeon pea and cassava, scattered mangoes and tamarinds. citrus groves and banana plantations.

The case for maintaining and developing the agriculture of the island partly rests on the importance of preserving the feeling for the visitor of being part of a functioning system as well as to open-up views and increase diversity in the landscape.

Most visitors would appreciate interpretative facilities to enable them to understand more of the variety and richness of the flora, fauna and history of the island. We suggest that an information centre be provided and short, self-guided nature trails from natural focal points such as beaches and the lagoon. These should not be too arduous and should provide an alternative route back to the starting point.

6.2 Main difficulties:

(a) Proposed opening of lagoon and swamp to the sea -

1. Lagoon (south-west corner of the island) - Consideration of the present salinity of this water body (see table 10 section 5.3.1.) its proximity to the sea and the absence of strong currents indicates that the opening of the lagoon to the sea on the west coast is a feasible operation. The tidal range is small (about 2 feet) so that the volume of sea-water that would flush the lagoon with each tide will be quite small. The presence of the sand-spit on the south-west corner of the island indicates that there is a gentle north to south current on the leeward side of the island as well as the stronger east to west current on the south side. The construction of a small groyne to the north of the opening

would reduce the amount of sand deposited and any should be flushed away each time the lagoon part-drains with the tide. This operation is not likely to increase the salinity of the fresh-water lens at the Old Plantation.

2. Swamp (north-west corner of the island) - It has been proposed that the swamp should be opened to the sea and thereby flushed with sea-water to eliminate the mosquito larvae. However, the number of possibly diastrous side effects is too great to seriously contemplate such an operation. The swamp is approximately ten times less saline than the lagoon and is further from the sea with coconut palms occupying the intervening land. The introduction of such a volume of sea-water might result in an increase in the salinity of all the sourrounding land as saline-water tends to sink with respect to fresh water. If this took place the coconut palms would be likely to die and possibly the water in the pond by the Cotton House and soils elsewhere would increase in salinity. Instead, the swamp should be gradually filled leaving, if desired, a small lake in the centre as a landscape feature. Material for fill could be provided from the nearby spur which is already being quarried. The highly weathered rock at this point is very crumbly and easily excavated and might provide a cheaper supply of material than dredging it from the sea-bed, as has been suggested elsewhere.

(b) Golf courses The volume of water required for a golf course depends to a considerable degree on the quality of turf required, whether it is sited on the windward or the leeward side of the island, and whether the greens are on hillside water-shedding sites or valley floor receiving sites. The following theoretical calculation for the volume of water required to maintain a high quality turf for a small 9-hole golf course on the windward side of the island (say at Macaroni Bay) illustrates the very large volume of water required for providing this kind of facility.

Month of year	J	F	M	A	M	J	J	A	S	O	N	D
Precipitation (cm)	6	3	3	3	5	11	14	16	18	18	18	9
*Estimated potential evapotranspiration (cm)	10	10	10	10	10	10	10	10	10	10	10	10
Water surfeit (cm)						1	4	6	8	8	8	
Water deficit (cm)	4	7	7	7	5							1
Total water deficit (cm)			31									

* Taken from Harris (1965), based on the Thornthwaite equation, and probably an underestimate for Mustique. An annual estimate for Barbados is 154.7cm (Watts, 1966).

However, there should be sufficient water stored within the soil (5cm rainfall) for watering to be unnecessary during December and January. Consequently, it should be possible to maintain a good turf if the equivalent of 26cm of rainfall is applied. This figures does not take into consideration evaporative losses

during application. We should also bear in mind the high clay content of the soil and the fact that most grasses are surface rooting.

Minimum area of a golf course green	= 400 sq. m.
Minimum number of greens	= 9
Areas to be watered	= 3600 sq. m.
Depth equivalent of water to be supplied	= 0.26 m.
Volume of water	= 936 cu. m.
	= 200,000 gallons

This volume of water would need to be applied during February to May inclusive and would require a reservoir approximately 16 yd. x 30 yd. x 10 ft. deep.

The volume required could be reduced by siting most of the greens on receiving sites at the bottom of the valley or by siting the whole course on the leeward side of the island (about 2/3 of the above estimate) or by accepting poorer quality or artificial greens.

It is important to obtain actual volumes required for golf courses in similar situations, for example on Barbados. But it appears from this preliminary, theoretical calculation that the provision of a golf course would be a very expensive luxury unless watering can be done entirely from purified effluent.

(c) Volume of sand available for extraction at Pasture Bay - The beach at Pasture Bay is one of the most precious of Mustique's landscape and recreation resources, but the sand of which it is composed is limited in supply. Much of it is delicately stabilised by vegetation representing an early and very sensitive stage of succession, and it must be emphasised that unnecessary damage to the vegetation and excessive removal of sand is likely to ruin the quality and appearance of the beach.

Whilst the management of the vegetation is an ecological problem the assessment of the volume of sand is not, and we suggest that a specialist such as Dr. A. Smith of the Geology Department at U.C.L. be approached, to give advice on the volume of sand on the sea-bed available for the natural replacement of that excavated.

However, if an approximate estimate of the amount of material is required now, in the absence of information about the depth of sand and the quantity on the sea-bed, we would suggest that sand should only be removed from the back of the 'dunes', i.e. the area stabilised by littoral woodland, and that this area be excavated to a depth of not more than two yards. The area that would be suitable is approximately 200 yards long by 8 yards wide and would yield 3,200 cubic yards of sand. It is believed that this would represent a compromise between extracting no sand in order to maintain a perfect beach and its associated littoral vegetation, and extracting virtually all the sand to provide an ample and cheap supply of this building material. However, it must be emphasised that the extraction of even the volume recommended above would seriously detract from the quality of the landscape.

(d) Hurricanes Mustique lies just south of the main hurricane belt across the West Indies. To the north of St. Vincent hurricanes are experienced about once every 20 years. Mustique excapes these but experiences persistently strong winds from the east and north-east. The average wind-speed is quite strong (about 15 m.p.h.). Watt's estimate for a 47 year period on Barbados is 12 m.p.h.

(e) Volcanic Activity - Although the Lesser Antilles lie in one of the world's major belts of volcanic activity there are two arcs of islands. Mustique is a member of the older, outer arc which is generally considered free of risk. St. Vincent and Martinique, however, are members of the inner, younger arc and have volcanoes that have been active within historic times.

6.3 Further work required:

The primary objectives of a vegetation map, a soils map and an exposure map have been achieved and this report summarises an overall ecological assessment of this fascinating island.

In addition four critical problems concerning the future development of the island have been identified, some of which require further study and others need continuous appraisal. These are water supply and quality, insect control, erosion, and exposure. We presume that the services of a consultant water engineer will continue to be engaged and that provision will be made for supplying an adequate volume in the event of a year with only 25 inches rainfall. It is also important that a programme of insect control be initiated and that this be conducted in a restrained, selective and localised manner. This would require an initial assessment of the importance of Bromeliads as breeding-places for mosquitos, and the heights of plants occupied by the insect and then, if found necessary, a selective herbicide for monocots could be used in order to eliminate the plants. Secondly, by providing all water-bodies with vertical banks separating permanent water from well-drained land, and combining this with localised insecticidal spraying, it should also be possible to reduce the sand-fly population. This work should be supervised by a specialist entomologist.

The erosion problem although simply a case of applying common sense, requires continuous appraisal. Wherever possible it is important to maintain a vegetation cover to minimise the operations of heavy vehicles and machinery, especially on steep slopes, providing everywhere for surface run-off, and intelligently aligning and grading roads.

Protection from exposure is again one of prevention rather than cure. It is important to consider the most extreme possible conditions rather than average ones and practices such as facing doorless garages into the wind on exposed hillsides may be courting diaster. If attention is paid to this problem at all stages of planning and construction no specialist advice should be required.

Finally, we hope that all stages of planning and development will be subjected to an ecological examination and anticipation of the possible consequences to the biotic and abiotic environment.

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APPENDIX 11 : ECONOMIC BACKGROUND

APPENDIX II - ECONOMIC BACKGROUND

I THE RELATIONSHIP BETWEEN THE MUSTIQUE COMPANY AND ST. VINCENT GOVERNMENT:

The development on the island of Mustique is unlike any other project of its kind in view of the particular relationship between the Company and the Government. The particular relationship is that the Company will assume Government-type responsibilities on the island for a period of at least 20 years. This means that the Company will not only provide roads and other infrastructure but it will also administer the mail, police and education facilities on the island.

Therefore, a central point of the future study should be an examination of how the company will organize its Government-type duties and in particular how it will ensure recovery of the resources invested in such infrastructure.

The above issue becomes more complicated in view of the relatively short-time contract between the Government and the Company. The contemplated infrastructure will last more than the 20 years specified in the contract and therefore one has to provide means of liquidation or detailed procedures to hand over to the Government at the end of the contract. Of course, the contract might be renewed for an indefinite period of time. But at this stage we should take into account the uncertainty stemming from the possibility that the Government might ask termination of the contract before the end of the 20 year period.

This appendix concentrates on outlining some arguments which may be used to convince (a) the Government of the attractiveness of the project with regard to the general economic development of the country, and (b) the bankers of the financial feasibility of the project.

The first thing the study should demonstrate is that there is no insoluble inherent conflict between the objectives of the Company and the objectives of the Government. The objective of the Company, like any other business firm, is profit maximization subject to constraints. The major constraint is that the optimizing solution of the Company is politically acceptable by the Government. Therefore, such a solution should be complementary to the Government's objectives for the economic development of the country.

Section I concentrates on some items which are the concern of the Government and shows how the Company would help. These include increases in per capita income, creation of new jobs, foreign exchange earnings, increased tax revenues, externalities and the economic development of the country as a whole.

Section II deals with some issues related to the phasing of the development project under uncertainty, Section III outlines the inputs used in examining physical planning alternatives, and Section IV then traces the possible effects of the development of Mustique on the economy of St. Vincent.

1. Income Generation

The concern of every Government is to increase the income available to its people. Income generating opportunities are limited in the Eastern Caribbean, which is dominated by traditional agriculture. Tourism involves local spending by foreign people. Every pound or dollar spent by a tourist has a multiplicative (not additive) effect on income, due to the chain of transactions which are

initiated. This is known as the "income multiplier effect". Therefore, we should try to assess the magnitude of this multiplier effect and show the impact of the Mustique development on the St. Vincent economy as a whole.

2. Employment

The contemplated development will create two types of new jobs. Initially, it will draw construction workers from the neighbouring islands. Later, it will provide jobs for a support population serving the new facilities (e.g. hotel staff). Thus the development would have two effects. First, it would mitigate unemployment and underemployment in St. Vincent, and second it would reallocate labour from low earnings jobs (agriculture) to higher earnings jobs. Therefore, it is important to attempt to quantify the employment effect of the development. Comparisons with unemployment figures in St. Vincent and the neighbouring islands will give an eloquent picture of the developments' impact in this respect.

3. Balance of Payments

Tourism is equivalent to an export industry, the only difference being that the customer in this case comes to where the product (sun and water) is. St. Vincent has very limited export opportunities, other than traditional crops. Therefore, tourism development can bring foreign exchange beneficial to the balance of payments, and also help stimulate the local market for a variety of local products.

It should be noted, however, that foreign exchange spent locally is subject to leakage in the form of increased imports (i.e. tourists want to consume Western-type products as well). Although this leakage would reduce the multiplier effect, tourism would still favourably affect the St. Vincent balance of payments. Data is needed on the current balance of payments situation of St. Vincent in order to estimate the possible leakage and foreign exchange impact of the proposed development.

4. Tax Revenue

One of the results of any development project of this kind is that the local Government will enjoy higher tax revenue. In the case of Mustique, however, the Government seems to have foregone this privilege and settled for a modest £10,000 per year or 5% of profits (whichever is greatest). But this is not the true case.

What the Government does forego is a part of direct taxes that could have been imposed on the Company and residents of the island. The indirect tax revenues still exist. That is, the increased income generated on the island will seek purchases from St. Vincent and this will increase Government revenue from products indirectly taxed. Moreover, it will have a favourable effect on the Government revenue earned by import duty for that part of demand which seeks satisfaction by foreign products.

Similarly, the Government via its citizens will inevitably benefit from the infrastructure created by the Company on the island. That is, the provision of roads, airport facilities, sewer and water systems, electricity, telephones, schools,

police and mail service will all be initiated by the Company. It is well known that unless the community is large, the above utilities are not normally economic. Therefore, if the Government wanted to develop the island by itself it would have to commit extensive resources.

To clarify the benefits of development on Mustique one should, therefore, attempt to quantify the exact tax and duty revenue of the Government resulting from the development, as well as the value of infrastructure that would remain on the island, if and when the Company ceases to enjoy the special tax concession.

5. Externalities

When a resort complex is set up, the value of the whole complex is higher than the individual components of which it consists. For example, the creation of roads and provision of utilities will boost the value of the neighbouring property. Therefore, it is expected that the value of each site, or house, will increase sharply above its cost value when the resort complex is completed or near completion. The increased value of property will be shared by three groups.

First, by the Company itself, which will expect each site to sell at a higher price when firm commitment to the complex is made clear or construction of the main roads is initiated.

Second, by other individuals who own or will own part of the land.

Third, by the Government, which could ultimately have full control of the island and nullify the tax and other concessions.

It should be mentioned that the quantification of these externalities (extra value) is extremely difficult and that it is even more difficult to show how they will be shared by the three groups involved. Suffice it to mention here that they exist, and that they boost the value of the resort complex as a whole.

6. National Economic Development

Admittedly, the proposed development is small relative to the size of the St. Vincent economy. However, the development of the tourist industry is expensive but highly desirable in the Eastern Caribbean. Therefore, there is a value in the demonstration effect of the project for similar projects that might be started by the Government itself in other parts of St. Vincent. The Company qualifies in this case as the guinea pig, and the Government would certainly benefit from the Company's experience. This argument alone would be sufficient to justify the tax concessions granted to Mustique.

The uncertainty of the project stems from two facts:

First, as in any other project of its kind, there is uncertainty about future prices, sufficient demand for the product and the socio-political climate.

Second, in this particular case, the Government has committed itself to a 20 year tax concession contract. But what will happen if the Government terminates the contract before the end of the 20 year?

It is for this reason that the project should be carefully phased to ensure early recovery of the resources invested and take into account the fact that the infrastructure is likely to be handed over to the Government sometime in the future.

Moreover, investors have to be persuaded that the project is self-financed and does not rest entirely on the Government's tax concession. For the above reasons, a new type of discounted cash-flow must be used, taking into account the value of the infrastructure. Without taking into account this element the accounting would be misleading and it would underestimate the true wealth position of the Company.

Table 1 shows an illustrative conventional timetable of costs and benefits related to the company's operations. Costs are broken down into development (infrastructure) and servicing, while there are two sources of revenue: sales of property and other (e.g. from hotel rentals). In the first two years of operations high development costs and no rental receipts lead to losses, but sales of property later on produce profits.

The above conventional table is misleading in that, even in the first year of operation the Company has invested certain resources in roads and water supplies. If the whole complex were to be sold to the Government or to another private organisation, one could not expect losses even during the first years of operation. The difficulty is that the mechanism by which the changeover from the Company to the Government could be made has not been formulated. In view of this uncertainty, the project should proceed step by step.

The economic choice is between early recovery of resources in view of the above uncertainty, and later sale at a higher value. The optimum phasing of costs and benefits should be estimated using the discounted cash-flow technique and assuming that the Government contract could be terminated at any time. This would necessitate the inclusion of the value of the infrastructure in the Company's benefits. Needless to say, the Company should negotiate as soon as possible the exact terms on which such a changeover will take place.

A graph has been prepared and included in the main report (Figure 37) illustrating these principles.

Table 1 : A CONVENTIONAL COST-BENEFIT TIMETABLE

Year	Costs			Revenue			Net (a) Profit
	Development	Servicing	Total	Sales of Property	Other Revenue	Total	
1	XXX	X	XXXX				- XXXX
2	XXX	X	XXXX				- XXXX
3	XXX	XX	XXXXX	XXXX		XXXX	+ X
4	XXX	XX	XXXXX	XXXXX	X	XXXXXX	+ XX
5	XXX	XX	XXXXX	XXXXX	X	XXXXXX	+ XX
6		XX	XX	XXX	XX	XXXXX	+ XXX
7		XX	XX	XXX	XX	XXXXX	+ XX
.							
.							
.							
.							
.							
19	Uncertain						
20	Uncertain					Value of infra-structure ?	

↓ Uncertain

Note: (a) - Excluding the value of infrastructure

III DEMAND CONSIDERATIONS:

The method of work has been as follows:

1. Demand

Project the most likely demand for tourists and support population on Mustique over the next 20 years.

2. Supply

Establish a maximum range of accommodation on the island by some unspecified saturation date.

3. Equilibrium

Phase the development on the island over the years so that (1) matches (2) as closely as possible.

This section deals with only (1) above. In particular, it deals with a projection of:

- transient tourists
- hotel rooms
- residential dwellings
- resident population, and
- support population.

The values of the parameters used are preliminary and should be monitored over time. The horizon of the projections refers to 1990, consistent with the Company's 20 year contract.

Hotel Rooms

It is very difficult to establish tourist trends in the Eastern Caribbean, the reason being that tourism is a very young industry in the region and there is no basis for extrapolation. The best study on tourism in this area we know of has projected the following number of hotel rooms for St. Vincent as a whole.

Table 2 : HOTEL ROOM PROJECTIONS - ST. VINCENT (ZINDER 1969)

Year	Number of Rooms	Average Annual Rate of Growth between Periods
1967	80	
		33%
1972	330	
		10%
1977	540	

The implicit annual rate of growth of these figures is 33% for the 1967 period*. Regarding the share of Must ique, we have assumed that an initial unit of 50 bedrooms has to be built by 1972. This is not only to accommmodate transient tourists, but to lodge prospective buyers of property on the island as well. The number of rooms (50) is on the high side relative to the projected total for St. Vincent (330). But this has to be so in view of the discontinuities in hotel building (it does not pay to build a very small unit), and the demonstration effect of the hotel (it will give the impression to prospective buyers visiting the island that something "big" is going on there).

Table 3 (row 1) shows the projection of the hotel rooms on Mustique to 1977 and 1990. This projections is based on very rapid growth by 1972, and the assumption that, during the first half of the period under consideration (1972 to 1977) the number of hotel rooms on Mustique will grow at the same rate as for St. Vincent as a whole (10%). For the second half of the period, the assumption is made that hotel rooms will grow at a rate of 8% per year. This lower figure is adopted in view of the approach of an end state saturation point, and our desire to underestimate rather than overestimate the demand for transient tourist accommodation on Mustique.

On the assumption of 1.6 beds per hotel room and an average occupancy rate of 90% in season, the number of transient tourists will be 315 by 1990 (row 3).

Tourist Housing

At the present there are 15 (approximately) dwellings (completed or under construction) on Mustique. A study by Gladstone Associates (1970) on the demand for and construction of residential housing in the Eastern Caribbean, shows a 15% annual rate of growth figure. In this way one would arrive at 246 residential dwellings on the island by 1990. Assuming two bedrooms per dwelling and 1.6 person per bedroom, this would give 787 non-transient residents by 1990.

However, in view of the problem of projecting from the point of origin in a recently started project, it was thought useful to proceed the other way round. That is, start from a desired end state and then work backwards and see what this implies for the intermediate years. A look at similar developments in the Caribbean revealed the following ratios. (Table 3)

* All rates of growth in this note are compound ones, based on the formula $V_T = V_O\ (1 + g)^t$ where V_T and V_O are the terminal and initial values, respectively, of the variable under consideration, g is the rate of growth, and $t = T - o$.

TABLE 3: RATIO OF VISITORS' DWELLINGS TO HOTEL ROOMS (1970)

Development	Hotel Rooms	Residential Dwellings (lots or condominiums)	Ratio of dwellings to hotel rooms
Bath Plantation, Barbados	500	730	1.46
Durant Plantation, Barbados	100	300	3.00
Cedar Valley, Antigua	120	200	1.67
Mullet Bay, St. Maarten	240	600	2.50

The overall average ratio of dwellings to hotel rooms is 2.16. In the previous projection the implicit ratio was 1.12. If we accept the 2.16 ratio for Mustique, then the number of residential dwellings should be increased from 246 to 475 in 1990. (Equal to 220 hotel rooms x 2.16). This figure was in fact brought down to 400 to take account of the service population constraints, see P. 27 and P. 28 of the main report.

For the computation of the hotel service labour force we have assumed a coefficient of 0.5 per hotel bed, and for the residential service a coefficient per house bed of 0.35 in 1974, falling to 0.2 by 1990. The total service labour force by 1990 is estimated as 645 persons. The construction labour force is assumed to be double the service labour force in 1972, 75% of the service labour force in 1977 and one fifth of the service labour force by 1990, by when the construction activity will have levelled off. This yields a total service population of 2650 by 1990. On the basis of a 35% labour force participation rate, the total population of the island will be 5165 by 1990. This is consistent with an expected trend for the ratio of support to resident population to become one to one.

Table 4 : MUSTIQUE-DEMAND SIDE

	1972	1977	1990
1. Hotel Rooms 1972=50, 10% growth to 1977, 8% to 1990	50	80	220
2. Hotel Beds Supply (= 1 x 1.6 beds per room)	80	128	352
3. Transient Tourists per typical day (= 2 x 0.9 average occupancy rate in Season)	72	115	315
4. Residential Dwellings (1970 = 15, growth index see Page 14)	30	125	400
5. Residential Bedrooms (=4 x 3.75 bedrooms per dwellings)	113	470	1500
6. Non Transient Residents = Residential Beds (= 5 x 1.5 persons per bedroom)	170	700	2200
7. Hotel Service Labour (= 2 x 0.5 per hotel bed)	40	64	176
8. Residents' Service Labour (= 6 x 0.35 per house bed)	34	164	525
9. Total Residential Service Labour (= 7 + 8)	74	228	701
10. Construction Labour (1972 = 9 x 200%, 1977 = 9 x 75%, 1990 = 9 x 20%)	160	160	130
11. Total Service Labour Force (= 9 + 10 + others @ 7% population)	251	449	645
12. Service Population (= 11 / 30% 1972 / 7.35% 1990 participation rate)	830	1500	2650
13. Tourist Population (= 3 + 6)	242	815	2515
14. TOTAL ISLAND POPULATION	1072	2315	5165

IV EFFECTS ON THE ST. VINCENT ECONOMY

It is necessary to start by reviewing the present state of St. Vincent's economy as a reference to Mustique's impact.

Population:

The 1960 Population Census gave the following numbers:

Males	37,561
Females	42,387
Total	79,948

According to Demas* the natural rate of population growth in the Leewards and Windwards is 3.2% per year.

Labour Force:

Labour Force		Unemployed	Participation Rate
Males	15,093	6%	41%
Females	9,299	12%	21%
Total	24,392		30%

National Income: (G.D.P.)

1963	$US 12,150,000
1967	$US 15,000,000
Average annual rate of growth	4%

Per Capita Income (1967):

$$\frac{15,000,000}{99,935} = \$US\ 150$$

Industrial Origins of National Income	1963	1967
Agriculture	30%	30%
Manufacturing	4%	4%
Hotels	1%	2%
Other	65%	64%
	100%	100%

* See Bibliography

Balance of Payments	1968	1967
Exports ($US) - to GB. 2,500,000 - to US. 750,000 - Other 750,000	4,000,000	3,500,000
Tourism and Remittances	2,000,000	1,350,000
Foreign exchange earnings	6,000,000	
Imports	8,950,000	
Deficit	-2,950,000	

Government Revenue (1967):

Import Duties	1,192,500	42%
Income tax	590,000	21%
Other	734,000	37%
Total	2,861,500	100%

Agricultural Exports (1968):

Bananas	2,450,000
Arrowroot	600,000
Copra	250,000
Nut	80,000
Total	3,380,000

Banana Export Price:

1961	3.6 cents/lb.
1965	2.3 cents/lb.

It can be seen from the above key statistics that St. Vincent is a very small economy (G.D.P. equal to $US 15 million), depending primarily on agricultural exports (bananas). Per capita income is equal to $US 150 and is rising at about 3% per annum (total income growth 4% minus 3.2% population growth).

The labour force participation rate of males (41%) is double that of females (21%), the overall rate being 30%. The total labour force consists of about 24,000 persons with unemployment rates of 6% for males and 12% for females.

Agriculture dominates the economy (30% of G.D.P.) and the importance of it has remained constant between 1963 and 1967. Manufacturing accounts for only 4% of total income and this share has also remained constant between 1963 and 1967. Tourism, on the other hand, seems to be the only industry that increased its share of G.D.P. between 1963 and 1967. Even so, the absolute income from tourism is still appallingly small.

Exports consist almost 100% of agricultural products and within these, bananas dominate the scene. However, the export price of bananas is falling over time. The value of imports is more than double that of exports. Part of the deficit is covered by earnings from tou ism and part from foreign grants. The net deficit in 1968 was almost $US 3 million.

Government revenue consists mainly of import duties (42%) and income tax (21%).

Prospects for growth in this type of economy have to come from sources other than agriculture. The expansion of manufacturing although desirable, does not seem feasible since a country like St. Vincent has grave disadvantages in encouraging the growth of manufacturing industry. Therefore, the expansion of tourism has been seen to be a solution to developing economies of this kind.

It is also significant that tourism employs a high proportion of female staff and therefore would help to reduce unemployment in this sector of the labour market.

Income Generation:

In what ways then will the tourist industry generate income? There will be four spending units on the island:

1 - The Mustique Company
2 - Transient Tourists
3 - Residents, and
4 - Support population

In examining the impact of the development on the St. Vincent economy, we must take into account only the expenditure generated by 1, 2 and 3. Item 4 will come from St. Vincent itself, so it must be considered as a part of St. Vincent, or, as part of the ground on which we want to assess the effect of adding 1, 2 and 3.

1 - The Mustique Company Will create a value of about 56 million in $US on the island within 20 years. This will be broken down as follows:

. Land Value (equal to sales of land)	22,580,000
. Residential, Hotel and Support Construction	28,644,000
. Other infrastructure	5,235,000
Total	56,459,000

Of course, land sales receipts will be used to finance infrastructure and other construction. Or, if residents or contractors undertake construction, receipts from land sales will not necessarily be spent on the island. Therefore, the value of land sales should be excluded from the income generation flow.

This leaves us with the remainder, $US 33,879,000 to be spent on the island over the next 20 years, or $1,700,000 annually.

TABLE 5: MUSTIQUE

(All prices in $US)

	Number of Rooms or Dwellings Or seats	Number of People/ Dwelling	Total Number of People	Area Acres	Land Price/ Acre	Total Land Sales	Construction Costs/Unit	Total Construction Cost	Overall Outlay
COMMERCIAL									
Hotels	220			35	50,000	1,750,000	15,000/room	3,300,000	5,050,000
Restaurant Hotels	153						1,000/seat	153,000	153,000
Restaurants Outside*	331			30	50,000	1,500,000	1,000/seat	331,000	1,831,000
Shops	4,000sq.ft.						15/sq.ft.	60,000	60,000
SUB TOTAL				65		3,250,000		3,844,000	7,094,000
RESIDENTIAL									
Large lots	100	9	900	300	40,000	12,000,000	100,000	10,000,000	22,000,000
Medium lots	100	6	600	100	43,000	4,300,000	50,000	5,000,000	9,300,000
Small lots	100	4	400	50	46,000	2,300,000	30,000	3,000,000	5,300,000
Condominium	100	3	300	6	50,000	300,000	20,000	2,000,000	2,300,000
SUB TOTAL	400		2,200	456		18,900,000		20,000,000	38,900,000
SUPPORT									
Support Village	333	6	2,000	33	10,000	330,000	10,000	3,300,000	3,630,000
Hostel			80						200,000
Staff	100	6	600	10	10,000	100,000	15,000	1,500,000	1,600,000
SUB TOTAL	433		2,680	43		430,000		4,800,000	5,430,000
GRAND TOTAL				564		22,580,000			51,424,000

* The demand for restaurant places was estimated as shown on page 14.

Table 6 - Demand for Restaurant Seats

Transient Tourists

- In Hotels - 352 persons x 65% of meals (from Zinder) = 229 meals
  at 1.5 meal/seat = 153 seats
- Outside - 352 x 35%/1.5 = 82 seats

Residents

- 2,200 people x 17% out ($\sim \frac{1}{2}$ of transient tourists/1.5 = 249 seats

Total number of seats

- in hotels	153
- in outside restaurants	331
	484

2 - Transient Tourists appear to spend $US 12,500 per year/per hotel room in the Caribbean. When Mustique is fully developed, this will mean an annual expenditure of:

220 rooms x 12,500 = $2,750,000

3 - Residents (non-support) can be treated as tourists for expenditure purposes with one major qualification. That is, they do not pay rent, or their rent expenditure is already captured in item 1, above. It is assumed therefore, that residents will spend $10 a day and that they are resident for three months in each year. Again, when the island is fully developed, the annual expenditure from residents will be

2,200 persons x $10 x 100 days = $2,200,000

To summarize, annual expenditure 20 years from the initiation of the scheme will be:

- Company	$ 1,700,000
- Tourists	$ 2,750,000
- Residents	$ 2,200,000
Total	$ 6,650,000

This figure is the maximum annual amount of expenditure which will result from the development plan. In the years preceding the culmination of the Company's investment, tourist and resident expenditures will of course not be equal to the above figures. After the development plan has been financed, tourist and resident expenditure will continue to be (at least) at the level shown above, but the Company's expenditure will have ended.

Bearing in mind this explanation, calculations proceed on the basis of this annual expenditure.

Once we have an estimate of annual direct expenditure we must apply an income multiplier to it. The rationale for this is that a fraction of every initial dollar spent in Mustique will be respent in a transactions chain until leakages exhaust the initial value. Every time a portion of this dollar is spent, it is financing an expenditure and creating additional income. For example, if 50 cents out of each dollar of direct expenditure is saved or used to import goods to the island and 50 cents is respent within the country, then the total 'income generating' impact of each dollar is:

$$\$1 + 0.50 + 0.25 + 0.125 \ldots\ldots = \$2$$

Zinder has estimated that a reasonable estimate for a tourist expenditure multiplier in the Caribbean is 2.3. Using this value of the multiplier, the total annual income generated in St. Vincent as a whole (not only on Mustique) solely due to the tourist development of Mustique will be

$$2.3 \times \$6,650,000 = \$15,200,000$$

after 20 years and will be moving towards such a figure in the preceding years. It will of course be the aim of Government policy to increase this multiplier.

On the basis of the total generated income we can derive the impact of the development on Government tax revenue and total wages. Government tax revenue is estimated (Zinder) to be 15 per cent of total generated income, while wages represent 22 per cent of the total income.

Tax revenue generated = $0.15 \times 15.2 = \$2,275,000$
Wages generated = $0.27 \times 15.2 = \$3,354,000$

Total Effect on Employment:

Zinder estimates that the average annual wage is $1,000, in which case the above generated wages will give jobs to:

$$\frac{3,350,000}{1,000} = 3,350 \text{ persons}$$

In the above, we have concentrated on the final - 20-year- state. Let us see now how the impact of the development compares with the other magnitudes of the economy at the target year 1990. For this purpose we need a crude projection of the state of St. Vincent's economy by 1990.

Population:

$$\text{1990 population} = (\text{1970 population})\,(1 + g_p)^{20}$$

$$\text{1990 population} = 79,948\ (2.57) = 205,466$$

Labour Force:

$$110,520 \times 35\% \text{ participation rate} = 71,913$$

National Income:

$$(1967 \text{ National income}) (1 + g_y)^{23}$$

$$g_y = 4\%/\text{year}$$

$$\$15,000,000 (1.04)^{23} = \$36,900,000$$

Per capita income:

$$\frac{36,900,000}{205,466} = \$US\ 180$$

Government Revenue:

In 1967, Government revenue = 19% of National income.
In 1990, Government revenue = 0.19 x 36.9 = 7,011,000

The following table summarizes the development's impact by 1990.

Projected Impact of Development Plan on St. Vincent Economy, 1990:

	St. Vincent as a whole 1990 (including Mustique	Thereof Mustique	Mustique as % of St. Vincent
Labour Force	75,301	3,388	4%
National income	$60 million	$15 million	25%
Government Revenue	$10.5 million	$2.77 million	21%

The percentage figures in column (3) give a picture of the effect of the Mustique Development Plan on the overall economy of St. Vincent. The income and tax revenue look exaggerated, but this is not so if one bears in mind at this point two things: First, the magnitude of the investment, which is considerable. Second, the fact that these estimates have been based on the assumption that the whole complex will be built within the 20 years of our plan horizon.

National accounts as well as micro data area extremely scanty for the Eastern Caribbean. The following is a list of documents which have been used in estimating the variables of the previous section.

1. INVESTECO, Prospects for Sterling Investment in the Caribbean, Prepared for the British National Export Council, by Investment Development and Technical Services Ltd., Albany Buildings, 47 Victoria Street, London, S.W.1., 1961.

2. H. Zinder & Associates, Inc., The Future of Tourism in the Eastern Caribbean, Washington, D.C., 1969. Contains a wealth of data on tourist trends in the area, as well as cost data for resort complexes.

3. Gladstone Associates, Bath Plantation, Washington, D.C., 1970.

4. Carleen O'Loughlin, Economic and Political Change in the Leeward and Windward Islands, Yale University Press, 1968.

5. William G. Demas, The Economics of Development in Small Countries with Special Reference to the Caribbean, McGill University Press, 1965.

6. 1960 Population Census of St. Vincent

7. Facts for Investors on St. Vincent (Economic Planning Unit, Kingstown, 1968).

8. 1969 Budget Address of Honourable Milton Cato, Chief Minister and Minister of Finance (Legislative Council of St. Vincent, 1969).

9. St. Vincent Economic Survey and Projections (British Development Division of the Commonwealth, 1967).

On the Problem of Economic Power: Lessons from the Natural History of the Hawaiian Archipelago

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ABSTRACT

One of the greatest logicians of the twentieth century, Bertrand Russell, proposed that *Economic power, unlike military power, is not primary, but derivative* Curiously, this conjecture has received scarce attention. This paper explores this theory. Our illustrative discourse tests this overlooked theory in the light of evolution: We model *Homo* evolution by sampling the past ≈1000 years of cultural evolution in the Hawaiian archipelago. Our analysis concludes Russell's theory is true.

Key terms: economic power; military power; evolutionary game theory; cultural evolution; evolutionary stable strategy; resource holding power; long-distance dispersal; Kamehameha; Hawaiian history; Hawaiian sovereignty; Hawaiian annexation

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DEDICATION

To my Father[1]

[1] It has been an old custom for authors to offer to their [fathers] the fruits of their studies in belles letters, from a persuasion that no work can be published with propriety but under the auspices of the [father], and that the knowledge of a [father] should be more general, and of the most important kind, as its influence is felt so keenly by… his [family]. We have many instances of the favorable reception which Augustus and his illustrious successors conferred on the works presented to them; and this encouragement of the Sovereign made the sciences flourish. The consideration of Your… superior indulgence for attempts of this sort, induced me to follow this example, and makes me at the same time almost forget my own inability when compared with the ancient writers. One advantage, however, I derive from the nature of this work, as it requires no elegance of expression, or extraordinary share of genius, but only great care and fidelity in collecting and explaining, for public use, the instructions and observations of our old historians of military affairs, or those who wrote expressly concerning them.

My design in this treatise is to exhibit in some order the peculiar customs and usages of the ancients in the choice and discipline of their new levies. Nor do I presume to offer this work to You… from a supposition that you are not acquainted with every part of its contents; but that you may see that the same salutary dispositions and regulations which your own wisdom prompts You to establish for the happiness of [our family], were formerly observed by the founders thereof; and that You… may find with ease in this abridgement whatever is most useful on so necessary and important a subject (1,*dedication*).

EPIGRAPH

Instead of trying to pigeonhole the natural world into prescribed classifications, Kant had argued, scientists should work to discover the underlying scientific principles at work, since only those general tenets could fully explain the myriad natural phenomena. Thus Kant had extended the unifying tradition of Thales, Newton, Descartes, et al.... Humboldt agreed with Kant that a different approach to science was needed, one that could account for the harmony of nature... The scientific community, despite prodigious discoveries, seemed to have forgotten the Greek vision of nature as an integrated whole.... 'Rather than discover new, isolated facts I preferred linking already known ones together,' Humboldt later wrote. Science could only advance 'by bringing together all the phenomena and creations which the earth has to offer. In this great sequence of cause and effect, nothing can be considered in isolation.' It is in this underlying connectedness that the genuine mysteries of nature would be found.

This was the deeper truth that Humboldt planned to lay bare – a new paradigm from a New World. For only through travel, despite its accompanying risks, could a naturalist make the diverse observations necessary to advance science beyond dogma and conjecture. Although nature operated as a cohesive system, the world was also organized into distinct regions whose unique character was the result of all the interlocking forces at work in that particular place. To uncover the unity of nature, one must study the various regions of the world, comparing and contrasting the natural processes at work in each.

The scientist, in other words, must become an explorer.

–Gerard Helferich, *Humbotdt's Cosmo's*, 2004

§1. In Defense of Exploration

Economic analysis through exploration is an unusual, but far from unprecedented proposition.

But in light of the fact that it has been decidedly out of fashion since Condorcet coined the phrase "social science" in 1780 (2), perhaps a few preliminary words in defense of this unfashionable method may be warranted.

As I noted in a seminar delivered to the Department of Biology at the University of Prince Edward Island in November of 2008 (3), I have explored – both literally and theoretically –Åland (4-5), Mustique (6) and many aspects of many insular bio-geo-politico-economic models (7-11), and discovered the comparative method employed by naturalists since the time of Humboldt (12-22) continues to offer extraordinary analytical value.

In short, in the poetics of Proust's *À la recherche du temps perdu* (23)*:*

> *Le seul véritable voyage … ce ne serait pas d'aller vers de nouveaux paysages, mais d'avoir d'autres yeux, de voir l'univers avec les yeux d'un autre, de cent autres, de voir les cent univers que chacun d'eux voit*[2].

Indeed, exploration represents the very essence of all human problem solving endeavours, and, moreover, has served as the primary driver of human dispersal, which began, in earnest, 2 Mya, as a lush tropical forest transformed into the Sahara Desert, directing intrepid *Homo* survivors "Out of Africa," spreading out and fighting to hold unfilled, *relatively insular*, ecological niches.

This exploration, this human *Struggle for Life* (24), continued for the next million years and continues on into the present. As recently as one thousand years ago, several niches of insularity remained undiscovered and unoccupied by *Homo sapiens*: Viking explorers set out in search of a better world, and,≈980AD, discovered the uninhabited island of Iceland. About the same time, Polynesian explorers set out on their voyaging canoes from Tahiti, crossed 2,500 nautical miles of the great Pacific Basin, and settled the Hawaiian archipelago[3]. Five hundred years later, Columbus crossed the Atlantic to the Caribbean and North America, Cabot explored Newfoundland, Cortez explored Mexico, and Magellan and Juan Sebastian del Cano became the first circumnavigator.

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[2] "The only true voyage of discovery … would be not to visit new landscapes, but to possess other eyes, to see the universe through the eyes of another, of a hundred others, to see the hundred universes that each of them sees" (23, p 131) [often translated as:*The only true voyage of discovery consists not in finding new lands, but in seeing them with new eyes*].

[3] Polynesian voyagers from the Marquesas had previously discovered and established small settlements in Hawaii≈300 AD.

But as time moved forward, these *explorations* became more and more about *seeing these landscapes with new eyes* than about being the first to arrive, claiming natural resources, and discovering and filling an unclaimed ecological niches. Yes, the voyages of the early European explorers were largely ones of conquest, but Cook and Vancouver also began to systematically map the territory, to chronicle their journeys, and to begin to grasp and piece together the *nature* of the world in which we live. And of course the *unity of nature*, the holiest of grails which Humboldt first sought, revealed herself in full to a young, inexperienced naturalist aboard the *Beagle*,[4] and to Alfred Russell Wallace, exploring *Island Life* in the Malay Archipelago alone, each independently piecing together solutions to the most fundamental problem of their era.

In 1872 HMS *Challenger*[5] took this British tradition to the next level, a tradition which continued with Scott on HMS *Discovery.* Yes, exploration began facilitating the greatest breakthroughs in science: Alfred Wegener – who's lost body remains frozen in Greenland's unforgiving ice – revolutionized geology,[6] Routledge uncovered several mysteries on Easter Island, Carter unearthed Egyptian wisdom in Valley of the Kings, and Hans Hass opened our eyes to the sea as they had never been before.

But of course much – perhaps even *most* – about all of these places and their biotic and abiotic processes remain to be explored, re-discovered, and discovered yet for the first time. As Wallace remarked in 1855:

> Every naturalist who has directed his attention to the subject of the geographical distribution of animals and plants, must have been interested in the singular facts which it presents. Many of these facts are quite different from what would have been anticipated… None of the explanations attempted from the time of

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4 WHEN on board HMS *Beagle*, as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species — that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes (24, p 1).

5 On December 21, 1872, HMS *Challenger*, a 2,300-ton corvette originally built with 18 cannons, left Portsmouth, England, under the command of Captain Geogre Nares. Powered by sail… and steam…,*Challenger* was setting out on a mission never before undertaken – a full-scale expedition dedicated exclusively to scientific study of the oceans (25, p 7).

6 Through most of the history of science it was assumed that the continents of the earth had always held their current positions. In the early 1900s, however, the Austrian meteorologist Alfred L. Wegener put forth the radical theory that at one time all of the land of this planet had been a single huge mass, which he termed *"Pangea"* (Greek "pantos" [whole] and *"gia"* [earth]), but had subsequently broken into northern and southern positions and then further split into smaller units that dispersed or "drifted" through the surrounding ocean to form the various current continents.

For many years, Wegener's theory was usually not seriously considered, but scientific discoveries made since the mid-1900s now show that his idea is basically correct (26, pp 5-6).

> Linnæus are now considered at all satisfactory; none of them have given a cause sufficient to account for the facts known at the time, or comprehensive enough to include all the new facts which have since been, and are daily being added….
>
> If we now consider the geographical distribution of animals and plants upon the earth, we shall find all the facts beautifully in accordance with, and readily explained by, the present hypothesis. A country having species, genera, and whole families peculiar to it, will be the necessary result of its having been *isolated* for a long period, sufficient for many series of species to have been created on the type of pre-existing ones, which, as well as many of the earlier-formed species, have become extinct, and thus made the groups appear isolated….
>
> To discover how the extinct species have from time to time been replaced by new ones down to the very latest geological period, is the most difficult, and at the same time the most interesting problem in the natural history of the earth. The present inquiry, which seeks to eliminate from known facts a law which has determined, to a certain degree, what species could and did appear at a given epoch, may, it is hoped, be considered as one step in the right direction towards a complete solution of it (16).

Indeed, yet today, the 5th of April, 2009, I submit, *remarkably few of the explanations attempted from the time of Linnæus are yet at all satisfactory.* But the following exploration is an effort to improve upon these explanations.

§2. On the Problem of Economic Power

My most recent field trip to Hawai'i offered another opportunity to simplify[7] and convey a complex, difficult, slippery truth, and, moreover perhaps the most fundamental economic principle of all, which I had confirmed on my expedition to Mustique last year (6). I might also note that this fundamental truth remains largely unknown, unrecognized, or, at the very least, very dimly seen or perceived.

> Consider, for example, a recent statement by one of Popper's most well-known students, George Soros:
>
> These unprecedented measures have begun to have an effect: interbank lending has resumed and the London Interbank Offered Rate (LIBOR) has improved. The financial crisis has showed signs of abating. But guaranteeing that the banks at the center of the global financial system will not fail has precipitated a new crisis that *caught the authorities unawares*: countries at the periphery, whether in Eastern Europe, Asia, or Latin America, could not offer similarly credible guarantees, and financial capital started fleeing from the periphery to the center (27, p 3).

Why did capital flee from the periphery to the center? Why were we caught unaware? Because the "authorities" did not grasp the first principle of economics & evolution: Economic *power is not primary, but derivative*.

[7] Compared with continents… [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range… their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (17, pp 241-242).

> Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war or the threat of war. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.
>
> Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it (28, p. 95).

We shall clarify this conjecture in due course, but in the meantime, I might suggest this theory remains rather dimly perceived because a primary logical implication is decidedly out of favour: "*Si vis pacem, para bellum.*"[8]

Thus it may prove fruitful to digress and explore the significance of perhaps the most influential *magnum opus* in human history, and, moreover, its adoption as an *Evolutionary Stable Strategy* for ≈1000 years:

> The most influential… treatise in the western world from Roman times to the 19th Century was Vegetius' DE RE MILITARI. Its impressions on our own traditions of discipline and organization are everywhere evident.
>
> The Austrian Field Marshal, Prince de Ligne, as late as 1770, called it a golden book and wrote: "A God, said Vegetius, inspired the legion, but for myself, I find that a God inspired Vegetius." Richard Coeur de Lion carried DE RE MILITARI everywhere with him in his campaigns, as did his father, Henry II of England. Around 1000 AD Vegetius was the favorite author of Foulques the Black, the able and ferocious Count of Anjou. Numerous manuscript copies of Vegetius circulated in the time of Charlemagne and one of them was considered a necessity of life by his commanders. A manuscript Vegetius was listed in the will of Count Everard de Frejus, about 837 AD, in the time of Ludwig the Just.
>
> In his Memoirs, Montecuculli, the conqueror of the Turks at St. Gotthard, wrote: "However, there are spirits bold enough to believe themselves great captains as soon as they know how to handle a horse, carry a lance at charge in a tournament, or as soon as they have read the precepts of Vegetius." Such was the reputation of Vegetius for a thousand years.
>
> Manuscript copies dating from the 10th to the 15th centuries are extant to the number of 150. DE RE MILITARI was translated into English, French, and Bulgarian before the invention of printing. The first printed edition was made in Utrecht in 1473. It was followed in quick succession by editions in Cologne, Paris and Rome. It was first published in English by Caxton, from an English manuscript copy, in 1489 (1).

Alas, it seems 1000 years of popularity was not sufficient enough; thus my expedition in February was a quest to come to understand the rejection of this time-tested strategy; my focal point was the Pu'ukohala Heiau…

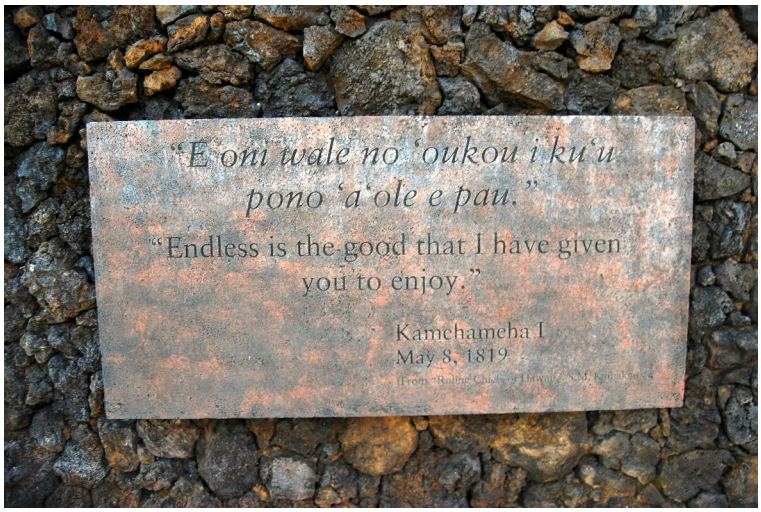
[8] "If you wish for peace, prepare for war," is undoubtedly the most common, popular translation, but Flavius' exact words (*Igitur qui desiderat pacem, praeparet bellum.*), are more accurately translated as, "Therefore, he who wishes peace, should prepare war; he who desires victory, should carefully train his soldiers; he who wants favourable results, should fight relying on skill, not on chance."

One remarkable aspect of this temple is that it took thousands of men one year to construct it, passing one million stones *hand-to-hand* from twenty miles away, up and over Kohala Mountain, from the Pololu Valley:

Why were these rocks passed hand-to-hand, from man-to-man, over such a great distance and mountainous terrain? To answer this weighty question, we must begin at the end of a mighty and great life:

> Kamehameha grew no better but steadily worse, and after three days they took him… to his own sleeping house. At the close of the day he was carried to the eating house, where he took a mouthful of food and a swallow of water, but when he was asked to speak made no reply. About ten o'clock he was again carried to the eating house and again took a mouthful of food and a swallow of water. Ka-iki-o-'ewa then asked him for a last word, saying, "We are all here, your younger brothers, your chiefs, your foreigner. Give us a word." "For what purpose?" asked the chief. "As a saying for us" (*hua na makou*) (29, p 211).

Visitors to the *Pu'ukohala Heiau National Historic Site* may find the finale of Kamakua's account of Kamehameha's last words, etched in marble on the exterior of the impressive visitor's centre:



But the problem is this: these were *not* Kamehameha's final words, and the very essence of our entire argument lies within this discrepancy, which was, hereto, a lost treasure, buried in the deep, patiently awaiting discovery.

Kamakua did not have access to any eyewitness accounts, and, in his day, the sole extant writings (John Young's dairy) from such an account was lost in a flood. But one of Kamakua's Elders, Stephen L. Desha, a scholar who predated Kamakua by forty years, *did* seek and discover a first-hand account.

Although Kamakua (29) was undoubtedly well-versed in Desha's writings, including *Kamehameha and his Warrior Kekuhaupi'o* (30), it is perhaps revealing that he failed to quote – or, perhaps more likely, *misquoted* – this

true scholar and unflinching *realist*:[9]

> At this time Kamehameha was again lifted by the *ali'i* [an individual of high hereditary rank] and taken into the *ahi'a* house. This was late at night. When the feet of the *ali'i* who were carrying Kamehameha's body entered the house, he fainted for the third time. When the *ali'i* saw this, they quickly took him back to the Ke'olohiani Hale. A little while after this, Kamehameha revived again.
>
> Then Kalanimoku took charge and evicted the numerous *ali'i* from the house save only for the wives (na ali'i wahine) and his sons and daughters. Also two of his old, long-time canoe paddlers remained. These were Nakuielua and his old companion. The reason these two old canoe paddlers of Kamehameha remained within the house with their *ali'i* was that they were to be the *moepu'u* [death companions] of Kamehameha, prepared to go with their lord on the road which has no return.
>
> At this time Kalanimoku bowed over at the side of the weakened ali'i and asked him: *'E Kalani e*, what of us?"
>
> Kamehameha only gazed at him and he made no reply.
>
> Then some prominent *ali'i kane* [male chiefs] of the land entered again, whom Kalanimoku was unable to put outside, and they stood close to where Kamehameha lay. One of them asked him: *Ea, e Kalani e*, [O heavenly one] what of us? A little word for us."
>
> When Kamehameha heard these words from some of the *ali'i*, he closed his eyes and then opened them. The *ali'i* again asked him: *"E Kalani e*, a little word for us." Kamehameha's weary eyes gazed hither and yon at this gathering then said weakly:
>
> "Why are you making demands?" Then Kalanimoku bent over quickly, close to Kamehameha's head and said gently: *"E Kalani ho'i e*, a little word for us."
>
> When Kamehameha heard Kalanimoku asking for a little word for them, he spoke these final words:
>
> "Endless is the good I have conquered for you" (30, pp 485-486).

---

[9] When it was fully daylight and the skin of man could be seen, Kamehameha commanded his paddlers to take the canoe ashore. When the warriors on the shore realized that the canoe was going to land, they closed their ranks to prevent the landing. Kamehameha moved forward to the bow of one of the double-canoe hulls, grasping his great spear, and Kekuhaupi'o moved to the other bow, standing ready before that Maui multitude.

While Kamehameha's canoe was moving shoreward those on shore fully realized that this was truly a war canoe of the Hawai'i people. Amazement grew among the Maui multitude at the daring of the people on the canoe in coming ashore, because the cove was covered over with great numbers of warriors standing ready. Nevertheless the canoe did not retreat. When the canoe reached striking distance the leader of the Maui warriors ordered his men to hurl their spears at this Hawai'i canoe which was landing wrongfully and to direct their spears straight at the men standing on the bows of the double canoe.

At the same time, Kamehameha's men stood ready on the platform of the canoe with their *polulu* spears. At the onset of battle Kamehameha and his companion Kekuhaupi'o caught the Maui people's spears and they piled up alongside Kamehameha's canoe hulls. At the same time Kamehameha called out to his few warriors on board his canoe to prepare to move ashore immediately. Kekuhaupi'o and Kamehameha seized the spears lying alongside their canoe and commenced to hurl them at the Maui people. When the Maui people saw the genuinely fearless and remarkable actions of these warriors an inward chill occurred, weakening their warlike thoughts, and their spears were hurled uselessly. At this moment Kekuhaupi'o and his chiefly foster son arrived in the midst of those Maui people and began to slay them with such terrible effect that they fled, leaving their dead behind. When the people fled Kamehameha did not follow them but he turned and spoke to his teacher who had entered with him into this superhuman fight: "Perhaps we should return from whence we came, as we have been moistened by surfing on the famous waves of this land?" These words were spoken with a smile….

Some of those Maui warriors who had been put to flight ran to Kahekii, who questioned one of them: "What news of the battle at the shore?"

> The news, O heavenly one, is that we were put to flight by only two warriors, one of them garbed in his feather cloak and helmet. It is understood that this was a truly great chief, godlike. Though there were many of us we were slain with our own spears which had been seized by those men. The other man had a very stout body, with dark features and square shoulders, and I have never seen the like of these men. Our spears were piled alongside their canoe hulls and they became a way for them to come ashore. When they came on land those godlike men continued to slay us. If we had not run from that battlefield there would have been no one to bring the news (30, pp 39-40).

Kamehameha didn't say, "endless is the good that I have *given* to you," he said, "endless is the good I have *conquered* for you." Although the gravity of this seemingly subtle difference may not be immediately apparent to those unfamiliar with the cultural evolution of Hawaii, Kamehameha's final words freight enough power to bring tears to the eyes of at least one explorer familiar with the Natural History and cultural evolution of this most "wonderfully isolated" archipelago, to borrow a descriptive phrase Wallace used often in *Island Life* (17).

For the past thousand years – since the first arrival of voyaging canoes from Tahiti, Hawaiian history has been dominated by constant warfare, political instability, and extreme economic uncertainty, punctuated by two *relatively brief* periods of peace, prosperity, and political stability. Contrary to popular myth, surfing was *not* the sport of Kings, it was *Lua*, the art of bone-breaking.

After the first arrival of Tahitians ≈1000 AD, the first 800 years of Hawaiian history may be readily summarized as a constant state of inter-island warfighting, fear, misery, volatility, and uncertainty. Each island kingdom was perpetually consumed with conquering or being conquered by neighbouring island kingdoms. And this brings us back to an important question we are now presently well-positioned to answer: Why were one million rocks past hand-to-hand by thousands of men (≈16,000) from Polulu Valley to Pu'ukohala from 1790 to 1791? Perhaps at this juncture we should note that the heiau at Pu'ukohala is a temple dedicated to the war-god *Ku*. The casual observer may see the construction of the Pu'ukohala Heiau as an exercise in futility, directed by a war lord deluded by superstition. But a more thorough exploration of our great leader reveals he fully grasped perhaps the most profound politico-economic principle: *Si vis pacem, para bellum.*

We should also offer a bit of perspective on the magnitude of Kamehameha's campaign: In 1790 the United States military numbered 5,000 troops. At this point in time Kamehameha had 16,000 soldiers under his command.

And Kamehameha had a plan: The construction of this heiau was essentially a means for *training – for strengthening* – his troops for their final cooperative effort: to bring *peace and prosperity* to the Hawaiian archipelago.

After setting out in 1791 to *conquer* the island kingdoms neighbouring his kingdom on the big island of

Hawai'i (which was ultimately achieved in 1810), Hawaii entered into and enjoyed its very first, relatively brief, nine year period of peace, prosperity, and political stability.[10]

Why so brief?

This period of peace, prosperity, and tranquillity came to an abrupt end shortly after Kamehameha's son, Liholiho, dismantled the kapu system, ordered the destruction of the war temples and idols,and, furthermore, perhaps since he did not have a warrior instructor as his father had had,[11] Liholiho despised the thought of war, refused to discuss it with his *ali'i,* and "often escaped from reality by drinking, gambling and seeking other pleasures" (31, p 25).

Realism is invariably too bitter for liberal escape-artists to swallow.[12]

The famous battle call of his father, as he led his troops into countless battles, "Forward my brethren, drink of the bitter waters, there shall be no going back" (30, p 490) fell upon the deaf ears of his imbecilic son.

In the course of my exploration of the Pu'ukohala Heiau, I had the great fortune of gaining valuable insights from Gregory A. Cunningham, Interpretive Ranger, National Park Service, The U.S. Department of the Interior…

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[10] The consolidation of the Hawaiian Islands by Kamehameha into one kingdom was one of the greatest achievements in Hawaiian history. Three important factors contributed to this achievement: 1) the foreigners with their weapons, advice and physical aid; 2) the feudal Hawaiian society with its lack of distinct tribes having intense tribal loyalties; and probably the most important influence 3) the personality of Kamehameha.

High-born and trained to lead, Kamehameha possessed all the qualities of a strong leader. Powerful in physique, agile, fearless and possessing a strong mind, he easily inspired loyalty in his followers. Though ruthless in war, he was kind and forgiving when the need arose. He used new things and new ideas to promote his own interests. He appreciated the advantages offered by the foreigners and used them in his service. Yet he never fell into their power. Kamehameha's good judgement and strong will prevailed. Through constant vigilance and internal strength, he held his kingdom together until the last days of his life (31, p 21).

[11] A certain man from Kohala arrived at Ke'ei, and on meeting Kekuhaupi'o was questioned as to his lord, Chief Kamehameha. The man replied frankly:

> When you left your chief, he engaged in the pleasures of surfing and lele kawa, and also in the "famous favourite occupation of our chiefs," and when he began to engage in these pleasures he was followed by his common people. Pleasure is the work at Kohala these days, and the farms are abandoned and weeds growing in them. If the young chief continues thus, famine will come to the land and to us.

When Kekuhaupio heard those words from that Kohala man, he immediately prepared to leave his family in Ke'ei and go to Kohala, since he cherished his lord. When he arrived in Kohala he went to Kamehameha's house and inquired for him. He was told that the young chief and his companions in pleasure had gone to enjoy themselves with lele kuwa and surfing. When Kekuhaupi'o heard these words from some of Kamehameha's men he sought his foster son at the lele kawa place. When that young chief was informed that his instructor was seeking him he quickly left the leaping place. He joined his instructor, who, without delay or uncertainty, spoke: *E Kalani e*, cease your activity, my lord. This is not the activity which will gain you the island. Return to your war maneuvers, care for the little man and the big man, for this that you are now doing has no future, my lord' (30, p 65).

[12] It may also be relevant to consider the fact that Liholiho was raised during the years of his father's hard-earned peace, as is typical of this problem. As Vegetius observed, "in the midst of peace, war is looked upon as an object too distant to merit consideration" (1).

§3. Discussion

During my initial exploration of Pu'ukohala, at the end of Cunningham's fascinating tour of this hallowed ground, he kindly led me back to the information centre and, after generously listening to more than he may have wanted to hear about the nature of my research, Cunningham thoughtfully suggested a half-dozen superb volumes, all of which I immediately purchased from their well-stocked bookstore.

One of these gems was *Kamehameha and his Warrior Kekuhaupi'o* (30).

One week later, on my third and final visit to Pu'ukohala, after careful review of these volumes on the beach, I pointed out the discrepancy between Kamakua's and Desha's accounts of Kamehameha's final words.

Cunningham stated he was unaware of this considerable discrepancy but, without skipping a beat, offered, "Hawaiians don't like the word *conquer*."

Indeed, it seems Cunningham was right on the mark, Hawaiians, like Kamehameha's son Liholiho and countless Americans and Europeans today, those raised in this brief, mirage-like stretch of peace since the end of the Cold War, have developed distastes for words and phrases such as *conquer, military training, the Second Amendment, military power,* and *war* – and that's exactly why *Hawaii* no longer belongs to *Hawaiians.*

Naturally, it did not take long for this island paradise to slip away from Liholiho, for he clearly did not grasp that *economic power is derivative, not primary.*

Political instability quickly returned to the Hawaiian islands. Economic uncertainty prevailed. Foreign powers began circling the Hawaiian islands like sharks. The Hawaiian kingdom's centre of power and former glory faded like cheap plastic in the hot Kohala sun, and, in time, a few *haoles* with a few guns[13] took it all away[14] and procured the protective shield of a nation with sufficient *Resource Holding Power* (*military* power) to help steer Hawaii back toward the the state of peace and prosperity Kamehameha and his trusted warrior, Kekuhaupi'o, had once *conquered* for them.

Political stability, prosperity, and peace did not return to this islands again until 1900, until the islands became *the possession*, a territory of a nation which grasped this greatest of profound truths: *Si vis pacem, para bellum.*[15]

Yes, though this evolutionary stable strategy was quite clear in (1) and exhaustively detailed by Adam Smith

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[13] The Hawaiian League developed two inner factions: a radical wing which favored the abolition of the monarchy and the setting up of a republic, possibly even seeking annexation to the United States; and a conservative wing which favored retaining the monarchy, but wanted a change in the ministry and a drastic revision of the constitution. To this latter group, a republic was a last resort should the king refuse to agree to the reforms demanded.....

Believing that Kalakaua would not willingly agree to its reforms, the Hawaiian League felt that a show of force would be necessary. To this end, the League provided its members with guns and ammunition, and formed an alliance with the Honolulu Rifles – an all-*haole* volunteer [organization]... ...The Honolulu Rifles attained little importance until Volney V. Ashford was elected captain in late July of 1886. He had extensive and varied military experience both in the Union Army during the Civil War and in the Canadian Army. Being an excellent drillmaster, Volney Asford brought the small group up to a state of great proficiency. By the end of June, 1887 when the political crisis came to a head, the Honolulu Rifles consisted of a battalion of three companies numbering about two hundred men (31, p 83).

[14] Dubbed the "Bayonet Constitution" because of the manner in which it came into existence, the constitution of 1887 revised the constitution of 1864, taking away from the king the greater part of his power and transferring that power to the cabinet thereby making the Hawaiian monarch in effect a ceremonial much like the sovereign of Great Britain (31, p 84).

[15] Given the difficulty of determining how much power is enough for today and tomorrow, great powers recognize that the best way to ensure their security is to achieve hegemony now, thus eliminating any possibility of a challenge by another great power. Only a misguided state would pass up an opportunity to become hegemon in the system because it thought it already had sufficient power to survive (32, p 35).

in that eventful year of 1776,[16] despite our progress, we may be enduring another sort of intellectual epidemic which first spread through the United States late 19th century.[17]

Indeed, this lesson is readily illustrated on nearly every island, every continent, and through every epoch at one wishes to look: If alpine exploration should take you to Switzerland, consider a reflexion by the *Lowendenkmal*, "the most mournful and moving piece of stone in the world" (35); it is also

> a paradox that DE RE MILITARI, which was to become a military bible for innumerable generations of European soldiers, was little used by the Romans for whom it was written. The decay of the Roman armies had progressed too far to be arrested by Vegetius' pleas for a return to the virtues of discipline and courage of the ancients (1, *introduction*).

But we need not turn back the pages of history that far to find another wise man who pleaded the same case, a fearless leader who "had translated the story of his country and the meaning of… war into words and ideas accessible to every American. The child who would sleeplessly rework his father's yarns into tales comprehensible to any boy had forged for his country an ideal of its past, present, and future" (36, p 587 ;*cf.* 37):

> Fourscore and seven years ago our fathers brought forth on this continent a new nation, conceived in liberty and dedicated to the proposition that all men are created equal.
>
> Now we are engaged in a great civil war, testing whether that nation or any nation so conceived and so dedicated can long endure. We are met on a great battlefield of that war. We have come to dedicate a portion of that field as a final resting-place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.
>
> But, in a larger sense, we cannot dedicate, we cannot consecrate, we cannot hallow this ground. The

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[16] The first duty of the sovereign, that of protecting the society from the violence and invasion of other independent societies, can be performed only by means of a military force.

The first duty of the sovereign, therefore, that of defending the society from the violence and injustice of other independent societies, grows gradually more and more expensive, as the society advances in civilization. The military force of the society, which originally cost the sovereign no expense, either in time of peace, or in time of war, must, in the progress of improvement, first be maintained by him in time of war, and afterwards even in time of peace.

As it is only by means of a well regulated standing army, that a civilized country can be defended, so it is only by means of it that a barbarous country can be suddenly and tolerably civilized. A standing army establishes, with an irresistible force, the law of the sovereign through the remotest provinces of the empire, and maintains some degree of regular government in countries which could not otherwise admit of any. Whoever examines with attention, the improvements which Peter the Great introduced into the Russian empire, will find that they almost all resolve themselves into the establishment of a well regulated standing army. It is the instrument which executes and maintains all his other regulations. That degree of order and internal peace, which that empire has ever since enjoyed, is altogether owing to the influence of that army (33).

[17] We seem to be passing through what may be called an exceptional development of the heart without a corresponding development of the head. Through all classes of people there seems to have run a contagious epidemic of sentiment which has arisen from a really high and noble moral purpose. Persons of sensibility, refinement and intelligence have been touched as never before by a strong desire to do for the classes below them. So find and so lofty has unquestionably been the purpose behind this movement, that it seems ungracious, if not unjust, to hint at a possible improvement in it; and yet the ascertainment of the causes of things and the subsequent remedying of evils can be advanced only by the most rigorous, logical, and scientific investigation. Lofty as the well meaning purpose of many persons may be, still, if founded only on a sentimental basis, it may be as dangerous as error (34, p 2).

> brave men, living and dead who struggled here have consecrated it far above our poor power to add or detract. The world will little note nor long remember what we say here, but it can never forget what they did here. It is for us the living rather to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us -- that from these honored dead we take increased devotion to that cause for which they gave the last full measure of devotion -- that we here highly resolve that these dead shall not have died in vain, that this nation under God shall have a new birth of freedom, and that government of the people, by the people, for the people shall not perish from the earth (38).

Indeed, alas, this "unfinished work" is never –*and will never* – be complete. *The Struggle for Life* (24) is an unending affair; and thus, "economic power, unlike military power, is not primary, but derivative" (28, p. 95).

On September 16th 1835, Charles Robert Darwin began his exploration – both theoretical and physical – of the Galapagos archipelago.[18] The following day, back on board the *Beagle*, he wrote "the natural history of this archipelago is very remarkable: it seems to be a little world within itself" (13, p 454).

Yes, this simple, straight-forward, comparative method, has been and remains the method of choice amongst naturalists and true problem-solvers. Those philosopher kings searching in vain for authoritative "validity" and/or various degrees of "probability" of these profound truths which I have found, will be left untended, for Xenophanes, Democritus, Socrates, David Hume,Sir Karl Popper,[19] F.A. von Hayek, Bertrand Russell, and others have sufficiently tended to these long arguments. And of course one of the greatest lessons to take away from the *Logic of Scientific Discovery* (41) is the fact that scientific method does not exist (42).

Thus, in conclusion, perhaps we may be willing to consider the possibility that our humble historical narrative of cultural evolution in the Hawaiian archipelago does indeed offer a representative, descriptive, useful, and valuable politico-economic model insofar as the true nature of economic power is concerned.

I also trust I have sufficiently highlighted the controversial nature of these truths. As a naturalist, game-

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[18] ON September 16, 1835, in the course of the voyage of the *Beagle*, a call was made at the islands of the Galapagos archipelago in the Pacific. This visit was one of the most momentous incidents in the life of Charles Darwin, who was on board the ship as naturalist, for the observations which he was enabled to make gave that orientation to his thoughts which ultimately led him to formulate his theory of the evolution of species (39).

[19] This problem had been seen and solved long before; first, it appears, by Xenophanes, and then by Democritus, and by Socrates… The solution lies in the realization that all of us may and often do err, singly and collectively, but that this very idea of error and human fallibility involves another one-the idea of objective truth: the standard which we may fall short of. Thus the doctrine of fallibility should not be regarded as part of a pessimistic epistemology. This doctrine implies that we may seek for truth, for objective truth, though more often than not we may miss it by a wide margin. And it implies that if we respect truth, we must search for it by persistently searching for our errors: by indefatigable rational criticism, and self-criticism (40, p 21).

theorist, and economist who has spent a decade in search of a solution to *The Problem of Sustainable Economic Development* (43-45), nobody was more surprised than I was that military strategy would factor so heavily, and end up playing a central role in my theoretical developments, but that is because I simply did not realize when setting out so long ago, that economic power is a derivative power. I had to discover it for myself!

And of course I have since discovered that many have reached similar conclusions (1 ; 30-34 ; 46-52).

But as a follower of the Enlightenment,[20] my endeavour is not to attempt to influence or even to sway; it is only to state plainly the truths I find, to cast light on my theoretical and physical explorations of the Hawaiian islands. Yes, these are the hard truths I found on the shores of Polulu Valley, carried over the Kohala Mountains to Pu'ukohala, then carried *home* with me, to serve as constant reminders of the *"intensively unusual, unstable, complicated, unreliable, temporary nature"* of this thing we know as life on earth, to serve as constant reminders to stand guard, to maintain nobility of purpose under adverse conditions, and to protect those whom I love and those whom have protected and continue to protect me:

[20] A follower of the Enlightenment speaks as simply as possible: we want to be understood. In this respect Bertrand Russell is our great master (53, p 206).

As noted in my introduction, I suspect this politico-economic analysis may strike many as odd, but I hope this methodological curiosity does not detract from this sound arguments. Indeed, the more I explore our world of islands, the more I see – *in far ways than one* (43-44) – that we are far too eager to cast our protective shields aside, disregarding the most fundamental lessons human evolutionary narratives have to offer. Yes,

> the power to become habituated to his surroundings is a marked characteristic of mankind. Very few of us realize with conviction the intensively unusual, unstable, complicated, unreliable, temporary nature of the economic organization by which [we have] lived for the last half century. We assume some of the most peculiar and temporary of our late advantages as natural, permanent, and to be depended on, and we lay our plans accordingly. On this sandy and false foundation we scheme for social improvement and dress our political platforms, pursue our animosities and particular ambitions, and feel ourselves with enough margin in hand to foster, not assuage, civil conflict….
>
> The outward aspect of life does not yet teach us to feel or realize in the least that an age is over…. Evidently we did not exploit to the utmost the possibilities of our economic life. We look, therefore, not only to a return to the comforts [prior to our present economic crisis], but to an immense broadening and intensification of them….
>
> But perhaps it is only in England (and America) that it is possible to be so unconscious… The earth heaves and no one but is aware of the rumblings. There is not just a matter of extravagance or '[economic] troubles'; but of life and death, of starvation and existence, and of the fearful convulsions of a dying civilization (54, pp 3-4).

Prince Edward Island, December, 2009

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On the Problem of 'Inexplicable Insouciance': An Open Letter to Daniel S. Loeb[$]

TABLE OF CONTENTS

[$] From: Matt Funk, Fellow
The Linnean Society of London
Burlington House, Piccadilly, London W1J OBF, United Kingdom
matt@funkisland.org

ABSTRACT

In November of 1859, Charles Darwin's *On the Origin of Species by Means of Natural Selection, Or the Preservation of Favoured Races in the Struggle for Life* launched evolution into theoretical orbit, and it continues to influence its trajectory, but recent theoretical developments have demonstrated that this seminal work freights a nontrivial error which misguides several crucial developments – not only in the evolving structure of evolutionary theory, but across the entire spectrum of science, including politico-economics. The logical implications which follow from these revelations are far-reaching and inform wide-ranging strategies, including those relating to national defense, global threat mitigation, reserve currencies, and personal finance. These implications are especially relevant and applicable to hedge fund (alternative investment) strategies; thus this paper contextualizes and introduces the relevance of Darwin's nontrivial error to the hedge fund sector.

31 October 2009

> Honour be to those who in their life mark out and defend a Thermopylae….
> It was there that three hundred of Sparta's finest warriors held back the invading millions of the Persian empire and valiantly gave their lives….
> Thermopylae stands for integrity, loyalty, and steadfast adherence to principles.
>
> —Elena Ambrosiadou, *Ikos*, 2009

Attn: Daniel S. Loeb
Third Point LLC
390 Park Avenue
New York, New York 10022
The United States of America

CC: Elena Ambrosiadou
Ikos Cif Limited
1 Iacovou Tompazi Street
Limassol 3107
Cyrpus

Re: *Trick or Treat?*

Dear Daniel,

I'm writing to inform you that you have made a great mistake.

Your error occurred to me a few days ago, when, through a curious lattice of coincidence, it came to my attention that you were struggling to find good recruits for your scrappy band of multicultural metrosexuals (see: § I).

I emphasize the greatness of your mistake because it seems you've been barking up the wrong trees.

But I like your style, admire the course you've charted through stormy seas,[$] and I was impressed by your bold moves along 8 Mile Road and dare-devil safari through the perilous economic bogs of Michigan in Q2 (*2*); your 13D letters are priceless.

So, after conducting in-depth, exhaustive due diligence and a thorough background check (see§ II), I decided to offer my assistance and a few words of advice.

In short, it is simply impossible to find "good help" (i) amongst Citadel's incompetents in Chicago, (ii) in urban finance centres in general, and (iii) buried in a stack of spectacular CV's featuring BSc's, MSc's, and PhD's in finance/economics, and "expertise" and "valuable insights" gleamed from "The Carlyle Group," "Eos Partners," *etc.*

Of course this is in part due to the simple fact that the most crucial economic insights are located entirely outside of economics proper (*3*)—but there's much more to it than that.

In fact, there's much more to this letter than may initially meet the eye;although this dense communiqué may appear

---

$ We did not throw down gates, create an SPV, or restrict fund redemptions in any way when these practices were becoming prevalent in the Fourth Quarter…. While taking redemption limitation measures may not have violated the letter of contractual agreement, in many cases I believe it violates the spirit of an industry that marketed itself on easy liquidity for its investors (*1*, p 3).

excessive and extravagant, all cost-added *accoutrement* and contextual *décor* are essential.[$]

This costly, extraordinary need stems from the fact that the problem at hand must address problems relating to both new (very new) and old (very old) ideas.

The new ideas are just that – *new*, and thus not well-known (or known at all); but this may be remedied in short order by simply spending a few moments contemplating the first reference (*5*) in a rather controversial (see § III: *On the Problem of 'Standard Thesis Formats'*) one-page Master's thesis (see § IV: *On the Origin of Mass Extinctions: A Thesis*), reviewing a brief game-theoretical communique (*6*), or spending few more minutes with an expanded and annotated iteration of this truly noncooperative game (*7*). This is the easy part. Indeed, these new "ideas, which are expressed so laboriously… are extremely simple and should be obvious" (*8*, p vii).

But "the difficulty lies," as Keynes noted, "not in the new ideas, but in escaping from the old ones" (8, p vii).

And to this salient point, what I was trying to say in another way is this: the likelihood of "finding good help" by barking up "economic", "finance", or "extensive industry experience" trees is about as likely as finding a true scholar in an ivory tower (see § III). Ted Turner's father tried to explain this to him while he was a student at Brown (see§ V).

For example: based upon the widely accepted and employed central theorems of economics, compost heaps of economic analysis over the past decade have concluded (to my knowledge, without exception) that Barbados is the "most wealthy" nation in the OECS, and that the island of Mustique is situated in one of the poorest nations in the OECS. These conclusions, however, could not be any further from the truth (*in fact, the truth happens to be the exact opposite*). If you have four minutes and twenty seconds to explore an overview of this conjecture, I encourage you to cross*The Funk Line* with a quick round-trip flight from Barbados to Mustique: http://www.youtube.com/watch?v=CoM3ubcknqM.

From an ever broader perspective, consider setting-off on an intellectual journey through economic history, beginning with the stern warning F.A. von Hayek issued in December of 1974:

> I must confess that if I had been consulted whether to establish a Nobel Prize in economics, I should have decidedly advised against it.
>
> One reason was that I feared that such a prize, as I believe is true of the activities of some of the great scientific foundations, would tend to accentuate the swings of scientific fashion (*9*).

Now ask yourself: "Have we heeded this warning?"

$ A cost-added signal is a signal that is more costly to make than the minimum required to transmit the information. The excess cost exists because, in the past, receivers have been more likely to respond appropriately to costly signals (*4*, p 308).

Start in 1975 and work your way through to the present – look at their theories, listen to their speeches, read their prize lectures, and then think very carefully through the logical implications which follow from their influential theories, and endeavour to estimate the manner in which they have "accentuated the swings of scientific [and politico-economic] fashion". I'd be curious to know what you come up with; I've spent a few years working through this thought exercise and here's what I've concluded: with less than two dozen exceptions – Friedman, Schultz, Stigler, Buchanan, Coase, Fogel, North, Harsanyi, Nash, Selten, Lucas, Mirrlees, Vickrey, Mundell, Heckman, Akerlof, Spence, Kahneman, Smith, Aumann, Schelling, and Phelps – the Academy's blessing has, despite Hayek's warning, served up more economic plague than tonic.

Although these noble names may seem to present an impressive roster of deft acrobatic theorists, keep in mind most years there are two or three winners, 53 prizes have been doled out since 1975. Indeed, based upon my qualitative estimate, the Swedish Academy is batting much less than .500. And thus, as Hayek feared, perhaps more than half of well-established economic theory may boil down to a complex cauldron of toxic, Bitches Brew; and worse yet, these highly contagious ideas don't go away, they've been immortalized, emblazoned upon our minds, stuck to the face of human civilization like a nasty case of herpes. But let's merely consider a single, toxic externality these intellectual pesticides have left in your backyard. Consider, for example, the evolutionary, etymological turn the word 'hedge' took in 1672: "To insure oneself against loss, as in a bet". Then take a look in your back yard: how many hedge funds even come close to meeting this basic requirement? When I peer over the fence (or, better yet, the 'hedge'), I see unregulated mutual funds, with 10-20 times greater costs, far greater risks, and much less liquidity, *all pretending to be 'hedge' funds.*

But if that was the lesson LTCM *should* have taught us, why haven't we learned?

I'll tell you why: Because all the players from every angle – from Nobel prize winners to academic departments to central bankers to VaR models to "extensive industry experience", *teaches* us not to understand the nature of the beast. In short, it goes to very great lengths to teach us to disregard *The Problem of Induction.*

Over the past few days, I've been trying to explain the nature of this snafu to Andy Haldane[$], Henry Waxman, and a

---

$ -------- *Original Message* --------
Re: Attn: Andy Haldane
Date: Wed, 21 Oct 2009 15:53:32 +0100
From: The Bank of England
To: Matt Funk, FLS

Hello, thank you for your mail. I passed your mail to Mr Haldane's office and he has asked me to thank you for your mail and for letting us know your views.
Kind regards. Roger Beaton.

guy who works on biological models from an ivory tower enviously close to Windasnsea and Blacks:

> -------- *Original Message* --------
> *Re:* *Biology based financial models*
> *Date:* *Tue, 20 Oct 2009 10:32:17 -0300*
> *From:* *Matt Funk, FLS*
> *To:* *George Sugihara*
>
> Greetings George,
>
> Just thought you might be interested in reviewing a theoretical development (attached) and this brief communiqué (copied below).
>
> I wish I were able to have to hear you speak at the Global Arc (I had hoped to attend with my cousin, Jason Funk, whom you might bump into at the bar), but I hope that we may have to opportunity to meet someday—my mother lived in San Diego for decade, and I did a BSc and a Masters degree at USC. I find much to agree with in your researches—you may find aspects of mine agreeable as well.
>
> > -------- *Original Message* --------
> > *Re:* *Economic models*
> > *Date:* *Mon, 19 Oct 2009 20:54:02 -0300*
> > *From:* *Matt Funk, FLS*
> > *To:* *ee@mail.house.gov*
> >
> > Dear Chairman Waxman,
> >
> > I am writing to inform you that you have made a great mistake.
> >
> > Your error occurred to me while reviewing your 2 October 2009 letters to the EPA's Honourable Lisa Jackson *et. al*, regarding your search for "economic models which predict the potential impacts of HR 2454". Although I commend you for recognizing that "models are not crystal balls," the greatness of your mistake is rooted in your ill-founded conclusion that "reasonable assumptions can be used to inform policy decisions and evaluate various policy choices". I'm afraid they can not. Furthermore, I'm afraid that believing we have answers when in fact we have none poses grave, evolutionary unstable dangers (not to mention a myriad of national security threats). Although there are some models which may offer value, unless they are accompanied by a time-machine, they are certainly not economic models, they are biological models - - such as the model attached herewith.
> >
> > For example, consider this passage from the brochure for the *Global Arc Conference* which began in Boston today:
> >
> > > Structurally, the market turbulence of 2007 and 2008 has profoundly shaken confidence in traditional physics based approaches to modelling financial structures. Rather than merely tweak existing physics models, Andrew Haldane of the Bank of England, Professor Lord Robert May, Baron of Oxford and Fellow of Oxford University and Professor George Sugihara of UC San Diego will argue that a more radical shift may be required: a full scale migration to biology based financial models.
> >
> > This is, essentially, the systemic, deeply entrenched problem Soros attempted to highlight (indirectly) when testifying before the committee on oversight & government reform last November, and this was, in fact, a crucial, timely point I tried (and apparently failed)[$] to make when I delivered an early (and admittedly unrefined, perhaps even unintelligible) draft of the theory presented herewith in a letter to Ken Griffin (*11*) in December of 2007 (and proposed to make some serious cash in the process; alas, I walked alone).
> >
> > The logical implications which follow from this theoretical framework are indeed far-reaching. As Aristotle noted, "In framing an ideal we may assume what we wish, but should avoid impossibilities." Alas, economic

---

$ Last summer, Kenneth C. Griffin and his wife, Anne, hedge fund managers both, were so rich that they did something most wealthy couples don't do until much later in life. Still in their 30s, they hired a Ph.D. student in economics to help dole out their money to charities.

Fast-forward six months, and Mr. Griffin, who built the Citadel Investment Group into one of the largest hedge funds in the world, has seen the value of his funds plunge by roughly $10 billion—one of the biggest amounts lost in the hedge fund carnage last year.

He was down 55 percent while the average fund was down 18 percent (*10*).

models are all constructed upon an impossibly false and sandy foundation: probability theory. David Hume recognized this problem long ago, Sir Karl Popper figured out just how serious Hume's problem was in the 1930s, and then Popper spent the rest of his life trying desperately to tell everyone what it all meant (and wrote some of the most valuable books on earth in the process). Of course one of Popper's most industrious students, George Soros, learned his Professor's lessons and, moreover, used them to make cake by, essentially, betting against all those (that is, nearly the entire human population) who did not and still do not understand *The Problem of Induction* (*12*).

If you would like to discuss this development or your research, please drop me a line.
Sincerely, Matt Funk.

PS: By the way, George, I thought you might also be intrigued by a curious link between my admittedly imperfect letters to Ken Griffin (in which, beginning in December of 2007, I tried to warn him that shit was about to hit the fan), an esteemed UCSD professor, and an esteemed professor at your *alma mater*, Princeton. I had several very interesting conversations about utilizing biological financial models with Clive Granger while he was in New Zealand, and although he was unwilling to go far enough to say that he was ready to abandon econometrics in favour of the biological models I have been trying to advance for the past three years, he did tell me that he had once thought of conducting similar research in the Falklands. But in any case, I reference these conversations (*cf. 11*), and, furthermore, I noted

> that Warren Buffett's recent declarations that 'US equities presently represent a good value,' are - despite his impressive *track record* (*The Problem of Induction* strikes again) – emphatically false. Neither Buffett nor anyone else is sufficiently equipped to say what 'represents' or 'does not represent' a good value, because, as Stigler duly noted 1982, economics does not have a *theory of value*.£ Once again, however, I have developed a unified *Economic & Evolutionary Theory of Value* in order to address this most central, open problem.

And, to this point, you may also recall that my methods are rather unusual—that I do not believe in the inductive methods of economics, and that I utilize islands as economic models. Although it may be true that, as far as I know, I'm the only naturalist/economist/problem-solver utilizing such methods, I believe that many may be willing to consider that, perhaps Popper, Hayek, Soros†, and Taleb are all right, that econometrics is utterly useless (or, more likely, as we've discovered far too many times to recount here ~~*dangerous*~~), that as far as so-called 'social sciences' are concerned – probability theory causes far more harm than good.

Needless to say, George, many economists, game-theorists, and mathematicians have found my conjectures thoroughly disagreeable; one of those individuals, referencing my discussions with Granger, sent the following reply when I attempted to bring the truths that I have found to his attention last July:

> *-------- Original Message --------*
> *Re: Truly Noncooperative Games*
> *Date: Mon, 06 Jul 2009 17:56:29 -0400*
> *From: Harold W Kuhn*
> *To: Matt Funk, FLS*
>
> Dear Matt:
> I suggest you contact Dr. John Nash at:

£ In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyze for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories (*13*).

† People generally remember the time and geographic condition where they were swept with a governing idea. …Paul Claudel remembers the… spot of his conversion… to Catholicism in the Cathedral Notre-Dame in Paris, near a precise column. Thus I remember… the spot at Barnes & Noble on 18th Street and Fifth Avenue where in 1987, inspired by Soros, I read fifty pages of *The Open Society* and feverishly bought all the Popper titles I could get my hands on lest they run out of stock (*14*).

kjfnj@math.princeton.edu
He is alive (barely) and should be more interested in your ideas than I am.
All the best,
Harold kuhn

PS: I have googled you and found your extensive references to my student Clive Granger. If you have further contact, give him my best regards. I am in retirement in New York City.

Anyway, Dan, as for the 'economic' nature of your problem, apparently Professor Kuhn doesn't care, and Ken Griffin couldn't figure it out (*6-7* ; *10-11*), but I suspect you may care *and* be able to figure it out.

But setting any and all potential deficiencies and complex inter-dependencies attributable to new ideas, new knowledge, and unsolved economic riddles aside, what, exactly, did I mean to imply when I suggested that "good help" would be impossible to find in London or New York?

Sure, there are a lot of smart, hungry people in Chicago, London, and New York—but they*all* want chilled Gewurztraminer, crustaceans on ice, VIP luxury skybox access, and tickets to go see retards running around on stage. And what I'm trying to tell you, Dan, is something I think you already know—these are not the kinds of people you're looking for.

Perhaps at this point you're thinking, "Yeah, and I bet this is the part where Funk tells me that he'd take Miller High Life over Gewurztraminer any day (which happens to be true), that he's a bloodthirsty badass (which also happens to be true), and such a focused, tireless, and relentless reading/thinking/writing/analytical-machine that hasn't had a television since 1997, let alone wasted a single second or a cent on something "playing" on or off-Broadway (which of course is true, too).

And maybe you're thinking that this is where I put the icing on the cake by re-emphasizing my intelligence, fierce independence, creative problem-solving abilities, and seduce you with a Bierdstadt landscape of the majestic mountains of cash my hereto unrecognized and unexploited strategies could net you and/or Third Point LLC.

Yes, it may be quite logical for you to suspect that this marks the narrative climax when I convince you that I'm the kind of "good help" you've been unable to find. But if that is what you're thinking, then you've missed my point entirely.

Truth be told—if your shop just happened to be located on Malta, the Isle of Man, the Caymans, Luxembourg, Zurich, Zug, Montana, Wyoming, South Dakota, or even someplace in New Hampshire—then maybe I'd be writing some kind of kiss-ass letter of introduction, highlighting the relevance and pedigrees of both my Masters degrees (one of which is regularly ranked #1 in the world, the other is the only such program in the world), and stating up-front that I finished the most recent Master program with a first class standing).

But the problem—perhaps the main reason why you're finding that "good help is hard to find" may be due to the fact that *nobody* (not even you or Soros, whom, along with Jim Rogers and Nassim Taleb, may find my theories more agreeable than any three savvy investors I can think off) could ever pay me –*and others like me* – enough to live in under Mayor Bloomberg and Governor Paterson's guard (or rather, lack thereof - two true enemies of the Open Society) in New York~~shitty~~ city. Rod Blagojevich is perhaps the only better example of the political embodiment of the debased populace which elected him to leadership (see § VI – *In Defense of Private Clubs*) – which is why I won't be setting up shot in Chicago any time soon, either.

But Elena Ambrosiadou wouldn't have to pay me very much at all to fight like a crazed*Úlfhéðinn* to defend her Thermopylae (*15*) on *Cyprus,* hence my CC to her.

In fact, I'd work for peanuts to spend a*Wanderjahre*[$] as a naturalist/strategist onboard the *Maltese Falcon* (*17*); it seems that Ambrosiadou also loves islands, and, like you, values constructive criticism, open communication, plain speaking, and clear understanding;[£] thus I feel confident that, despite the fact that her strategies appear to be even more steeped in econometric models than yours, that she may grasp the value of an economic & evolution theory of value based upon*relative*

$ One very important but seldom noticed feature is its exemplification of the *Wanderjahre* (years of wandering) in the genesis of the scientific mind. No English term conveys the exact same meaning as the German. It refers originally to the medieval custom of sending young men to other villages or towns to learn a craft and more of the world in a different setting. History has shown that there is no more fruitful way to launch the career of a naturalist than by such an interlude, during which the adventurer travels alone, searching, freed from domestic ties…

The pages of *Voyage of the Beagle* are the diary of Darwin's *Wanderjahre*. As he proceeds around the world…, the young naturalist unconsciously builds the foundation of what was to be his evolutionary view of life (*16,* pp 18-19).

£ 'We begin well, sir,' the fat man purred, turning with a proffered glass in his hand. 'I distrust a man that says when. If he's got to be careful not to drink too much it's because he's not to be trusted when he does'….

The fat man raised his glass and held it against a window's light. He nodded approvingly at the bubbles running up in it. He said: 'Well, sir, here's to plain speaking and clear understanding.'

They drank and lowered their glasses.

The fat man looked shrewdly at Spade and asked: 'You're a close-mouthed man?'

Spade shook his head. 'I like to talk.'

'Better and better!' the fat man exclaimed. 'I distrust a close-mouthed man. He generally picks the wrong time to talk and says the wrong things. Talking's something you can't do judiciously unless you keep in practice.' He beamed over his glass. 'We'll get along, sir, that we will….' The fat man pulled another green plush chair around to face Spade's within convenient distance and placed a smoking-stand within reach of both chairs. Then he took his glass from the table, took a cigar from the box, and lowered himself into his chair. His bulbs stopped jouncing and settled into flabby rest. He sighed comfortably and said: 'Now, sir, we'll talk if you like. And I'll tell you right out that I'm a man who likes talking to a man that likes to talk.'

'Swell. Will we talk about the black bird?'

…. 'You're the man for me, sir, a man cut along my own lines. No beating about the bush, but right to the point. Will we talk about the black bird? We will. I like that, sir. I like that way of doing business. Let us talk about the black bird by all means, but first sir, answer me a question, please, though maybe it's an unnecessary one, so we'll understand each other from the beginning. You're hear as Miss O'Shaughnessey's representative?'…

'I can't say yes or no. There's nothing certain about it either way, yet… It depends.'

It depends on—?'

Spade shook his head. 'If I know what it depends on I could say yes or no.'…

The fat man's eyes glistened…'Who else is there?'

'Who else is there?'

Spade pointed his cigar at his own chest. 'There's me,' he said.

The fat man sank back in his chair and let his body go flaccid. He blue his breath out in a long contented gust. 'That's wonderful, sir,' he purred…. I do like a man that tells you right out he's looking out for himself. Don't we all? I don't trust a man that says he's not. And the man that's telling the truth when he says he's not I distrust most of all, because he's… going contrary to the laws of nature (*18*, pp 105-106).

insularity (5-7); presently, I'm excited by the prospect of heading to the University of Malta to complete a PhD and conduct research in Dr Joseph Falzon's new Hedge Fund Research Centre—but I'm *also* excited about the prospect of heading to Malta, several steps closer to Ambrosiadou's shores.

Why aren't I as optimistic about the prospect of joining up with your scrappy band of multicultural metrosexuals at Third Point?

I trust by now you may recognize it's simply because Third Point's offices are not anywhere near *Third Point*.

I read, for example, that you recently dropped $45 MM USD (cash) on a luxury skybox in Jihad Stadium.

Of course there's nothing wrong with that, *per se*, assuming, that is, that you only need to spend a few weeks of the year in Manhattan, that you've got a nice perch up on Kohala mountain, a private island off Maine, a well-armed and relatively self-sufficient sailing yacht, or, better yet, a 500,000 acre ranch someplace *inhabitable*, someplace with clear, flowing water, fish and game, an old orchard, and fresh, country air. Honestly, I haven't tried to figure out if you do or not—but if you don't, *you're fucking crazy.*

Where's your sphere of relative insularity? Your fortress? Your retreat? Where do you go to get or stay connected with the most primitive, *most utterly essential* evolutionary struggles. If Third Point is your only Thermopylae, then you're in trouble. And, if the evolutionary stability of such a retreat has not occurred to you, I'd strongly suggest that you spend a little time visiting with Ted Turner or reading up on the penultimate stage of the *taxon cycle*—or, better yet, simply think about the long-term logical implications which readily follow from my core theoretical developments (5-7).

Of course I'm presuming a lot here. Maybe you think I'm the kind of guy you'd like to hire, or maybe you think I'm the kind of guy you should alert your security staff about—the truth is, I don't care.

Who is John Galt, anyway?

Why don't I care? Are NYC, Chicago, and London truly that horrible?

On the evolutionary front, there is certain more to this predicament than urban politics.

This letter does not offer ample space for such a lengthy evolutionary discourse, but since you have mentioned that you're not fond of shooting, I'll merely offer the following anecdote: I like to spend a lot of time sneaking through the woods with my trusty .30-06, looking for something big and tasty to eat.

When I find it, I shoot it.

If it doesn't die, I chase it like a crazed *Úlfhéðinn* and stab it or shoot it again.

Then I skin it with my Damascus steel knife, disembowel it with my own two hands, carry the boon back home, stick some in the freezer for a rainy day, roast the rest over a hardwood charcoal fire, then feed it to my family, just like my ancestors have done ever since they got the hell out of Africa 50,000 years ago. And in doing so, I help my little six year old son learn the most important lesson there is to learn: *how to survive on a very unpredictable and – from time to time – incomprehensibly inhospitable planet.*

I hunt, fish, and gather because I love it, and I love it because I know that I *must* love it if I want to stay hungry, if I want to survive, if I want my children and my children's children to survive.

I love it because it's *evolutionary stable* to love it.

And you can't do that in New York city, London, or Chicago.

And the more time you spend living in those cities – no matter how much cake you're able to make or accumulate – in the very long run, city dwellers are all dead meat (alas, it is probable that we're all dead meat).

Perhaps you may start wondering, if Funk is not hunting for an opportunity at Third Point, what *does* he want?

It's simple, Dan: I need your help.

And the good news for me is, it seems there's a fair chance you'll end up giving it to me – *in one way or another* – whether you want to or not.

In short, as it turns out, Dan, essentially, we have the same problem: Good help is *also* very hard to find in academic circles. Walk into any academic office and you're almost bound to meet an incarnation of Alan Lewis or *Long Term Capital Management.*

And my problem is this: I've made a very serious, very frightening revelation, and, so far, I've *barely* found *anyone* capable of figuring-out what the hell I've done. With a half-dozen notable exceptions (my wife , the Fellows of The Linnean Society (including Brian G. Gardiner), Jeff Kanipe, Jianhui Wang (Argonne National Laboratory), Russel Fielding, Mark de Silva, Dr Joseph Falzon, Dr Barry Bartmann, Dr Clive Granger, Jordan Walker, Randall Hobbs, and my cousin Ben), my efforts to illuminate the truths that I have found have failed far more often than not. As noted, I've failed to explain this to Ken Griffin, but I've also failed to communicate these truths to President Bush, President Obama, the King of Spain, Joseph Stiglitz, Kenneth J. Arrow, William C. Clark, Harlod Kuhn, John Nash, Bruno Frey, John Mearsheimer, George Sugihara, most

of the economics department at Princeton, Michael Anastasio, a half-dozen members of the National Academy of Sciences, the entire Aland International Institute of Comparative Island Studies (*19*), a half-dozen members of the faculties of Arts and Biology at the University of Prince Edward Island (*i.e., 20-26*).

But despite this poor track record, I think there is an excellent chance that you will grasp the illusive truths that I have found and that's why I need your help. And in light of the great difficulty I've had, I've chosen you for several key reasons, most of which I've already mentioned or inferred (smart, fiercely independent, pragmatic,*etc.*), but one which I have not – an ability which has steadily flowed from the minds of great genius since the beginning of the human race – from Da Vinci to Van Gogh to John Nash to Albert Einstein: *It seems you have a great imagination*.

And I have become progressively convinced that scholars are not able to remotely*grasp* a solution that they are not able to *imagine* in the first-place. Although I'm no artist, I've read too many good books, sat in wonder before too many awe-inspiring paintings, spent too much time staring at the beautiful big blue sea, and seen too many epic films not to have some of the magic pixie dust rub off on me. So, in light of the fact that I am merely a few years younger than you (I realize I'm so old-school that I must sound ancient), I'll attempt to convey the magnitude of the problem I'm facing with a scene analogy from a cinematic masterpiece which I suspect may have influence your childhood to a certain degree as well.

Imagine, Daniel, if you will please, that this letter is not actually an elegant .pdf email attachment, but rather, R2D2. And now I'd like you to imagine that the letter before your eyes and three brief theoretical communiqués (5-7) are all somehow programmed into this crafty little R2D2 droid.

But perhaps the penultimate step is the most important: It is absolutely crucial at this stage that you imagine that I did not write these letters, derive these theoretical frameworks (5-7) or program the droid. It is crucial that you imagine all of this work was done by someone else – it doesn't really matter who, but preferably a woman, such as you wife, or a hot Third Point receptionist (it seems you must have one or two), or even some random, such as my wife's best friend, a cute little Dutch lesbian named of Natalie (*cf.* 27: "*Hawaii 2009*","*Marcy, Nat, & Matt*"), or Tara, my wife's co-worker (my wife is the best nurse on the planet, by the way), someone who happens to be at our Halloween party tonight (happy Halloween, by the way) – she's 24, sharp as a tack, hot as hell, funny as me, and just broke up with her loser boyfriend. I just went out and snapped a quick picture (sorry, I'm not much of a photographer) – she's wearing a white toga, sucker in her mouth, autumn leaves in her hair, long gold chain draped loosely around her neck:

In any case, you must also imagine that you are not Daniel S. Loeb, the fearless fund manager from the isle of Manhattan, but rather Obi-Wan Kenobi, the fearless Jedi-knight from some other planet, and that you've travelled back to the moment in time when you opened "R2D2". Now, imagine a holographic image of your*femme fatale*-of-choice projecting through the dark and onto the big-screen in your luxury skybox at 15 Central Park West. Her image flickers as she reaches down to program the droid by her side; you hear Jedi knights battling –*struggling for life*– in the background, and she pleads:

> General Kenobi… I've placed information vital to [human] survival… into the memory systems of this R2 unit…. This is our most desperate hour. Help me, Obi-Wan Kenobi; you're my only hope (*8*).

A bit dramatic? Maybe.

But then again, maybe not. Consider, for example, the manner in which I recently attempted to bring the significance of my findings to a Professor at the University of Chicago:

> -------- *Original Message* --------
> *Re:* *Committee on Evolutionary Biology*
> *Date:* *Tue, 27 Oct 2009 02:43:30 -0300*
> *From:* *Matt Funk*
> *To:* *David Jablons*
>
> Greetings David,
>
> As you remarked on your homepage:

> There are extremely dramatic crashes, like the extinction that killed off the dinosaurs because of an asteroid impact 65 million years ago. It's just a very dramatic story.
>
> And it's a great vehicle for teaching the principles of evolutionary biology, which is really what this course is all about.

This observation reminded me of something Dobzhansky once said:

> One can argue that all environments are hostile, and that death and extinction are probable events, while survival is improbable. Just how life has managed to overcome this improbability is a problem which many biologists find challenging and fascinating. In my opinion, this problem may well be used as the framework on which to build the teaching of biology (*29,* p 450).

Although it seems both you and Dobzhansky are essentially in agreement here, I would emphasize that it's much more than just a dramatic story, that it's one of the half-dozen or so most important lessons for the human race, and that it is the very framework on which to build the teaching of biology. Gould emphasized this in one of the final chapters of *The Structure of Evolutionary Theory.* Of course this is the chapter in which he also noted your research.

In short, my research objective is to take the logical implications which follow from your research – and the research of others insofar as mass extinctions are concerned – and ask: given this reality, that is, given the reality that these events *do* occur, and that these events *will* occur again, What is the dominant strategy for the long-term survival of the human species?

Of course I didn't know that this was my research objective when I set off on this long journey over a decade ago. In fact, I was studying economics at the time, and I was concerned with what I thought were primarily 'economic' problems. Over time, however, I came to understand the significance of an open problem which made me realize that I needed to spend a long time studying natural history and evolutionary theory if I was ever going to make any progress on the most central economic problem which I had my sights set upon (*cf.* 13).

Remarkably, I've solved this problem. Actually, I solved it nearly two years ago, and perhaps surprisingly (though I don't think it should come as much of a surprise), it seems it may be true that, to date, I'm still the only person on Earth who knows that I've solved this problem!

In any case, I solved it, in short, by deriving a unified theory of economic and evolutionary value; and I'd like to talk to you about the possibility of coming to the University of Chicago to work it all out in a CEB PhD thesis under your direction.

Many scholars have scratched their heads over the fact that, after spending nearly five years circumnavigating the globe, studying, comparing, and contrasting the great diversity he found, and contemplating *The Struggle for Life*, Darwin returned to Down and he never travelled again. Not even to the other side of the English channel. For over thirty years a wealthy man of leisure stayed home. He could have gone anywhere he wanted to go.

Why didn't he go anywhere?

I have a theory: *Darwin didn't want to die.*

He knew that he was working on something so utterly important, that he was terrified by the thought that he might die before he had the chance to offer the most significant solution ever tabled in the history of human life on earth.

I came up with this theory as I was driving alone, down a seemingly endless stretch I-95 through the northwoods of Maine last winter. The afternoon began to wear on, light grew dim, and I began to think about the significant number of giant yellow Moose-warning signs. And then I started to *worry.* Suddenly, my chest felt tight and I couldn't breathe.

I slowed down, pulled over to the side of the road, and dialled 911. An operator came online as I drove on up to the next mile-marker and stopped. I told him where I was and that I was having a heart-attack. He stayed on the phone with me for the next 15 minutes or so, waiting for the ambulance to arrive. He dialled my wife, back on Prince Edward Island, and brought her online so I could tell her that I loved her.

In hindsight, that was a big mistake, because she freaked-out, and – as it turned out – I was not having a heart attack.

I was merely a simple man burdened by a big idea. And I was afraid of dying before I had a chance to tell everyone about it.

I know that I'm on to something big, David, and I will do everything within my power to see to it that I am able to explain it all very clearly (to as many people as I'm able) before I'm gone.

And I want you to help me.

If you're interested in giving this proposition further consideration, you may wish to review the brief theoretical outline (attached) which provides the foundation for my unified theory of value.

If you'd like a longer introduction, I've been discussing a few details with my faithful champion, sorcerer's stone, and greatest benefactor (my cousin, Ben Funk), and I'd be happy for forward this exchange if you'd like greater context.

Fortune willing, I'll make it back from Mustique (http://www.intermilanvideo.com/video/CoM3ubcknqM/The-Funk-Line.html), and head back home to Chicago – I realize you will probably be busy over the holiday, but if you'd like to get together, I'll be staying at the Union League Club, and I would be happy to make time to see you.

Am I overestimating the significance of the truths that I have found?

I don't think so, Dan, but of course you must be the judge.

And if you think it's important, talk to other people about it. Use it as a competitive advantage – because in doing so, it will invariably become necessary to explain what I am trying to teach you (to your team at Third Point, for example), and thus you will help me achieve my objective, which is, quite simply, to foster long-term human survival and national security (and in that order).

And here's why it's a win-win for me: If you don't get it, if you think I'm fucking retarded or just a pompous jackass —then simply do what you always do: *pass this along to all your fruity friends and tell them what an idiot I am.* You see, not only do I suspect you're capable of grasping the logical contents of the theory enclosed herewith, you also happen to represent a *very* strong repeating station with a *very* strong signal, narrow-casting to small but highly intelligent and influential audience. I'm not looking for broadcast coverage, I'm looking for niche-casting because very, very close to zero percent of the human population is capable of comprehending more than a few things I've said in this long letter—but there are those who are able —and I suspect you may be one of them.

My problem is hardly unique—in fact, it has happened throughout our nation's history, and it happened in the time of Vegetius (*30*).

In the meantime, if you'd like to get together to discuss any of this, I'm passing through JFK on November 10th, *en route* to Boston, and then on to Exeter *to drop off this letter*, which is, in reality, neither a letter to you nor the voice of Princess Leiha, but rather the *prima materia* for a chapter of a very big, very unusual book.

You see, I wasn't kidding when I told you there was much more to this than initially meets the eye.

Otherwise, my wife (Marcy) and I are visiting my cousin Ben and his family on Mustique tomorrow. There's no surf, but the fishing is great, Mustique is paradise, and I imagine Walter Noel's house will be for sale soon. Moreover, as noted, Mustique happens to serve as a very descriptive bio-economic model. I explained this all in a very long letter to The Linnean

Society of London last February (*31*); but you should come down and see it for yourself:

Date	*Flight*	*Depart*	*Arrive*
02 Nov 2009	JetBlue 871	JFK 8:30 am	BGI 2:18 pm
02 Nov 2009	GrenAir 814	BGI 4:30 pm	MQS 5:20 pm
10 Nov 2009	Charter	MQS TBA	BGI TBA
10 Nov 2009	JetBlue 872	BGI 4:20 pm	JFK 8:31 pm

Dates	*Locale*	*Accommodation*	*Telephone*
02-08 Nov	Mustique	*Serenissima*	784.488.8821/8823
08-09 Nov	Mustique	*The Firefly Inn*	784.488.8414
09-11 Nov	Boston	*The Algonquin Club*	617.266.2400
24-28 Nov	Chicago	*The Union League Club*	312.427.7800

If you're interested in connecting elsewhere to discuss any of the above, I've read you're not too keen on private clubs, but you might want to consider § VI: *In Defense of Private Clubs* in the light of an evolutionary stable, game-theoretical heuristic known as the 'Always Imitate' rule (32).

Otherwise, if you're looking for capital, I'll make introductions for 100bps at signing, 50bps trailering (annualized, quarterly). If you want research, we can talk; if you want to discuss any or all over fishing at the Ocean Reef Club (*cf. 27*), or hunting up at Lake Gogebic (*cf. 27*), that could be arranged at your convenience. And who knows, perhaps Ambrosiadou will invite us over to discuss this long letter over a few ice-cold bottles of Miller High Life onboard the *Maltese Falcon*?

Happy Halloween!

Matt Funk, FLS

PS: In the meantime, I'll leave you with two final pieces of advice:

(*i*) I just received a letter from which began: *Dear Matt: It is my great pleasure to present you with your new National Rifle Association membership card. Carry it with pride knowing that you're doing more than most Americans will do in a lifetime to promote firearm safety, share your enjoyment of the shooting sports and defend freedom today and for future generations.* Advice: Send the NRA $1,000 USD for a lifetime membership.

(*ii*) On 28 April, 2009, you noted that "we have closed out all of our 'doomsday,' 'fat tail risk' trades (including gold-related investments)". Thus I might suggest that, after reviewing the paper enclosed herewith, you may want to rethink your long-term position on gold and other hard assets. Also, spot gold traded at $1068 and change on the 13th, which means, of course, that if you would have moved *into* gold, rather than moving *out*, theoretically you could have saved yourself 169 days of dodging bullets and drunk drivers along 8 Mile Road (and the bleary eyes and "investor fatigue" that came with it), spent some of that time hunting or fishing, instead—and netted yourself a nifty 62.19% annualized rate of return. I might also add that the SEC Chairman, readers of Forbes.com (see § VII: *Top-10 Buy Recommendations for 2009*), and several family members and friends, (see § VIII – *Financial Advice for my Family & Friends,* which happens to offer a curious historical account of the development of my unified theory of value based upon relative insularity, by the way) who may have headed my advice regarding gold on the 18th of August could have (again, theoretically, of course), stood with 112.02% annualized rate of return on the same day—and, not to mention, of course, stood with much greater liquidity and faced much less inherent risk. Your job is hard enough the way it is, why make it harder?

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20. Funk M (2009) *On the Extinction of Species by Means of Insularity Lost, or The Law Which Regulates the Struggle for Life: Lessons from Mustique.* International Development Week presentation. 2 February 2009, 1:30 PM, Atlantic Veterinary College, Lecture Theatre A (University of Prince Edward Island, Charlottetown).
21. Funk M (2009) *Solving Island Problems with Island Solutions: Amplification-by-Compression, Complex Systems, & Cultural Evolution* Guest lecture presentation for IST 604, Research Methods & Designs in Island Studies, Main 311, 26 January 2009, 6:00 PM (University of Prince Edward Island, Charlottetown).
22. Funk M (2008) *On the Extinction of Species by Means of Insularity Lost: Lessons from Prince Edward Island.* 20 November 2008. Seminar presented to the Department of Biology, 26 November 2008, 3:00 PM (University of Prince Edward Island, Charlottetown).
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AFTERWORD

-------- Original Message --------
Subject: Trick or Treat?
Date: Tue, 29 Dec 2009 12:44:42 -0500
From: Daniel Loeb
To: Matt Funk

Dear Matt

For some reason, your email has a been sitting in my inbox. I can't remember if Popper influenced Nassim Talib or George Soros or both.

In any case, flattered to see the reference my seminal correspondence with Lewis.

I enjoy your passion and good luck!

Dan

-------- Original Message --------
From: Matt Funk
Sent: Sunday, November 01, 2009 10:38 AM
To: Daniel Loeb
Subject: Trick or Treat?

Greetings Daniel,

Happy Halloween!

Sincerely,

Matt Funk, FLS
[Attachment: *On the Problem of 'Inexplicable Insouciance': An Open Letter to Daniel S. Loeb*]

--------Original Message--------
From: Alan Lewis
To: Daniel Loeb
March 22, 2005

Daniel, thanks for calling earlier today.

Enclosed is my CV for your review. I look forward to following up with you when you have more time.
Best regards, Alan.

--------Original Message--------
From: Daniel Loeb
To: Alan Lewis
March 28, 2005

What are your three best current European ideas?

--------Original Message--------
From: Alan Lewis
To: Daniel Loeb
March 28, 2005

Daniel, I am sorry but it does not interest me to move forward in this way.

If you wish to have a proper discussion about what you are looking to accomplish in Europe, and see how I might fit in, fine. Lesson One of dealing in Europe: Business is not conducted in the same informal manner as in the U.S.
Best regards, Alan.

--------Original Message--------
From: Daniel Loeb
To: Alan Lewis
March 28, 2005

One idea would suffice.

We are an aggressive, performance-oriented fund looking for bloodthirsty competitive individuals, who show initiative and drive, to make outstanding investments.

This is why I have built Third Point into a $3bn (£1.6bn) fund with average net returns of 30% over 10 years.

We find most Brits are a bit set in their ways and prefer to knock back a pint at the pub and go shooting on weekends rather than work hard. Lifestyle choices are important, and knowing one's limitations with respect to dealing in a competitive environment is too. That is Lesson One at my shop. It is good that we learned about this incompatibility early in the process, and I wish you all the best in your career in traditional fund management.

--------Original Message--------
From: Alan Lewis
To: Daniel Loeb
March 28, 2005

Daniel, I guess your reputation is proved correct. I have not been in traditional fund management for more than 11 years. I did not achieve the success I have by knocking back a pint, as you say. I am aggressive, and I do love this business.

I am half-American and half-French, and having spent more than half my life on this side of the pond I think I know a little something about how one conducts business in the U.K. and Europe.

There are many opportunities in the U.K. and Europe, shareholder regard is only beginning to be accepted and understood. However, if you come here and handle it in the same brash way you have in the U.S., I guarantee you will fail. Things are done differently here. Yes, place in society still matters, where one went to school etc. It will take tact and patience (traits you obviously do not have) to succeed in this arena. Good luck! Alan.

--------Original Message--------
From: Daniel Loeb
To: Alan Lewis
March 28, 2005

Well, you will have plenty of time to discuss your "place in society" with the other fellows at the club. I love the idea of a French/English unemployed guy, whose fund just blew up, telling me that I am going to fail.

At Third Point, like the financial markets in general, "one's place in society" does not matter at all. We are a bunch of scrappy guys from diverse backgrounds (Jewish, Muslim, Hindu *etc.*) who enjoy outwitting pompous asses, like yourself, in financial markets globally.

Your "inexplicable insouciance" and disrespect is fascinating; it must be a French/English aristocratic thing. I will be following your "career" with great interest.

I have copied Patrick so that he can introduce you to people who might be a better fit. There must be an insurance company or mutual fund out there for you. Dan Loeb.

--------Original Message--------
From: Alan Lewis
To: Daniel Loeb
March 28, 2005

Hubris.

--------Original Message--------
From: Daniel Loeb
To: Alan Lewis
March 28, 2005

Laziness.

[*1* ; *cf. 2*]

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2. McGrath B (2005) The Angry Investor. *New Yorker*, 18 April.

§ II – FAIRFIELD GREENWICH-ESQUE DUE DILIGENCE

Fairfield Greenwich Group (FGG) is introduced to several hundred potential managers in the course of each year. A relevant subset of these leads are pursued and background information on promising potential relationships is collected and shared among FGG's professionals for initial assessment.

The nature of FGG's manager transparency model employs a significantly higher level of due diligence work than that typically performed by most fund of funds and consulting firms. This model requires a thorough understanding of a manager's business, staff, operational practices, and infrastructure.

At this stage, FGG begins qualitative and quantitative reviews of a manager's past performance obtained from independent sources, as well as a series of manager interviews and reference calls.

Through this process, a preliminary assessment evolves of a manager's business and investment practices. Particular attention is paid to the extent to which each manager's controls are reasonably suited to maintain operational, market, and credit risks at an appropriate level and as represented by the manager.

During this period, FGG personnel also have an opportunity to evaluate a manager's attitudes and receptiveness (as opposed to his proclaimed intention) towards providing FGG with full transparency of its security level trading activity and access to its investment thought process.

This close level of communication and access is the cornerstone of FGG's ongoing relationship with the manager, without which a business relationship with FGG would not exist.

A small portion of managers who pass through this basic screening process are considered for further, significant investigation. Some do not progress beyond this stage; some are placed on a watch list for further monitoring.

FGG's business model enables the firm to have privileged access to all aspects of a manager's operation and investment process, including security level transparency for risk monitoring purposes.

—Fairfield Greenwich Group, *c.* 2008

-------- Original Message --------
From: Matt Funk
Sent: 19 October 2009 06:22
To: Ben Funk
Subject: Dan Loeb

Who is this guy?

[Attachment: *Dan Loeb's Third Point LLC Q1 2009 Investor Letter*]

-------- Original Message --------
Subject: Dan Loeb
Date: Mon, 19 Oct 2009 11:42:26
From: Ben Funk
To: Matt Funk

An icon.

Ben Funk, Partner
Liongate Capital Management
Phone: +44 (0)20 7073 4622 **Fax**: +44 (0)20 7073 4601 **Mobile**: +44 (0)7973 525 911
Address: 103 Mount Street, London, W1K 2TJ, United Kingdom

§ III – ON THE PROBLEM OF 'STANDARD THESIS FORMATS'

Canadian Winner Bemoans Beurocracy

The Canadian inventor of technology that led to the birth of digital photography won a Nobel Prize Tuesday. But physicist Willard Boyle had to move to the United States[§] to do his cutting-edge work. Dr Boyle, who won the award with former colleague George Smith, warned that [we] need to give scientists leeway to come up with the kinds of transformative inventions that are too often stifled…

What scientists face today is 'almost disgraceful'…. What is needed is 'an appreciation for the free will, free spirit of scientists. Give them a chance to do the things they want to do.'

—Willard Boyle, *Globe and Mail*, Tuesday, 6 October, 2009

Attn: Professor
University of Ivory Towers
Welfare Isle
Canada

CC: Dr Willard S. Boyle
1326 Lower Water Street
Halifax, Nova Scotia
Canada

Dear Professor,

I'm writing to inform you that you have made a great mistake.

Your mistake occurred to me while reading this article in the *Globe and Mail,* yesterday.

I emphasize the greatness of your mistake because, despite the fact that this error is neither yours nor this university's alone, that, like many other problems, it may prove especially difficult to solve here in Canada.[£]

But setting these peculiar Canadian struggles aside, I have completed the final draft of my thesis in which I have addressed several of your points and integrated your advice.

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§ Perhaps the most haunting lines in Canada's history were written in 1858: 'It will be observed that the basis of Confederation now proposed differs from that of the United States in several important particulars. It does not profess to be derived from the people but would be the constitution provided by the imperial parliament…' These words are from a letter signed by three Fathers of Confederation (, p 3).

£ Twenty years ago, when I was teaching a university course on the American and Canadian constitutions, I covered the Canadian material while a colleague, Walter Berns, presented the American side. We attended classes together, each listening to and commenting on the other's account of his country's constitutional experience. One day after I had been going on for some time about Canada's constitutional debate, Walter turned to me and said, 'Peter, you Canadians have not yet constituted yourselves a people.' I have been brooding about Bern's remark ever since.

As the years rolled by and Canada's constitutional debate went on… with rising levels of intensity, I had to concede that Berns was right (, p ix).

There were two methodological points, however, which I addressed in short-hand, with a reference to *On the Problem of Breathing, Eating, & Drinking Poison: An introduction to problem solving, nobility of purpose under adverse circumstances, and the search for truth with Sir Karl Popper on Prince Edward Island* (*2*). Could you please review this and see if we are in agreement on all of the points here? Once you've had a chance to read, please let me know and I'll send along the final draft for your review.

Yours very truly,

(The Student)

> -------- *Original Message* --------
> *On 10 Oct 2009 20:41:28 -0300, The Professor wrote:*
> I have gone through this paper. Looking forward to receiving the final draft in a "standard thesis format" as we discussed in our last meeting.

-------- *Original Message* --------
On 11 Oct 2009 00:20:29 -0300, The Student wrote:

Thanks for reading that preliminary paper (*2*); I appreciate that you took the time to do so; however, it seems perhaps it did not have its intended effect, as the main point I hoped to clarify was, since "scientific method"[$] does not exist, then it follows logically that there can be no "standard thesis format"—that the proper thesis format is whatever format is necessary

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$ As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

> (*i*) There is no method of discovering a scientific theory.
> (*ii*) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.
> (*iii*) There is no method of ascertaining whether a hypothesis is 'probable', or probably true *β*, pp 5-6).

to communicate the thesis at hand, and thus whatever format the thesis adviser and the student are able to agree upon.[$]

Is this conjecture true?

Yes it is.

Is it radical and revolutionary?

Of course it is; and that is *exactly* the purpose of a University Education![£]

It seems that you missed my emphasis upon the fact that the 'literature review' in John Forbes Nash, Jr.'s revolutionary PhD thesis was one short paragraph (*2*, p 25), and that his Bibliography consisted of just two references, one of which was to his own work (*2*, p 26), and that, as Harold H. Kuhn once duly noted, "the entire thesis is 27 typescript, very generously double-spaced. Frankly, I have always considered the most important sections to be the first 6 pages…and the last pages (from twenty-one to twenty-six) on motivation, interpretation, and applications. For many years, I have accused John of padding the thesis in the middle" (*6*, p 5).

And as Kuhn noted, maybe twenty-seven "generously double-spaced" were unnecessary, perhaps the twelve pages Kuhn had noted would have sufficed? Afterall, the second reference (*7*) in Nash's Bibliography was less than two pages long and it stands today as one of the most influential communiques on Earth (*8*).

And, to this very point, high-calibre theses in well-under a dozen pages are not unheard of: Consider, for example, this excerpt from yesterday's telephone interview with George E. Smith, who was awarded the 2009 Nobel Prize in Physics with Willard S. Boyle (and Charles K. Kao):

> [Adam Smith]: The first thing is that you, I gather, have a record for having submitted the shortest thesis on record at the University of Chicago - just three pages.
> [George Smith]: Something like that, yes.
> [Adam Smith]: So, you were obviously a star student (*9*).

Note the interviewers suggestion that a three page-thesis infers that Smith was *obviously a star student,* not an

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$ There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws. . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these… laws. They can only be reached by intuition, based upon something like an intellectual love (*£infühlung*') of the objects of experience' (*4*, p. 37).

£ Within the unique university context, the most crucial of all human rights are the rights of freedom of speech, academic freedom, and freedom of research. And we affirm that these rights are meaningless unless they entail the right to raise deeply disturbing questions and provocative challenges to the cherished beliefs of society at large and of the university itself. It is this human right to radical, critical teaching and research with which the University has a duty above all to be concerned; for there is no one else, no other institution and no other office, in our modern liberal democracy, which is the custodian of this most precious and vulnerable right of the liberated human spirit (*5*).

incompetent fool merely capable of writing a fraction of the required, 'standard thesis' page-count.

Yes, perhaps we may attribute much of Smith's and Boyle's stylistic choices to fierce independence – and it may prove illuminating to explore potential sources at length. Although this short discourse does not offer the opportunity for in-depth analysis, I will merely speculate that much of Boyle's independence was*not* rooted in dogmatic academia because he was home-schooled by his mother.

And of course we may wish to consider the fierce independence routinely demonstrated by Nash as well[$] and perhaps in doing so we should also consider the extraordinarily hospitable environment at Princeton during the 1940s and 1950s, an environment shaped by great teachers from Soloman Lefschetz[£] to Albert Einstein[†] to Harold H. Kuhn to Nash's Canadian-American thesis adviser, A.W. Tucker.

In fact, as you sit in starry-eyed wonder, staring at my 600-page letter-of-introduction to my 1-page thesis (*12*), I encourage your to keep Tucker's answer to the following question emblazoned upon your mind…

> "*What about your philosophy of teaching on the graduate level? What do you see as the purpose of a Ph. D?*
>
> [Tucker]: I felt very strongly that if someone did a publishable piece of research, the *publication* was the acknowledgement….
>
> As a thesis adviser, I felt that my principal role was one of encouragement. Almost all my PhD students seemed quite self-reliant. Very often I really did nothing for them…; I simply was the straight-man against whom they could bounce their ideas (*13*, p 218).

Thus, you (and other faculty members, including my external and internal reviewers) may set my entirely optional 600-page letter of introduction aside for a rainy day and merely concentrate on my 1-page thesis, carefully noting the

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$ No one was more obsessed with originality, more disdainful of authority, or more jealous of his independence. As a young man he was surrounded by the high priests of twentieth-century science - Albert Einstein, John von Neumann, and Norbert wiener – but he joined no school, became no one's disciple, go along largely without guides or followers. In almost everything he did – from game theory to geometry – he thumbed his nose at the received wisdom, current fashions, established methods. He almost always worked alone, in his head, usually walking, often whistling Bach. Nash acquired his knowledge of mathematics not mainly from studying what other mathematicians had discovered, but by rediscovering their truths for himself…. His indifference to others' skepticism, doubt, and ridicule was awesome (*10,* p 12).

£ Lefschetz's, hence Princeton's philosophy of graduate… education had its roots in the great German and French research universities. The main idea was to plunge students, as quickly as possible, into their own research, and to produce an acceptable dissertation quickly. The fact that Princeton's small faculty was, to a man, actively engaged in research itself, was by and large on speaking terms, and was available to supervise students' research, made this a practical approach. Lefschetz wasn't aiming for perfectly polished diamonds and indeed regarded too much polish… in a youth as antithetical to later creativity. The goal was not erudition, much as erudition might be admired, but turning out men who could make original and important discoveries (*10*, p 60).

† Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels…. And, as recent research into Einstein's personal papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity…. Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern…. Other scientists had come close to his insight, but they were too confined by the dogmas of the day. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics since Newton. 'Imagination is more important than knowledge,' Einstein later said. Indeed, if we are ever going to… come up with a unified theory… we should carve that proclamation above all of our blackboards (*11*, p 4).

publication which represents the first of my four references.

In short, I have lectured (*e.g., 14*) and written exhaustively on scientific method elsewhere (*e.g.*, *2* ; *15*), but I am well-prepared to go to great lengths to defend my methods, stylistic choices, and, more generally, my fierce intellectual independence, but all this seems quite unnecessary. Don't worry about the format – again, neither 'scientific method' (*3-5* ; *11* ; *16-18*) nor a 'standard thesis format' exist; my sole requirement is to make a contribution to knowledge. As you must surely know, every year countless University students triumphantly defend double-spaced, standard length thesis formats without making the slightest contribution to knowledge.

So, at this juncture, I ask only that you review my thesis with this single question in mind: "Have I made a considerable contribution to knowledge?"

Afterwards, if you find that I have forwarded an intelligible, well-supported argument in the spirit of the advancement of science, we can address any trivial formatting concerns you may have.

Again, I am willing and quite able to table a strong defense for my stylistic and methodological choices, but this would mark a wholly unnecessary discourse and conflict with my obligation to communicate the truths that I have found as simply as possible - *nothing more, nothing less.*[$]

And please do spend some time thinking about the strong words of advice Willard S. Boyle offered in his interview with the *Globe and Mail*.

> Scholars may be compared to artists, who we expect to express their own original ideas and convictions. We do not simply expect them to produce what the market wants. Production for the market was the rule in the Middle Ages, painters and musicians were simple artisans who had to do what their customers wanted. But the Renaissance brought a complete reorientation: artists were given the right to express themselves with as few restrictions as possible. The result was an explosion in creativity, Leonardo da Vinci and Michelangelo Buonarotti being the best-known examples. If scholars are to be original in a similar way to artists today, they have to be given as much independence as possible. This principle has been accorded to universities a long time ago, and is rightly guarded by them. It has also brought about an explosion of innovation never seen before (*18*, pp 13-14).

And, I might even go so far as to suggest that it is not ultimately up to the "University" or "Professors" to guide or show "Students" the way, but rather, the reverse[£].

Thank you for your time and consideration of this weighty matter, Professor. The implications which follow from it

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$ The true responsibility of a scientist… is to the integrity and vigor of his science. And because most scientists, like all men of learning, tend in part also to be teachers, they have a responsibility for the communication of the truths they have found (*7*, p 91).

travel through the very heart of *The Purpose of a University Education* (*5* ; *13*) and extend well beyond, into some of the most central problems and tenable solutions relating to the human struggle for life on earth.

As a great teacher, leader, warrior, and gentleman who lived in an era where neither man nor nation could escape reality in ivory towers reminded us, "undisciplined free men are superior to veteran slaves."[$]

Yours truly,

(The Student)
Welfare Isle, October, 2009

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19. Campbell J (1949) *The Hero with a Thousand Faces* (Bollingen Foundation, Princeton).
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$ John Stark was a product of the frontier he grew up in. Survival was the ultimate achievement. Shaped and molded by the wilderness, he developed and became the embodiment of the virtues that defined most frontiersmen, *i.e.,* modesty, self-discipline, independence, frugality, and resourcefulness coupled with a hefty dose of common sense. These virtues remained the cornerstone of his illustrious career. He was one of our great patriots, rising to the challenges of the times and risking everything to turn the dream of independence and freedom from tyranny into the reality that became our United States of America…..

At the height of the national despair, Brigadier General John Stark, who had earned praise from all who participated in the Battle of Bunker Hill, arrived at Bennington with a New Hampshire militia contingent. Independent, cantankerous, and strong willed, Stark had honed his military and survival skills in the vast wilderness known as the New Hampshire Grants as captain in the fabled Rogers' Rangers. He now reviewed the military situation, and accurately assessed where he could do the most good, disobeying an order from the Continental army to place his command under their control. He steadfastly ignored the demand, leading his formation of irregular fighters against some of the best troops in the world—the British regulars and the Hessian mercenaries. 'Undisciplined free men are superior to veteran slaves,' said General Stark (*20,* p xii-xiii).

§ IV – ON THE PROBLEM OF MASS EXTINCTIONS: A THESIS

I, _____, do hereby recommend acceptance of *On the Origin of Mass Extinctions: Darwin's Nontrivial Error* [1],

in fulfilment of:

MASTER OF ARTS IN ISLAND STUDIES
THE UNIVERSITY OF PRINCE EDWARD ISLAND

_____ _____

[Signature] [Date]

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[5]. British Antarctic Survey. (2005). *20th Anniversary of Ozone Hole Discovery.* 14 September (BAS, Cambridge).

£ After graduating from the University of Glasgow, Brian Gardiner joined the [British Antarctic Survey] (BAS) in 1967. Posted to the Antarctic, he spent two years working in the atmospheric physics and meteorological programmes before returning to the UK in 1970. Arranging special ozone observing programmes to coincide with satellite activity, he and his team provided critical 'ground truth' observations for the satellites. In 1975 he was appointed Head of the Radiation and Ozone Section at BAS. Since 1989 Brian has been Principal Scientific Officer at BAS and continues his research into the ozone hole and related issues. He has recently been heavily involved in EU ozone measurement projects [4].

$ This year scientists at British Antarctic Survey (BAS) commemorate their discovery of the Antarctic 'ozone hole' 20 years ago and commend the historic international agreement (the Montreal Protocol 1987) that will lead to its eventual recovery.

Jonathan Shanklin, one of the researchers who made the discovery says,

> The… hole is larger and deeper than the holes that formed when the discovery was made but the situation would be much worse if the Montreal Protocol had not come into force. This agreement shows us that global action by governments to stop the release of ozone depleting chemicals really can help society to successfully mitigate a global environmental problem. We are still experiencing large losses of Antarctic ozone each spring because CFCs and other chemicals live for a long time in our atmosphere. However, the ban ensures that we will see an improvement in the future. We now need to take similar actions to control greenhouse gasses, otherwise we will bequeath future generations a significantly different climate from that of today.…

Members of the British Antarctic Survey's Meteorological and Ozone Monitoring Unit… carry out ozone observations at Halley and Rothera Research Stations. Ozone has been monitored at BAS research stations for nearly 50 years – the longest record of ozone measurements in the Antarctic. There was no ozone hole until the late 1970s. Joe Farman, Brian Gardiner and Jonathan Shanklin first announced the discovery of the annual depletion of ozone above the Antarctic in… *Nature* in May 1985. Later, NASA scientists re-analysed their satellite data and found that the whole of the Antarctic was affected.…

[BAS] is a world leader in research into global issues in an Antarctic context. It is the UK's national operator and is a component of the Natural Environment Research Council. It has an annual budget of around £40 million, runs eight research programmes and operates five research stations, two Royal Research Ships and five aircraft in and around Antarctica. More information about the work of the Survey can be found at: www.antarctica.ac.uk [5].

§ V – ON THE PROBLEM OF IVORY TOWERS

My dear son,

I am appalled, even horrified, that you have adopted Classics as a major. As a matter of fact, I almost puked on the way home today.

I suppose that I am old-fashioned enough to believe that the purpose of an education is to enable one to develop a community of interest with his fellow men, to learn to know them, and to learn how to get along with them. In order to do this, of course, he must learn what motivates them, and how to impel them to be pleased with his objectives and desires.

I am a practical man, and for the life of me I cannot possibly understand why you should wish to speak Greek. With whom will you communicate in Greek? I have read, in recent years, the deliberations of Plato and Aristotle, and was interested to learn that the old bastards had minds which worked very similarly to the way our minds work today. I was amazed that they had so much time for deliberating and thinking, and was interested in the kind of civilization that would permit such useless deliberation. Then I got to thinking that it wasn't so amazing - - after all they thought like we did because my Hereford cows today are very similar to those ten or twenty generations ago. I am amazed that you would adopt Plato and Aristotle as a vocation for several months when it might make pleasant and enjoyable reading to you in your leisure time as relaxation at a later date. For the life of me I cannot understand why you should be vitally interested in informing yourself about the influence of the Classics on English literature. It is not necessary for you to know how to make a gun in order to know how to use it. It would seem to me that it would be enough to learn English literature without going into what influence this or that ancient mythology might have upon it. As for Greek literature, the history of Roman and Greek churches, and the art of those eras, it would seem to me that you would be much better off by learning something of contemporary literature and writings and things that might have some meaning to the people with whom you are to associate.

These subjects might give you a community of interest with an isolated few impractical dreamers, and a select group of college professors. God forbid!

It would seem to me that what you wish to do is to establish a community of interest with as many people as you possibly can. With people who are moving, who are doing things, and who have an interesting, not a decadent, outlook. I suppose everybody has to be a snob of some sort, and I suppose you will feel you are distinguishing yourself from the herd by becoming a Classical snob. I can see you drifting into a bar, belting down a few, turning around to the guy on the stool next to you - - a contemporary billboard baron from Podunk, Iowa - - and saying, 'Well what do you think about old Leonidas?' Your friend, the billboard baron, will turn to you and say, 'Leonidas who?' You will turn to him and say, 'Why, Leonidas, the prominent Greek of the twelfth century.' He will, in turn, say to you, 'Well, who the hell was he?' You will say, 'Oh, you don't know about Leonidas?' and dismiss him, and not discuss anything else with him the rest of the evening. He will feel that you are a stupid snob and a flop; you will feel that he is a clodhopper from Podunk, Iowa. I suppose this will make you both happy, and as a result of it, you will wind up buying his billboard plant.

There is no question that this type of useless information will distinguish you, set you apart from the doers of the world. If I leave you enough money, you can retire to an ivory tower, and contemplate for the rest of your days the influence that the hieroglyphics of prehistoric man had upon the writings of William Faulkner. Incidentally, he was a contemporary of mine in Mississippi. We speak the same language - - whores, sluts, strong words and strong deeds.

It isn't really important what I think. It's important what you wish to do with your life. I just wish I could feel that the influence of those oddball professors and the ivory towers were developing you into the kind of a man we can both be proud of. I am quite sure that we both will be pleased and delighted when I introduce you to some friend of mine and say, 'this is my son. He speaks Greek.'

I had dinner during the Christmas holidays with an efficiency expert, an economic adviser to the nation of India, on the Board of Directors of Regents at Harvard University, who owns some 80,000 acres of valuable timber land down here, among his other assets. His son and his family were visiting him. He introduced me to his son, and then apologetically said, 'He is a theoretical mathematician. I don't even know what he is talking about. He lives in a different world.' After a little while I got talking to his son, and the only thing he would talk to me about was his work. I didn't know what he was talking about either so I left early.

If you are going to stay on at Brown, and be a professor of Classics, the courses you have adopted will suit you for a lifetime associated with Gale Noyes. Perhaps he will teach you to make jelly. In my opinion, it won't do much to help you learn to get along with people in this world. I think you are rapidly becoming a jackass, and the sooner you get out of that filthy atmosphere, the better it will suit me.

Oh, I know that everybody says that a college education is a must. Well, I console myself by saying that everybody said the world was square, except Columbus. You go ahead and go with the world, and I'll go it alone.

I hope I am right. You are in the hands of the Philistines, and dammit, I sent you there. I am sorry.
Devotedly, Dad (*1*, p 34-36).

1. Turner T (2008) *Call Me Ted* (Grand Central, New York).

§VI – IN DEFENSE OF PRIVATE CLUBS

-------- Original Message --------
Subject: Objects of Association
Date: Wed, 04 Feb 2009 13:29:32
From: Matt Funk
To: Marsha Pender

> The condition of membership shall be absolute and unqualified loyalty to the Government of the United States of America.
>
> The primary objects of this association shall be:
>
> 1st. To encourage and promote, by moral, social, and political influence, unconditioned loyalty to the federal government, and to defend and protect the integrity and perpetuity of this nation.
>
> 2nd. To inculcate a higher appreciation of the value of sacred obligations of American citizenship: to maintain the civil and political equality of all citizens in every section of our common country, and to aid in the enforcement of all laws enacted to preserve the purity of the ballot box.
>
> —*Articles of Association,* The Union League Club of Chicago,[$] 19 December 1879

Greetings Marsha,

I just made a new reservation to bring my wife and my son, William, to the club to celebrate his 6th birthday this weekend, discovered President Owen's letter (*2*) to the former Governor on your home-page, and decided to write you a quick note.

You may recall that I'm a reciprocal member from The Halifax Club.

William and I love everything about the club – the beautiful rooms, genuine service, inspiring artwork, impressive and useful library, and your superb athletic facilities. Of course we enjoy eating in the dining rooms, the pub, and room service, too. William especially loves the pool. But your fine facilities, fabulous location, and fantastic service is not what I value the most. And, although William is still a little too young to understand, what I value most are your *Articles of Association*.

Yes, the past is secure, but that is all.[£]

Bidding you Godspeed…Matt Funk

1. Kersh R (2001) *Dreams of a More Perfect Union* (Cornell Univ Press, Ithaca).
2. Owen, N (2008). *Resolution and Call for Resignation of Illinois Governor Rod Blagojevich* (Union League Club, Chicago).
3. Story J (1840) *A Familiar Exposition of the Constitution of the United States*. 1997 Ed (Regency Gateway, Lake Bluff).

$ Union College, the Union League Club. These and thousands of other familiar US landmarks, along with more than six hundred towns and cities bearing the name, testify to a once vital theme in American popular discourse. Few of those who today pass through, disembark at, or otherwise inhabit these places are likely to recognize the Union appellation as meaningful, much less as stating a profound aspiration to political unity. But from the late colonial period to the early Gilded Age, American leaders and ordinary citizens constantly expressed—in everyday talk and grand administrative planning, as well as in place names and architecture—their dreams of a 'more perfect' national union.

Beginning in the mid-1880's Americans' references to union declined sharply. So did the public testaments they left behind: of the eight states admitted since 1890, and the four lands that remain US territories today, just two included a (single) Union town or county, each established well before statehood. In succeeding years the practice was in fact reversed, as former Union cities, streets, and so forth were renamed or dismantled (, p ix).

£ The past is secure. It is unalterable. The seal of eternity is upon it. The wisdom, which it has displayed, and the blessings, which it has bestowed, cannot be obscured; neither can they be debased by human folly, or by human infirmity. The future, is that, which may well awaken the most earnest solicitude, both for the virtue and the permanence of our Republic. The fate of other republics, their rise, their progress, their decline, and their fall, are written but too legibly on the pages of history, if indeed, they were not continually before us in the startling fragments of their ruins. Those republics have perished; and have perished by their own hands. Prosperity has enervated them; corruption has debased them; and a venal populace has consummated their destruction… They have disregarded the warning voice of their best statesmen; and have persecuted and driven from office their truest friends. They have listened to the councils of fawning sycophants, or base calumniators of the wise and the good… They have surrendered to faction, what belongs to the common interests and common rights of the country. Patronage and party, the triumph of an artful popular leader, and the discontents of a day, have outweighed, in their view, all solid principles and institutions of government. Such are the melancholy lessons of the past history of republics down to our own….

In theory, a government may promise the most perfect harmony of operations in all its various combinations. In practice, the whole machinery may be perpetually retarded, or thrown out of order by accidental maladjustments…. Every change discomposes for a while the whole arrangements of the system. What is safe, is not always expedient; what it new, is often pregnant with unforeseen evils, or attracts only by imaginary good (*3*, pp 267-268).

§ VII – TOP-10 BUY RECOMMENDATIONS FOR 2009

-------- Original Message --------
Re: SEC Seeks Comment on Alternative Short-sale Rule
Date: Tue, 18 Aug 2009 04:37:08
From: Matt Funk, FLS
To: chairmanoffice@sec.gov

Dear Mr Chairman,

I am writing to inform you that you have made a great mistake.

In light of the fact that your office has "asked for comments" regarding your short-selling proposal, it seems that it may be my duty to share a few comments I emailed to family and friends, and posted at forbes.com (below) moments ago. I have spent the past several years investigating the underlying, evolutionary stability of the financial markets, and although I will certainly not impose with a long discourse, in short, I will humbly suggest that the sound and logical economic and evolutionary theories which argue "capitalism on the way up, socialism on the way down" will not work, also apply to your new proposal: "free markets on the way up, impeded markets on the way down" is inherently unstable for many of the same reasons.

If you find that there are members of your staff who are unfamiliar with the theories which inform these strong conclusions, I will humbly suggest that you refer them to FA von Hayek's*The Constitution of Liberty,* Adam Smith's timeless essay of 1776, or *On the Origin a Species by Means of Natural Selection, or the Preservation of the Favoured Races in the Struggle for Life* (1859), by Charles Darwin, Esq., FLS.

I realize that these are *relatively* difficult times (relative, that is, to the past 100 years, in terms of evolutionary time, *we 'ain't seen nothin' yet*), and I do appreciate your great service to our nation; if you would like to hear a more detailed argument, or if I may be of service in any way, please do not hesitate to ask[$]

Comment: *Posted by mattfunk | 08/18/09 03:03 AM EDT | forbes.com*
Yet another inherently destabilizing, bad idea. Needless to say, when we discover that the SEC is trying to figure-out how to bar the emergency exits shut while the markets are smouldering and full of highly combustible derivatives, run for the doors while you can.

Top-10 buy recommendations for 2009:

1) XAU and/or 2009 Ultra High Relief Double Eagles
2) US Treasuries
3) USD
4) RMB
5) WMT
6) Montana rangeland
7) South Dakota "East River" farmland/wildlife production systems (East of the Missouri River).
8) 2010 Ford F-450 Super Duty, XL, turbodiesel, 4x4, crew cab, six speed manual.
9) 2009 Winchester Model 70, .30-06, MOA trigger system, Swavorski Z6, 1-6x24 EE scope.
10) 2006-2008 Hallberg-Rassy 62 (fishing gear, hollow-keel full of Double Eagles & ammo).

$ *-------- Original Message --------*
Re: SEC Response - File HO1343856
Date: Thu, 27 Aug 2009 16:52:03 -0400 (EDT)
From: Brenda Stanfield
To: Matt Funk

Dear Mr. Funk:

Thank you for your email and taking the time to provide us with your comments.

We welcome your comments because they help us to regulate and enforce the laws that assure fair and orderly securities markets.

I have passed your views on to the people at the SEC who specialize in the issues you've raised. If they have any questions or wish to respond directly to your comments, they will contact you.

Once again, thank you for taking the time to inform us of your views.

Sincerely, Brenda E. Stanfield
Office of Investor Education and Advocacy
U.S. Securities and Exchange Commission

§ VIII – FINANCIAL ADVICE FOR MY FAMILY & FRIENDS

-------- Original Message --------
On Mon, 05 Mar 2007, at 07:00:35 -0400, Matt Funk wrote:

Dad, Did you get me email before you left for the weekend? I don't voice opinions on this sort of thing very often, but I certainly can't see any compelling reason not to sell US equities and sit on the sidelines – 25% cash (USD), 25% T-Bills, 25% Gold, and 25% CHF – for a while, (maybe the remainder of 2007, possible the rest of the decade). Anyway, I know you're not overly interested in the markets, but just thought I'd offer my two cents. Love, Matt.

-------- Original Message --------
On Sun, 12 Aug 2007, at 02:47:45 -0300, Matt Funk wrote:

Hi Dad, Perhaps you'll recall the brewing economic quagmire which had kept me up late several nights last winter.….

Despite the foreboding clouds gathering over this precarious scenario – much to my amazement – the equity markets continue to offer investors opportunities to exit long positions – if you have been 'averaging out' of positions, I would recommend continuing to do so (and if you have not begun to do so, it wouldn't be a bad time to consider doing so). The Swiss franc still looks undervalued to me.

Looking forward to seeing you soon! Love, Matt.

-------- Original Message --------
On Thu, 08 Nov 2007, at 03:05:59 -0400, Matt Funk wrote:

Hi Dad, Heard you're just getting back from Spain, hope you had a great trip, I'd love to hear about it, so give me a call when you have a chance… Hope all is as well there as it is here! Love, Matt.

PS: I know I've voiced my concerns for the US dollar/US equities over the past two years (admittedly*ad naseum),* but thought I'd mention that the fundamentals are looking weaker as time goes by (and if you look back at the USD/CHF returns over the past two years, you'll see I may have been on to something).

I'll attempt to explain why I've sent these dire communiqués, and why I still believe they are increasingly valid concerns. A few days ago, on the 14th, CHF hit USD parity for the first time in history. And this morning the dollar tumbled to new lows against most currencies.

Moreover, consider the Swiss Franc's rise against the USD since I sent my first recommendation last March.

Depending upon where you would have hypothetically entered the CHF market (I'd be curious to know if you did), to date you would be looking at a 18-24% ARR. I'd imagine most personal and/or investment advisers would have tried to dissuade you from making (I'd also be curious to know if you presented my suggestions to anyone – I'd like to hear what they had to say). In any case, I didn't write to be a smartass, rather, I'd like to do is explain why I made these suggestions in the first place. I'll attempt to do so in as few words as possible.

As you're aware, my primary intellectual interest has been*The Problem of Global Warming,* which I have concluded at long last is, in essence, merely one problem associated with a much larger problem,*The Problem of Sustainable Economic Development.* And, to make a very long story of my ten-year search for a solution to this problem short, I came to understand the problem was rooted in economics, more specifically, in economic methodology, which relates most specifically to (i) *The Problem of Inductio*n, and (ii), a long-standing, fundamental, open problem in economics: an entirely missing theory of value, which, as I've noted before, Stigler highlighted in his 1982 prize lecture.

Now the primary reason I wrote to you regarding the CHF, was because I had discovered a solution to The Problem of Value Stigler noted above. I realize how extraordinary or implausible this may seem, especially in light of the fact that you are my father and know all-to-well what a great fool I've been for much (most) of my life, but I also suspect that – as a seedsman well-aware of central role genetics play – you may recognize a few favourable traits, and I will also add that I have been invited to present my findings at a conference in the Ålands this summer (of course I hope you may be able to attend the conference). But in any case, what I'm saying is this: my theory may gain some traction in due course (which, of course, may take a long time).

My solution is a unified theory of value based on relative insularity which serves as a universal theory of economic & evolutionary value. I will attempt emphasize the significance of this conjecture from another angle: In 1944 John von

Neumann and Oskar Morgenstern noted in their seminal *Theory of Games and Economic Behaviour*:

> First let us be aware that there exists at present no universal system of economic theory and that, if one should ever be developed, it will very probably not be during our lifetime.

Again, although there is little reason to lend any credence to the issuance of predictions, it turns out that they were correct: Morgenstern died in 1957, Von Neumann died in 1977, and a viable, universal system of economic theory has not been tabled until the present!

You may be wondering that, if my solution is indeed tenable, why somebody else hasn't reached it first. I have wondered about this at length myself, and although there are several factors which come to mind, perhaps the most relevant factor has been the "denaturalization" of economics, which a writer named Shabas has detailed at length.

Rather than digging too deeply into the inter-working of this theory, however, it may prove more useful to demonstrate how a unified theory of value based on relative insularity works in the real world. Consider, for example, three different pieces of real estate. I'll use three properties you are intimately familiar with: (*i*) your house at 1425 North State Parkway in Chicago, (*ii*) your house at the Ocean Reef Club, and (*iii*) your lodge and the 180 acres along the shore of Lake Gogebic.

Now, imagine that all three properties were placed in an auction today, and that each property sold for exactly $10 MM USD (for a total of $30 MM USD). Now, in agreement with the central theorems of economics, each property was in fact worth $10 MM…. But as Stigler noted, this figure is ultimately meaningless because there is no underlying theory of value.

But if we analyze these assets in the light of relative insularity, we discover significant differences in their values: although this is, naturally, a very general sketch, *ceteris paribus*, the Chicago property would to be valued slightly lower, the Ocean Reef property would be valued much lower, and the lodge would be valued much, much higher. I believe you may grasp the essence of this discrepancy immediately: Key Largo's heavy de-valuation is based primarily on the fact that the entire island – and much of the southern tip of Florida, including all of Miami and the rest of the keys – is no more than 12 feet above see level and within the hurricane belt, and the Gogebic property's true value is based upon it's relatively high degree of insularity: far removed and well insulated from potential (yet highly unlikely, granted) shocks. In other words, in the event of an extraordinary economic decline (such as the great depression) and/or political upheaval, Lake Gogebic offers subsistence opportunities that the other properties do not (fish, game, relative insulation from potential urban violence, etc.).

Furthermore, a financial adviser, armed with my theory of value, may suggest that an owner of these three properties might want to consider taking out a reverse mortgage on the Key Largo property, and enhancing and preserving insularity (think self-sufficiency) on the Lake Gogebic property (such as a back-up generator, cultivating a substantial garden, ammunition, etc.).

PEI offers another excellent example: Potato production and revenues have increase 900% in the past ten years, and, without a theory of value beneath these numbers, all looks well…Until you try to reconcile the fact that Bravo (the fungicide) applications have also increased accordingly and thus our cancer rates have increased 26% in the past four years. Utilizing a theory of value based on relative insularity would have avoided this problem in the first place. Perhaps most significantly, however, I have also demonstrate that insularity has been fostered and maintained on Mustique through privatization and strict land-use policies.

You may be wondering how this relates to the Swiss Franc. I will briefly outline this scenario without getting bogged down into detail (but I'm happy to elaborate if you'd like). In a nutshell, what I have been – and continue to be – concerned with are financial valuations plagued by (a) *The Problem of Induction* (such as value-at-risk models used by banks), (b) the ever-increasing stakes in globalization (which by definition result in a global loss of insularity), (c) derivatives (which Buffet appropriately referred to as financial weapons of mass destruction in his annual shareholders letter a few years back), (d) the U.S. sub-prime market (as I've previously mentioned), and (e) an error I discovered in the Black-Scholes formula last year. I won't trouble with the details on these points except for (e), which is especially noteworthy since the Black-Scholes formula is the most widely used pricing formula for financial instruments in the world.

As you may recall from my email above, Myron Scholes was one of the so-called Nobel geniuses who blew-up LTCM and nearly sent the US economy into a tailspin in 1998. He had also previously co-formulated this famous formula which bears his name. After studying the case of LTCM, I realized that both Merton and Scholes' errors were systematic, that they were deeply entrenched in the way that they thought and acted (they were guided by inductive inferences, efficient and random-walk market theories, and were blinded by hubris), and thus I began to wonder if they had committed other egregious errors which had not yet revealed themselves by blowing up so spectacularly: I found one. Although this may initially seem small and

insignificant, this is extraordinarily significant: The Black-Scholes formula is based on the assumption that Treasuries are 100% risk free, and although they are nearly risk-free, of course they are not 100% risk free, and this is extremely problematic, because nearly every financial instrument traded in the world today is based on this inherently false assumption. The implications of this error are monstrous.

Though Switzerland is not well-situated in terms of military power (the most significant source of insularity at the national level), it is, very briefly, it is an island within the EU, geographically insular (the Alps), environmentally insular (through agreements such as The Alpine Convention and general trend toward sustainable, organic agriculture), and generally protective of it's culture and environment (for example, the Swiss deploy many mechanisms to make themselves less globalized (such as discouraging trucking transport through Switzerland). And although they have a tradition of fiscal conservatism, UBS has certainly not demonstrated this recently. That's the basis of my reasoning in a nutshell – although I do not believe the CHF is the place to be for the long-haul, it offers a reasonable spot to park assets until the equity markets correct. I might also note one of Sir Karl Popper's observations from 1958:

> British democracy owes its emergence to a sense of pride and independence among the upper nobility… Swiss democracy resulted not from the pride, independence, and individualism of an upper nobility, but from the pride, independence, and individualism of mountain farmers.
>
> These completely different beginnings and traditions have led to quite different traditional institutions and quite different traditional systems of values.

One other thing that had kept me up a bit last night was the recollection of our last conversation on the telephone about the Swiss Franc – you had mentioned that a friend of yours there in Chicago (I can't remember his name, but if memory serves me well, I believe you mentioned that he owns the White Sox or Wrigley stadium—or perhaps even both), but in any case you noted that he was a seasoned currency trader and that, in contradistinction to my advice, he was advocating buying U.S. dollar. Needless to say, I was a bit worried about this thinking about how the markets might open for the US dollar this morning, and also thinking about the potential bias you're likely to receive from and individual like this: He has taken a considerable position, thus he will try to strengthen his own position by attempting to create positive feed-back loops. My point is that it is always critical to consider the potential bias from any and every potential source. The same certainly holds true with stock brokers, hedge fund managers, and financial advisers: remember, they're very heavily invested in their positions: they have other clients holding the same positions, they have equity in their funds and/or proprietary trading floors which may also hold these positions, etc. I also recall that a financial adviser had encouraged your to enter the market as a buyer post September 11. I imagine there will be similar calls today and, perhaps in the possible market collapse which may ensue on any given day this year. Remember, the market posted negative returns for 12 years following the crash of 1929. I would not be surprised to see the Swiss Franc at $2 and the DJIA will below 10,000 by this time next year (or the year after….again, no predictions).

And, since you're well aware that my personal investments do not extend beyond those whom I love and the considerable books on my shelves, my advice is relatively unbiased, motivated primarily to demonstrate that your investments in my upbringing and education have not gone to waste! But having said this, Dad, I have a proposition: If your financial advisers have offered as prudent advice as I have over the past year, then perhaps there is little value I have to bring to the table at this juncture. If there is one or two amongst them, however, who has demonstrated less insight and less prudence than I have, please consider taking some of that business away from them and placing it under my guidance: I have devised an interesting strategy for "buying insularity," and although this method will most likely not produce exciting annual returns, it is poised to produce increasingly large returns over the long run—and extraordinary – potentially lifesaving – returns in the event of economic collapse. I'm ready and able to manage as little as $50 M and comfortable enough to manage $5 MM.

I've also attached a copy of Swiss economist Bruno Frey's *Being Independent is a Great Thing: Subjective Evaluations of Self-Employment and Hierarchy*, check it out when you have time, I'm sure you'll agree, I believe you've led your life in accordance with its central thesis! Love, Matt

-------- *Original Message* --------
On Mon, 17 Mar 2008, at 06:51:25 -0300, Matt Funk wrote:

Human, I spent the night formulating a final plea for reason to my father – I suspect what I have written to him over the past three years has, alas, been quite indiscernible. Of course it would help if I were halfway literate—but I'm going to try one last time before shit hits the fan!…Call when you have time!

-------- *Original Message* --------
On Mon, 17 Mar 2008, at 12:04:10 -0300, Matt Funk wrote:

Hi Frieda…Could you please fax or email this correspondence and three attachments to Dad as soon as possible?

If he wants to give me a call I'll be home this evening. Thanks!

Good Morning Dad, I hope that this email finds you well, and I hope you have time to review it as soon as you receive it, as it may be of some use to you today. I was up most of the night thinking about this letter, and I regret that I have not taken the time to write it sooner.

You have given me extraordinary latitude and extraordinary opportunities to follow my intellectual curiosity, and I have at last fully distilled a rather significant and original discovery which may prove fruitful, insightful, and valuable to you. Whether I publish this insight or whether I become famous or ridiculed for it is quite irrelevant (for my theory may be rejected yet hold truth, or be widely accepted, implemented, then determined to be as ridiculous as Jevons' sunspot theory). What is important is that I share it with you, since I do believe I have uncovered a great truth, and this letter may indeed offer the seed of opportunity for you. My regret is that I have not progressed as quickly as I had intended, and, I fear that my discovery may be arriving a bit late. I don't know if you received my voice-mail from a few days back, but as you'll see in the paper today, but I was very sorry to learn that your friend Joe Lewis has not fared well with his investment in Bear Stearns (I reviewed the SEC filings: it appears he paid approximately $1.2 Billion USD – at an average share price of 107 – for his 8% stake, which Morgan acquired this morning for $2/share). I'm sure he has a few dollars to spare, but that must sting a bit.

I believe it is fair to state that we may be entering an extraordinary period of volatility, decline—but perhaps ultimately great opportunity for those with the guts to go short.

As you will recall, over the past year I sent four emails outlining a deep concern and theoretical discovery which I may now clarify, and I apologize that I was unable to fully articulate the nature of my concern at those emails, but I believe I am presently more able to communicate their relevance.

Please find my Universal Theory of Economic & Evolutionary Value attached herewith.

Also, perhaps you've read in the papers of the past few days that the Fed's bailout of Bear Stearns is the first such action since the great depression: this widely published fact is in fact an error – it is the first time the Fed has taken such an action since it bailed out near all the investment banks in 1998 after the fall of LTCM.

-------- *Original Message* --------
On Fri, 29 Aug 2008, at 22:36:09 -0300, Matt Funk wrote:

Hi Dad, Great visiting with you on your Birthday today, hope you're having a great time in Door county, it sounds great!

I can't wait to send along my Researchers into the Natural History of the Gaspe Peninsula (the area we were talking about tonight). This place is extraordinary! Marcy and I are headed back up for hiking, camping, and hopefully a day of fishing on Tuesday (through Friday)—there's also a chance Ben Funk will pass through in late September, and, if so, we'll try to get one more trip in to this magical spot. The wild salmon fishing is the best in North America. Hope we fish the Cascapaedia next summer!

As a side note, I've been meaning to mentions that, if you've followed my lead on the Swiss Franc for nearly the past three years: I think it's time to take profits and close-out long positions (and, for that matter, the same hold true for the Euro, Pound, and Canadian dollar—which dropped another 1% against the USD today). My valuation, by the way, is based upon on the pervasive global economic weaknesses which seem to be finally saturating economies world-wide. But, as you can see below, CHF has certainly enjoyed a good ride against the USD since I first recommended it in January of '06, and you might want to pass along this graph to your friend there in Chicago who thought I had it all wrong - I can't remember who this guy was, but I think he's a currency trader and part-owner of the Cubs and/or Wrigley Field (or at least he was!) – who is that guy?

But in any case, presently I still certainly wouldn't recommend going long in the USD (especially with Hurricane Gustav speeding up the Gulf, the announcement today of yet another failed U.S. bank, and more woes for Freddie Mac and Sallie Mae!). To me, the best investment opportunities may ultimately be in the 'relative insularity' of rangelands and/or game preserves, such as the private hunting and fishing clubs which control the wild Salmon stocks of the Gaspe peninsula or the Leap and George River Caribou herds (if you ever want to come up on a winter Caribou hunt, let me know, I'd love to go - I'd also still like to come up to Gogebic and hunt pheasant with you this fall.

In any case, be sure to read the research on Wild Salmon I mentioned tonight on the phone (attached herewith): the health implications are as serious as can be! Love, Matt

[Hi Frieda! If you're able to print out the article I've attached for Dad, I'd appreciate it, and it would be best printed in colour, as there are several charts which will not be distinguishable in B&W. Thanks!].

------- *Original Message* --------

On Tue, 16 Sep 2008 02:08:53 -0300, Matt Funk wrote:

Hey Dad, thought I'd follow-up my "don't let anyone talk you into going long in 'discounted' US equities voicemail" with a little more food for thought (I might also add that, if you're sitting on unrealized profit in Monsanto shares, now could be a good time to begin to average out!).

In any case, although many are well-aware that the Dow lost over 80% of it value from 1929 to 1932, few seem well versed in the fact that the Dow did not return to it's pre-crash 1929 level until 1952! Of course the classic error would be to try to draw some inductive inference about this time series - - that's not my point at all - - the point is yes, of course it is possible that that is not the dire direction we are heading (though you might recall my email from last December which suspected the Dow might retreat below 10,000 before 2008 is up - - and we still have a few months to go!), but the important point to take away from it is, as Sir Karl Popper would certainly want us to keep emblazoned upon our minds, is that it is also possible that it could be much worse!

Most importantly, however, please give me a call when you have your hunting schedule put together for October - I'm beginning to suspect our survival here in the great north may depend upon whipping my fishing and hunting skills into top-form ASAP! If you think the economy is bad in the States, it has essentially ceased to exist here on PEI!

On the other hand, however, I'm enjoying teaching very much and my first class is going well! Love, Matt.

----- *Original Message* -----

On Wed Sep 17 07:40:50 2008, Matt Funk wrote:

Human, I agree, the CDS problem is unwieldy (50 trillion?), but I fear the bigger problem – given increasing disorder and the poor economic fitness that bail-outs inherently breed – may be that eventually bail-outs becomes so unwieldy that it topples the whole house of cards; as the Kansas City Fed chief noted, we have no modus operandi in place for ascertaining where to draw the line (i.e. to bail, or not to bail). What happens if B of A needs a bailout? There's only so far we can go! I'm sure you probably read Buffet's thoughts on derivatives back in the 2002 report, but here are two highlights from page 13:

> I. The derivatives genie is now well out of the bottle, and these instruments will almost certainly multiply in variety and number until some event makes their toxicity clear. Knowledge of how dangerous they are has already permeated the electricity and gas businesses, in which the eruption of major troubles caused the use of derivatives to diminish dramatically. Elsewhere, however, the derivatives business continues to expand unchecked. Central banks and governments have so far found no effective way to control, or even monitor, the risks posed by these contracts.
>
> Charlie and I believe Berkshire should be a fortress of financial strength – for the sake of our owners, creditors, policyholders and employees. We try to be alert to any sort of megacatastrophe risk, and that posture may make us unduly apprehensive about the burgeoning quantities of long-term derivatives contracts and the massive amount of uncollateralized receivables that are growing alongside. In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal.
>
> II. Unless derivatives contracts are collateralized or guaranteed, their ultimate value also depends on the creditworthiness of the counterparties to them. In the meantime, though, before a contract is settled, the counterparties record profits and losses -often huge in amount- in their current earnings statements without so much as a penny changing hands. The range of derivatives contracts is limited only by the imagination of man (or sometimes, so it seems, madmen).

Or, as Dante lamented, *Lasciate ogne speranza, voi ch'intrate.*

----- *Original Message* -----
On Wed, Sep 17 03:05:46 2008, Matt Funk wrote:

Fed to Loan A.I.G. $85 Billion in Rescue!

Excuse me? I'd be curious to hear your take on this 'rescue' mission, but, 'NASA, we have a problem,' sums up mine. Did you have a chance to look at the Fed paper I sent you? (by Hoenig). If not, check it out ASAFP (thank God someone knows what the hell they're doing). That we're able to shape, direct, control, and return the economy to a state of 'order' is a fools game. I was under the impression that we had collected sufficient experimental data to conclude that socialism was a failure, that we must simply allow Natural Selection to work its wonders and for Life on Earth to evolve. If you'd still like me to take a look at that water deal, send it along. Matt.

-------- *Original Message* --------
On Thu, 02 Oct 2008, at 22:15:58 -0300, Matt Funk wrote:

Thanks for the Canadian real-estate market analysis, Human. Overall, I concur.

I've been struggling to illuminate one of Hayek's most central thesis for my father, but it seems I have been so utterly unsuccessful that I'm on the verge of giving up – the truth may be that it takes 50,000 pages of Popper, Hayek, Hume, Russell, Einstein, Smith, Mises, Menger, Newton, Feyman, Hawking, Darwin, Wallace, Mayr, Carlquist, Neumann, Morgenstern, Aumann, Selten, Maynard Smith, and Nash etc.!!!– and, alas, so it seems, no short cuts and, thus little possibility of distillation. I've found little evidence of anyone even grasping the true significance of The Problem of Induction, let alone the more complex theoretical developments I've constructed. In any case, if you have any suggestions, I'm all ears.

The thesis I was referring to, by the way, is:

> EVER SINCE THE BEGINNING OF MODERN SCIENCE, THE BEST MINDS HAVE recognized that 'the range of acknowledged ignorance will grow with the advance of science.' Unfortunately, the popular effect of this scientific advance has been a belief, seemingly shared by many scientists, that the range of our ignorance is steadily diminishing and that we can therefore aim at more comprehensive and deliberate control of all human activities. It is for this reason that those intoxicated by the advance of knowledge so often become the enemies of freedom.
>
> —F.A. von Hayek,*The Use of Knowledge in Society*, 1945

And as far as I know, perhaps the greatest, most irrefutable support for this conjecture was none other than the big bang:

> Disorder increases with time because we measure time in the direction in which disorder increases. You can't have a safer bet than that—Steven Hawking,*A Brief History of Time*

Any thoughts?

And wat's your take on NZ? I made a good call with AUD – did you go long?

-------- *Original Message* --------
On Tue, 07 Oct 2008, at 23:18:08-0300, Matt Funk wrote:

> *Debate as Ban on Short-Selling Ends: Did It Make Any Difference?*
>
> By LOUISE STORY…
>
> At the stroke of midnight on Wednesday, the short-sellers will return to Wall Street.
>
> The question is, what will they do when they get there?
>
> Nearly three weeks ago, regulators abruptly banned short sales of financial stocks to protect companies that had come under siege in the stock market. Short-sellers, critics said, had contributed to the declines by betting against the companies' shares. But once the ban expires Wednesday night, shorters — viewed as villains by some and heroes to others — will be free to ply their trade again,

And I can't wait!

Just another example of far we have gone off the path of a free-market economy? The entire Chicago School must be rolling in their graves (in light of the fact that the 'Chicago School' has passed into extinctions); I imagine the celebrated socialists-of-the-hour, those crafty "Mechanism Design Theory" snake-oil salesmen are busy "designing a bailout strategy".

I can't think of a better way to lose what little confidence is left out there – talk about a curve ball to the forehead of capitalism in the time of volatility!

I will not be surprised if shorters re-enter the market on the opening bell – the sub-10,000 DJIA could be a sub-9,000 DJIA in ein augenblick!!!

Hope you're having a good run with this Polya downward spiral, as an opportunity like this has only presented itself twice this century! Jump in with me and let's short it to dust! Matt.

PS: Let's look back on this bold prediction on this day next year (I've noted it in my calendar): Warren Buffet looks like he's sitting at the black-jack table with an acute case of gambler's ruin - I won't be surprised if goes long all the way down and fumbles decades of unprecedented gains in a few short years!

-------- *Original Message* --------
On Wed, 08 Oct 2008, at 00:27:05 -0300, Matt Funk wrote:

Perhaps this will put an end to the random walk theorists: In the end, all markets – credit, equity, currency, US, EU, emerging, and otherwise – are all correlated!

-------- *Original Message* --------
On Wed, 08 Oct 2008, at 13:30:43 -0300, Matt Funk wrote:

> *I love the smell of napalm in the morning. You know, one time we had a hill bombed, for 12 hours. When it was all over, I walked up. We didn't find one of 'em, not one… body. The smell, you know that gasoline smell, the whole hill smelled like victory.*

Rapidly spiralling into sub-9,000 territory, the unmistakable scent of napalm in the air.

The endless drone of how terrible the markets are performing is hilarious! They're only performing terribly for those foolish enough not to recognize a giant ten-year-old bubble when they see it – and not to make a fortune as it pops! Moreover, zero-sum games are neither 'terrible' nor 'great' they're neutral.
DJIA: 9,234.69
-212.42 (-2.25%)
Real-time: 12:28PM EDT

-------- *Original Message* --------
On Thu, 09 Oct 2008, at 17:44:10 -0300, Matt Funk wrote:

Yes, a great ride indeed, enjoy it while it lasts!
DJIA: 8,579.19
-678.91 (-7.33%)
Oct 9 - Close

-------- *Original Message* --------
On Thu, 16 Oct 2008, at 19:53:50 -0300, Matt Funk wrote:

Human, Looking around for another market full of hot – any thoughts? Although I don't have the guts to short CAD (too many commodities, no sub-prime market to speak of), I don't think I'd be long at this juncture – there is a very mistaken belief here that the shit that is hitting the fan is going to somehow merely splatter on the wall behind our northern neighbour, #1 trading partner, and, moreover, commodity supply (which we won't be digging into much for awhile): gas hit a 14 month low here today, and as I'm sure you noted, oil dropped below $70. Seems like oil is the only real game in town in this welfare state, and of course the nature of the welfare beast adds fuel to the fire in a down economy (and of course it's not helping that the U.S. has decided to initiate an eleventh-hour, ad hoc, 'Capitalism on the way up, Socialism on the way down' strategy, as our attempts to 'control' the situation (*i*) make it worse by (*ii*) disabling cultural evolution from doing what it is does best and most efficiently: eliminating weak institutions staffed with weak individuals with weak minds because, ceteris paribus, they had weak genes to begin with! The 'bailouts' are, in essence, an economic 'breeding' strategy which our great-grandfather – a plant and animal breeder – would have understood with much greater clarity than any economist alive!

Those who grasp this great truth stand to prosper and to thrive, but those who resist or ignore or misunderstand it, or, worse yet, those how attempt to 'design' and/or 'bail-out' the 'economy' will – in the long run – simply fail to survive. The problem, of course is that they may take us down with them!

-------- Original Message --------
On Tue, 03 Feb 2009, at 14:38:52 -0400, Matt Funk wrote:

Dad, I do not intend to create any undue panic, thus weigh my words here carefully, but as I am deeply concerned for family and friends, I am thus in the unenviable position of being, yet-again, the bearer of bad news. I know I need not repeat most of my concerns and outlook for the economy, but I've been reviewing risk factors in the light a refined derivation of my recent theoretical discovery, and in conjunction with the deepening deterioration of economic conditions, I'm writing with my very strongest sell-recommendation to date:

> LIQUIDATE GLOBAL EQUITIES, LIMIT EXPOSURE TO INDIVIDUAL BANK/S. Reallocation: Cash, Federally-backed Money Market, Treasuries, Bio-geo-politically diversified, International Rangeland and Wildlife Production Habitats (e.g. Hawaii, Canada, Argentina, United Kingdom, New Zealand). Strongly recommend expanding Texas Land holdings and/or acquiring rangelands west of the 100th meridian (excluding California). Furthermore, liquidate any holdings with exposure to the California markets. Hedges: Gold, RMB, AUD, and possibly a small mix of southern hemisphere currencies; consider liquidating urban real-estate holdings. Also, per our previous conversation, I have reconsidered my valuation of your extensive wine inventories, and thus recommend holding all vintages with shelf lives of 3 years+.

Given the severity of my recommendations, however, I want to issue a very important bit of disclosure, which is, of course that I may be wrong.

Well, I should clarify this point: I may be wrong on the short-to-mid-term horizon, but I am unquestionably right, theoretically speaking, and, moreover, I am absolutely right over the long-haul. Most importantly, however, ignore the advice of all investments advisers, friends, family members (including me), and listen to your intuition, but may I suggest may arguments may offer to help neutralize much previous advice from others – which I understand has been consistently and considerably different than mine. Whatever you do, however, don't listen to a word anyone says on television. I saw a few minutes of "Squawk Box" the other day and laughed my ass-off for so long I lost twenty pounds.

Remember what I was saying about the point Soros made last November regarding the 'internal' nature of the present economic phenomena (evolution doesn't see it as a 'crisis')?

Here's what he said:

> Thank you Mr. Chairman and members of the Committee.
>
> The salient feature of the current financial crisis is that it was not caused by some external shock like OPEC raising the price of oil or a particular country or financial institution defaulting. The crisis was generated by the financial system itself. This fact-that the defect was inherent in the system-contradicts the prevailing theory, which holds that financial markets tend toward equilibrium and that deviations from the equilibrium either occur in a random manner or are caused by some sudden external event to which markets have difficulty adjusting. The severity and amplitude of the crisis provides convincing evidence that there is something fundamentally wrong with this prevailing theory and with the approach to market regulation that has gone with it. To understand what has happened, and what should be done to avoid such a catastrophic crisis in the future, will require a new way of thinking about how markets work—
> *Statements of George Soros before the U.S. House of Representatives Committee on Oversight and Government Reform*, Nov. 2008.

Recall this email which I sent last September (the 2nd) with the Hoenig paper attached? Well, if you didn't have a chance to read it then, take a look at it now, as the clear and present danger he clearly outlined detailed – well before shit hit the fan – has, I suspect been thoroughly disregarded by the powers that be, because, instead, we've elected to allocate 'emergency funds' to fight an internal fire, which may thus make it impossible to 'put-out' a very real external fire.

A few things you mentioned over the holidays left me feeling a bit uneasy, and even though I had taken the 2 January 2009 USA Today over to your house when we visited before I headed back to PEI, it was so good to see you, I decided not to bring it up. But I've had the paper sitting here on my desk to bring to your attention at some point – the cover story of the Money section offered a 'half-truth' rarely discovered in news media (simple 'truths,' are, I suspect, impossible to find):

Stock market forecasts tend to be sunny, and 2009 is no exception. Wall Street gurus are again predicting gains.

But this year's bullish market call comes with an asterisk. Wary stock strategists, unsure how the worst financial crisis since the Great Depression will play out, are hedging their bets. Rather than just sharing an opinion about what they think is the most likely outcome for stocks in '09 outlook reports, some strategist are including worst-case and best-case market scenarios

that reflect lower-probability outcomes - but ones that can't be ruled out. [The simple truth here, for example, would recognize that probability theory is meaningless in this regard].

Welcome to the new world of uncertainty on Wall Street [Again, of course, this uncertainty has been with us for at least the past 4.6 billion years].

The truth, of course, is that projections have never carried any more certainty in the past than they do in the present I mention this because you had mentioned something to the effect that one of your friends thought 2009 would be a down year, but that 2010 would be up, and another friend, if I recall correctly, thought the rebound might occur in 2011. You had also mentioned that, when you were discussing equities with Aline, that she had remarked that "market's always rebound." Indeed, to this point, I spoke with Mom's portfolio manager (who, predictably, knew very close to nothing about her positions or allocations) at Indiana trust yesterday, he said the same thing. He even offered to email me all sorts of data in support this naive conjecture. Everyone in that business, everyone who's gone to business school, will invariably tell you the same thing. But the problem is this: The class of mathematics they were taught is of an insufficient class with which to understand the complexity of the extended economic order we know as life on earth. Probability theory, the theory upon which their analysis rests, informs them to discard the extremely rare, yet most significant data as 'outliers'. One such 'outlier,' for example, is the atypical data series which began in 1929: The equities market did not return to pre-crash levels until 1952 (This is from memory, but refer to Robert Shiller's *Irrational Exuberance*, which I gave to you several years ago. But, since that's the only time in U.S. history in which that phenomena has occurred, probability theory informs us to reject it as an 'outlier'.

I've also been a bit worried about an email we discussed briefly.

When I asked you if you had sold any shares on this news, you said you didn't because you had paid more for them. That concerned me because that's a tell-tale sign of being 'married to the position.' It's okay if you didn't/don't want to sell at $86, and it may be a good idea to have a target sell price in mind, but it's inherently dangerous to base sell-strategy upon target price alone, without a stop-loss limit in place.

MON traded a moment ago at $75.95, up ten cents from yesterday. I know you didn't ask for my opinion, but if I were you, I would take the loss and call it a day. I know their cash position is enviable, but their potential exposure to environmental-related liability appears limitless to me. One of the reasons I gave you Call Me Ted for Christmas was the great lesson Turner kindly offers on this difficult lesson:

> Realizing that my days of having a meaningful say a the company were over…, I decided to start liquidating some stock. In May I sold 10 million shares of AOL at about $18.50 a share. This netted me almost $190 million and while it was a relief to pay off most of my bank debt, it hurt to know that just a year earlier these same shares were trading closer to $50.
>
> The price kept falling as we headed into the summer and by early July it fell below $13. Then, just as things couldn't get any worse, The Washington Post ran a story describing accounting irregularities on the AOL side of the company.…
>
> It had been hard enough watching what I felt to be mismanagement of the company, but when I first heard of these allegations, my disappointment reached new levels. Throughout my career, I had run the company aggressively but I always demanded that we be honest. At Turner Broadcasting, we worked hard and overcame huge obstacles, but we always played by the rules.… To be associated now with a company accused of dishonest behaviours left me disappointed and angry.
>
> Meanwhile, over the past two and a half years my net worth had gone from nearly $10 billion down to about $2 billion. To put this in perspective, I lost nearly $8 billion in roughly thirty months. This means that, on average, my net worth dropped by about $67 million per week, or nearly $10 million per day, every day, for two and a half years. Losing that much money so quickly might have been a record, but it obviously wasn't the kind I was hoping to set.
>
> But what could I do about it?.…
>
> That August, with Time Warner stock back up above $16.00, I sold my final 7 million shares.

I might also add that, as I site here at my desk writing this email to you, 1000 shares of TWX crept across the wire at $9.50!

Perhaps the most significant obstacle to understanding economics is time, because, as Jared Diamond failed to grasp in his inherently flawed heap of intellectual trash (*Guns, Germs, and Steel*, of which, more to follow on another day), even 13,000 years is an utterly insufficient time series in which to grasp the most important lessons in the march of human history and our great Struggle for Life. Politicians and economists looking for answers in the time of the great depression might as well be searching

for clues in yesterday's paper—because looking back on the past one hundred years is meaningless

Markets don't always rebound. Currencies collapse, civilizations rise, civilizations fall.

But the good news is this: those currencies and civilizations have fallen, though many of their citizens did in fact perish, some survive. Better yet, survival is "non-random" by nature—life and death – over the long haul – is no accident. Moreover, we may be thankful that Military Power if the primary determinant insofar as economic survival is concerned (and thus, although the financial markets may not be the placed to be, American assets (rangelands) are the place to be. In military circles this phenomena is commonly understood as Power Projection but it remains almost completely unknown amongst many politicians, so-called 'social scientists,' and not even dimly perceived by the general populace.

Here's one more point to consider from Soros' testimony last November:

These unprecedented measures have begun to have an effect: interbank lending has resumed and the London Interbank Offered Rate (LIBOR) has improved. The financial crisis has showed signs of abating. But guaranteeing that the banks at the centre of the global financial system will not fail has precipitated a new crisis that caught the authorities unawares: countries at the periphery, whether in Eastern Europe, Asia, or Latin America, could not offer similarly credible guarantees, and financial capital started fleeing from the periphery to the centre. All currencies fell against the dollar and the yen, some of them precipitously. Commodity prices dropped like a stone and interest rates in emerging markets soared. So did premiums on insurance against credit default. Hedge funds and other leveraged investors suffered enormous losses, precipitating margin calls and forced selling that have also spread to markets at the centre (p 3).

Why did this "catch authorities unaware"?

Because these 'authorities' are generally unaware of the fact that economic power is not primary, but derivative. And this in part by design; this is an arena in which we have had extraordinary success of the past two centuries, but global media access and the internet have made and will continue to make the manufacture of consent more increasingly difficult as time marches on: The hand-shake of diplomacy and Machiavellian smile of foreign policy are carefully designed to mask this reality:

> Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war or the threat of war. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.
>
> Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it (Bertand Russell 1928).

I gave a positively disastrous International Development Week talk at UPEI yesterday afternoon, for example, to attendees who were simply unable to grasp and/or accept this powerful truth. After carefully illustrating the descriptive power and a few potential pitfalls associated with the utilization of islands as evolutionary and economics models, the event organizer, Dr Terence Frater, asked me to explain how the Resource Holding Power (RHP: a handy, game theoretical tool developed by John Maynard Smith) differed amongst nations which simply used 'economics' to maintain this power versus nations which wielded 'military might' to maintain RHP. But the problem, as Russell noted above, is not only are these two powers inseparable from one another, one is actually a derivative of the other – they are inseparable! I thoughtfully explained that I could not answer the question because it was built upon a this false assumption, and offered some illuminations which seemed to be entirely missed.

As Keynes remarked a few years back, the earth heaves and no one but is aware of the rumblings.

On the Problem of the Hedgeless Hedgefunds of Sleepy Hollow: An Evolutionary Stable Solution in an Open Letter to Kenneth Griffin

Funk, Matt
The University of Prince Edward Island

01. April 2009

On the Problem of the Hedgeless Hedgefunds of Sleepy Hollow:

An Evolutionary Stable Solution in an Open Letter to Kenneth Griffin.

CC: Avy Stein
BCC: Jason Funk

Part I: 31 December 2007

Part II: 15 Feb 2009

Part III 1 April 2009

1 April 2009

Matt Funk, FLS
Department of Island Studies
The University of Prince Edward Island
matt@funkisland.org

Eppur si muove

ABSTRACT

This discourse explores and illuminates a fundamental problem, the Achilles' heel, which dominates the hedgefund industry: namely, that hedgefunds no are not positioned to accomplish what they were designed to do: namely, *hedge* against catastrophic loss in the financial markets. Contemporary fund strategies where built upon random-walk, efficient market theories which are now well-known to be false, thus our present dilemma. This discourse tables the *Evolutionary Stable* Strategy, for prospective hedgefund investors which, essentially, follows the dominant strategy outlined by Smith in 1776. Our discourse also highlights the dimly recognized difference between *internal* and *external* financial shocks, as well as several key points regarding economic methodology.

Attn: Kenneth Griffin 31 December 2007
Citadel Investment Group, L.L.C.
131 S. Dearborn Street, 32nd Floor
Chicago, Illinois 60603

Dear Mr. Griffin:

For the decade I have been working with Karl Popper's solution to David Hume's *Problem of Induction* [1] in order to derive an evolutionary stable solution to *The Problem of Sustainable Economic Development*.

At last I have indeed have derived a tenable solution, and, in the process, uncovered a class of undervalued assets.

As Stigler noted in his 1982 *Sveriges Riksbank Prize* lecture, meaningful economic analysis is not possible without a theory of value [2], and thus addressing this fundamental deficiency was an essential prerequisite of my game theoretical solution, a unified theory of value which you may find enclosed herewith. This paper also details pre-theory desiderata and, furthermore, outlines quantitative and qualitative characteristics of my solution. I hope to complete a full, axiomatic description of this discovery by the spring.

My inquiry has included a rather thorough investigation of the case of *Long Term Capital Management*, and I have concluded that both financial and political institutions have, in general, not learned the LTCM lesson (nor the Amaranth lesson, for that matter), and, as time moves forward, [3] extraordinary financial shocks [4] become more probable (and more volatile, and more severe), due to the irreversible nature of an expanding universe and the human tendency to denigrate history and our inability to comprehend *The Problem of Induction*. One of the most critical lessons the case of LTCM has to offer is the clear illustration that markets—contrary to the random-walk and efficient market theories—are heavily interdependent, and thus a good number of so-called 'hedge funds' do not facilitate the purpose for which they are ostensibly designed.

After attempting (and, I suspect, failing) to explain the gravity of the sub-prime quagmire in a series of emails to my father over the past year, it occurred to me that my theory of value illuminates a path for a very unusual, yet in many regards, very traditional fund: A geographically diversified and insulated fund which may perform fair in up markets, a bit better in down markets, but provide extraordinary returns, and, most importantly, potentially life-saving dividends and fringe benefits in the event of a 100-year economic storm.

Moreover, this *Relative Insularity Fund*, by nature of the theory of value upon which it is to be founded, would perform increasingly well over the long haul.

I am looking for a firm interested in exploring this prospect with me, as I find both Citadel and the city of Chicago very appealing. It seems to me that your endeavour to build a very independent firm has, perhaps, ultimately set you apart from the pack. Although I am not seeking full-time employment, I would consider any opportunity. I will be here in Chicago until 5 January, and will call your office on Thursday to see if you are interested in meeting to discuss this opportunity. You may reach me at the Union League Club (312-427-7800 or mfunk@upei.ca). If you are unable to meet this week, next month I will return to the U.S. to conduct field research on Key Largo (and will be staying at The Ocean Reef Club). If by chance you will pass through Miami, perhaps we could discuss this opportunity over a round of golf or an afternoon of fishing? In any case, please find my CV and the above-noted paper enclosed herewith. I hope to meet with you soon.

Naturae Discere Mores…Matt Funk

Enclosures: (1) *Cirriculum Vitae,* (2) *On the Problem of the Hedgeless Hedgefunds of Sleepy Hollow: An Evolutionary Stable Solution in an Open Letter to Kenneth Griffin.*

NOTES

1. (a) Our foregoing method of reasoning will easily convince us, that there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience—*David Hume, A Treatise of Human Nature, 1739, Book I,Vol I*

   (b) It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. I am afraid that even today many people still do not fully understand this….

   The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today. But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory. The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge—Sir Karl Popper, *In Search of a Better World,* 1992.

   (c) Hume has permanently influenced the development of the best of philosophers who came after him. Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing—Albert Einstein, *Ideas and Opinions*, 1956.

2. In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories—George G. Stigler, *The Process and Progress of Economics*, 1982.

3. Ever since the beginning of modern science, the best minds have recognized that 'the range of acknowledged ignorance will grow with the advance of science.' Unfortunately, the popular effect of this scientific advance has been a belief, seemingly shared by many scientists, that the range of our ignorance is steadily diminishing and that we can therefore aim at more comprehensive and deliberate control of all human activities. It is for this reason that those intoxicated by the advance of knowledge so often become the enemies of freedom… The growth of our knowledge of nature constantly discloses new realms of ignorance… The more men know, the smaller the share of all that knowledge becomes that any one mind can absorb. The more civilized we become, the more relatively ignorant must each individual be of the facts on which the working of his civilization depends—F.A. on Hayek, *The Use of Knowledge in Society*, 1945.

4. Since the time of Cournot it has been well understood that probability theory has no rightful place in economics, and when I refer to an 'extraordinary financial shock' I am referring to events which those whom have failed to grasp the significance of Cournot's insight commonly refer to as eight, nine, or ten-sigma events (last August Goldman's CFO was even foolish enough to state "We are seeing things that were 25-standard deviation events, several days in a row"). In any case, when I refer to an 'extraordinary financial shock' I mean, essentially, a 100–year economic storm, such as the Great Depression or unimaginably worse (i.e. unlike anything *H. sapiens* have encountered for thousands of years).

-------- Original Message --------
Subject: RE: Relative Insularity
Date: Sun, 15 Feb 2009 17:44:39 -0400
From: Matt Funk <matt@funkisland.org>
To: Avy Stein <astein@willisstein.com>

Dear Avy….I'd like to offer a very belated thank you. Many years ago you were kind and gracious enough to meet with me when I knew nothing and had even less to offer, and although I may now know merely next-to-nothing,[1] I have made a few discoveries which may be of interest to you.

As I was writing an overdue follow-up email to Ken Griffin (on the following page) a few moments ago, it occurred to me that you might appreciate a copy of my most recent findings as well. If you'd like the second or third instalments of the paper attached herewith, I'll be happy to send them along.

And although you may recognize that I am searching for a good opportunity to apply my theoretical findings, in consideration of the portfolio holdings listed on your website, I don't think I'd be much use to you, as my focus is squarely upon rangeland production systems and insular economic development.

If you develop interests in this class of investments in the future, however, please keep me in mind. For example, I've looked closely at *Tehon Ranch* (TRC), and it seems likely that their present strategy may run them into the ground (with or without an economic recovery) in due course, and, based upon my findings, it seems considerable value could be achieved by charting a course opposite from their present heading. I also see considerable unrealized value in the privately held *Molokai Ranch* (which is for sale), and *Parker Ranch* (where significant rangeland holdings are also for sale). Hawai'i does presently present a significant stochastic risk element (an active volcano), but this, in conjuncture with the present economic climate, has exerted and may continue exert excess downward price pressure on these rangeland holdings. It is also less commonly known that the type of volcanism on Hawai'i is much less problematic than the class of volcanoes in Alaska, for example, or, perhaps most notably, the Yellowstone Caldera. Otherwise, more generally speaking, I'm interested in helping someone pursue what I believe is the most evolutionary stable economic strategy in play in the United States: Ted Turner's vertically integrated strategy for his 2MM+ acres of rangelands, wildlife and large ungulate (*Bison bison*) production systems, and Ted's Montana Grills (If you haven't read *Call Me Ted*, I highly recommend it). Ideally, I'd like to go to work for Turner, as I am aware of several unrealized strategies which I'm well-positioned to help readily deploy (with no further capital outlays). CRESY (in Argentina) also interests me, but I have not had the opportunity to look closely at their operations. And as my research has focused squarely upon the privatization of islands, if you should come across an opportunity in this arena, I may have some insight to offer regarding development strategy. St. Helena, for example, offers an enticing privatization opportunity, as there are presently less than 3,000 inhabitants, and it remains nearly as "wonderfully isolated" as it was when Alfred Russell Wallace called it so in his extraordinary 1881 *Island Life* (p. 498).

In any case, I hope all is well, and please accept this belated thanks!

Sincerely….Matt Funk

Enclosure: *Journal of Researches into the Natural History of Mustique: On the Extinction of Species by Means of Insularity Lost, And The Law which Regulates the Struggle for Life, Or, The Evolutionary Stable Solution to The Problem of Sustainable Economic Development*.

[1] [Do not] believe *anything* that I suggest! Please do not believe a word! I know that that is asking too much, as I will speak only the truth, as well as I can. But I warn you: I know *nothing*, or *almost nothing*. We all know nothing or almost nothing. I *conjecture* that that is a basic fact of life. We know nothing, we can only conjecture: we guess [all italics Popper's 1999, p 37].

-------- Original Message --------
Subject: RE: Relative Insularity
Date: Sun, 15 Feb 2009 16:16:24 -0400
From: Matt Funk
To: Kenneth Griffin
Bcc: Jason Funk

Dear Mr Griffin:

I was in Chicago last weekend for my son's 6th birthday party, and as I was staying at The Union League Club, I thought of you.

You may recall that on 31 December 2007, I delivered (I was, once again, staying around the corner at the ULC) a letter of introduction and a research discovery which suggested that we were on the verge of a global economic collapse, and that I had a solution, since I had in fact solved the most fundamental, open problem in economics. If you had the opportunity to review this material, you might also recall that I had developed an *Evolutionary Stable Strategy* which informed a theoretically unbeatable hedge against economic collapse. Your assistant kindly thanked me for the materials via email, but I apologize that I did not have the opportunity to thank her in return (so, if it's not too much trouble, please pass along my belated thanks). I also apologize that, due to the fact that my findings were in an early stage of development and yet unrefined, that I suspect that they were not coherent enough to garner your attention or warrant further consideration. Naturally, I'm also sorry that we did not have the opportunity to meet, and, furthermore, to employ my strategy.

But I did have the opportunity to present these findings in Finland last summer, and I have been refining and clarifying them ever since. I have also just completed a comprehensive working paper (enclosed herewith), and an exhaustive, (and, perhaps oddly entertaining) manuscript detailing the complex inter-dependencies which relate to this problem and my theoretical solution: *On the Problem of 'Bailing-out' the Economy: The Principles of Economics & Evolution for the Inhabitants of Small Islands, including the Small Island of Earth in an Open Letter to President Barack Obama*. Yes, a rather long title for an essentially long manuscript (1259 pages – if this solution could have been presented with a PowerPoint presentation or within the pages of a refereed journal article, it would have been done so long ago). In any case, however, since your web-site notes that you are working on "the most complex financial problems in the world," I thought I might merely remind you that I solved *the* most complex financial problem (not to mention a fundamental evolutionary problems relating to the very survival of the human species), and hand-delivered that solution to you more than a year ago.

Moreover, although some of my fears (sub-prime, CDS, etc.) have indeed come to pass, the most significant economic threats remain outstanding, and largely unrecognized. You may recall that, when Mr Soros offered his testimony when you were both in Washington last November, he began by noting that *the salient feature of the current financial crisis is that it was not caused by some external shock*.[2] As you may discover, my research, the threats I'm primarily concerned with, are "external." It is impossible to convey the gravity of the logical implications of these "external threats" in such a short letter, but, in the meantime, I submit that the economic "Bail-out Plan" that we have begun to deploy has the deleterious potential to compound the problem by creating far greater exposure to

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[2] Thank you Mr. Chairman and members of the Committee.

The salient feature of the current financial crisis is that it was not caused by some external shock like OPEC raising the price of oil or a particular country or financial institution defaulting. The crisis was generated by the financial system itself. This fact-that the defect was inherent in the system-contradicts the prevailing theory, which holds that financial markets tend toward equilibrium and that deviations from the equilibrium either occur in a random manner or are caused by some sudden external event to which markets have difficulty adjusting. The severity and amplitude of the crisis provides convincing evidence that there is something fundamentally wrong with this prevailing theory and with the approach to market regulation that has gone with it. To understand what has happened, and what should be done to avoid such a catastrophic crisis in the future, will require a new way of thinking about how markets work (Soros 2008).

these external risk factors.

In short, we've elected to allocate "emergency funds" to fight an *internal* fire, which may thus make it impossible to 'put-out' or 'bail-out' an *external* fire. I submit the only upside to this otherwise grim reality is this: Those who understand the nature of this evolutionary unstable strategy stand to profit by betting against it (as I have indeed been doing with favourable and readily demonstrable results).

I will also note that Warren Buffett's recent declarations that "U.S. equities presently represent a good value," are - despite his impressive track record (which is, of course, part of *The Problem of Induction*) - emphatically false. Neither Buffett nor anyone else is sufficiently equipped to say what 'represents' or 'does not represent' a good *value*, because, as Chicago's very own George G. Stigler noted in his excellent Rinksbank Prize lecture of 1982, economics does not have a theory of value. Once again, however, this is exactly the problem I have solved with my *Universal Theory of Value*.

And, to this point, you may also recall that my methods are rather unusual - that I do not believe in the inductive methods of contemporary economics, and that I utilize islands as economic models. Although it may be true that, as far as I know, I'm the only economist/naturalist utilizing such methods, I believe that many may be willing to consider that, perhaps Popper, Hayek, Soros, and Taleb are all right, that most of all of econometrics is utterly useless (or, more likely, as we've discovered far too many times to recount here – even dangerous), that as far as so-called social 'sciences' are concerned – probability theory causes far more harm than good.

You may also recall that I was conducting some research in the Florida Keys and that, in my letter dated 31 December 2007, I had invited you to be our guests at the Ocean Reef Club, to witness the value of relative insularity first-hand. Well, I'd like to extend a similar invitation to see my theoretical solution at work on Parker Ranch, on the big island of Hawai'i. I'll be conducting field research there for the next two weeks, so if you'd like to experience the power and practical utility of an evolutionary and economic theory of value based upon relative insularity, or discuss my findings and proposed hedge fund strategy, my wife and I are set-up in a cottage on the ranch, and we have two spare bedrooms. Alternatively, if you've been Mustique, then you may have already sufficiently sampled *The Law of Relative Insularity*, and thus, you may now readily grasp the significance and implications of my discovery. Also, you may gain some insights by viewing some photographic explorations of *The Law of Relative Insularity* posed at http://www.funkisland.org.

I've enclosed the first 23 pages of my *Journal of Researches into the Natural History of Mustique: On the Extinction of Species by Means of Insularity Lost, And The Law which Regulates the Struggle for Life, Or, The Evolutionary Stable Solution to The Problem of Sustainable Economic Development. An Open Letter & Proposal of Fellowship to The Linnean Society of London.* If you'd like to review the remainder of this paper, I will be happy to forward it upon request. You'll find my Hawai'i contact details on the second page of the attached paper.

My itinerary for the next three weeks is below, and although I do not have a trip planned to Chicago in the next two months, this could be arranged as well. But, again, please consider joining us for a few days in Hawai'i. Although Parker Ranch doesn't model my solution as well as The Mustique Co. (Parker Ranch is merely able to protect 5-6% of the big island through privatization, The Mustique Co. protects 100% of Mustique), it does share several primary characteristics (though the "value" of Parker's relative insularity remains largely unrealized), and, of course the Hawaiian islands offer much greater biogeographic and politico-economic insularity than St. Vincent and the Grenadines..

*Naturae Discere Mores…*Matt Funk

Feb 16: American 223, Depart Boston at 6:55 PM, Arrive Los Angeles at 10:25 PM, Seat 3E, Z Class
Feb 17: American 247, Depart Los Angeles at 5:15 PM, Arrive Kailua-Kona at 9:00 PM, Seat 3B, Z Class
Mar 05: American 246, Depart Kailua-Kona at 10:30 PM, Arrive Los Angeles at 5:35 AM, Seat 2E, Z Class
Mar 06: American 551, Depart Los Angeles at 8:00 AM, Arrive Dallas at 1:05 PM, Seat 3B, U Class

Mar 06: American 802, Depart Dallas at 2:40 PM, Arrive Montreal at 7:05 PM, Seat 4B, U Class

-------- *Original Message* --------
Subject: RE: Relative Insularity
Date: Mon, 16 Feb 2009 16:01:56 +0000
From: Jason Funk <jasonrfunk@googlemail.com>
To: Matt Funk <matt@funkisland.org>

Hi Matt,

Not in Hawaii, not going until end of March, but very much looking forward to it. Are you there now? That was a pretty bold message to Ken Griffin…

Wow, have you sent your findings to Clive Ganger, Thomas Schelling or Ed Phelps?

Good luck with your research!

Jason

-------- *Original Message* --------

Jason Funk 1 April 2009
Strathmore Capital LLP
102 Sydney Street
London SW3 6NJ, England

Dear Jason,

Thanks for your thoughtful reply, your support[3] and insights are always greatly appreciated. Sorry it's taken me awhile to get back to you; Based upon your note dated 16 February, I believe that you're presently enjoying the "wonderful isolation" of Kauai and Lanai (to borrow Wallace's excellent description of relative insularity), so I'll leave you to thoroughly enjoy your holiday and mail these prosaic considerations to you in London, for you to consider upon your return.

The three great problem solvers you had noted above all great ideas, thanks.

My findings may be rather compatible with Schelling's sense of realism, and they also highlight the evolutionary stability hegemon status affords, including, ironically, peaceful economic development (*si vis pacem, para bellum*). As for Phelps, I haven't followed his recent writings, but it seems to me that, in general, the initiatives at Columbia are as misguided as the sustainability agendas at most Universities.[4]

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[3] -------- *Original Message* --------
Subject: Re: Granger, Schelling, etc.
Date: Tue, 17 Feb 2009 10:27:27 +0000
From: Jason Funk <jasonrfunk@googlemail.com>
To: matt@funkisland.org
Hi Matt,
I'd be glad to read [the introduction to your *Journal of Researches into the Natural History of Mustique: On the Extinction of Species by Means of Insularity Lost, And The Law which Regulates the Struggle for Life, Or, The Evolutionary Stable Solution to The Problem of Sustainable Economic Development*] this weekend. Your passion for your subject is admirable….

[4] -------- *Original Message* --------
Subject: Greetings from Prince Edward Island
Date: Mon, 24 Dec 2007 23:34:48 -0400
From: Matt Funk <matt@upei.ca>
To: director@ei.columbia.edu
Greetings Professor Sachs….I am in search of a PhD program, and find many aspects of your programme enticing.
I have attached the *Abstract* and table of contents of a recent working paper, and, if you find it intriguing, I would like to send it

I was in contact with Granger during the winter of 2007, and he was in fact kind enough to review an abstract, while my theoretical framework was in its infancy. At the time, I was also attempting to illustrate the manner in which *The Problem of Induction* plagues the social sciences (the Kuhn-Popper debate, in particular)[5] and I had asked both he and Peter Doherty to kindly clarify their positions on this weighty manner:

> *-----Original Message-----*
> *From: Matt Funk*
> *To: Doherty, Peter <mfunk@upei.ca>*
> *Sent: Sun Oct 28 20:44:21 2007*
> *Subject: Thomas Kuhn & Karl Popper*
> Greetings Dr Doherty:
>
> I am questioning a conjecture that the rejection of Karl Popper's logic and methods, and the general acceptance (in a popular sense) of Thomas Kuhn's logic and methods have been detrimental to science, especially social sciences such as economics.
>
> Nearly a dozen Nobel Laureates have thanked Popper and acknowledged his great influence upon their work: most notably, of course, was Hayek's Nobel Lecture[6] and, perhaps the most notable example in your field may be revealed in Eccles' Nobel biography.[7]
>
> *-----Original Message-----*

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along with my CV.

Although I have no doubt your program may live up to many of the aspirations noted on *The Earth Institute at Columbia* website, for considerable reasons I detail in the findings I have noted above, I believe *The Problem of Sustainable Development* is ultimately insoluble within the inherent limitations of the so-called 'social sciences'. In fact, during a seminar at Stanford University in 1956, Sir Karl Popper suggested that 'subject matters' do not exist, and some of the most eminent scholars of our time have concurred with this strong conjecture, and the logical implications it freights.

Thus, in light of this problem, is an interdisciplinary Ph.D with the biology department (or another University) a possibility? I believe the solutions you seek are readily discoverable withing the syllogistic core of evolutionary theory, but without it, as Darwin noted in 1859, *H. sapiens' Struggle for Life* will remain "dimly seen or quite misunderstood."

If you are interested in reviewing my paper, please let me know and I will send it along. *Naturae Discere Mores*…Matt Funk

[5] (a) The Kuhn-Popper debate, strictly speaking, refers to an encounter that took place at the former Bedford College, University of London on 13 July 1965, as part of the International Colloquium in the Philosophy of Science. It was designed to pit a relatively young theorist of science (Kuhn, aged 43) whose 1962 book, *The Structure of Scientific Revolutions*, was touted as the latest word from the Unite States, against a relatively old theorist of science (Popper, aged 63) whose seminal book, *The Logic of Scientific Discovery*, had been translated into English on in 1959, a quarter-century after it first appeared in German (Fuller 2003, p10).
(b) This brings me to the… source of the debate's continuing significance. Kuhn and Popper tapped into long-simmering, deep-rooted disagreements that went well beyond the pages of their major works on science…. Sometimes behind such scholastic fodder that frames philosophical debate lie opponents who are not so different from each other after all…. But sometimes the stereotype, for all its crudeness, *does* capture differences in sensibility that become deeper the more one looks. This is certainly the case with Popper and Kuhn (Ibid, pp14-15).
(c) The clash between Popper and Kuhn is not about a mere technical point in epistemology. It concerns our central intellectual values, and has implications not only for theoretical physics but also for the underdeveloped social sciences and… moral and political philosophy (Lakatos 1978, v 1, p 9).

[6] *If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments.We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass* [italics mine, Hayek 1974a].

[7] The New Zealand interlude was… notable because there Eccles met the philosopher, Karl Popper, from whom he learnt the relationship of the scientist to hypotheses; how to be daring in developing hypotheses of the greatest generality, and at the same time how to test them with the utmost rigour with the consequence either of falsification in whole or in part, or at best corroboration; but never confirmation. *He feels that this relationship to hypotheses has not only increased his conceptual power, but has also greatly helped emotionally! He can now rejoice even in the falsification of a cherished theory, because even this is a scientific success* [italics mine Nobel 1963].

From: Doherty, Peter <pcd@unimelb.edu.au>
To: Matt Funk <mfunk@upei.ca>
Date: 10/28/07 11:58 pm
Subject: Re:Thomas Kuhn &Karl Popper

A long time since I've read either. Popper's views re falsification of a null hypothesis seem correct to me. Much of the world's worst science is done by people who are determined to prove a point.

Kuhn's idea of the paradigm shift is spot on.

Peter C. Doherty,
Department of Immunology,
St Jude Children's Research Hospital

You may have guessed that, like George Soros, Nassim Taleb, F.A. von Hayek, Einstein, Ernst Mayr, Alan Sokal,[8] and even Popper[9] himself, I disagree with Doherty's assertion that "Kuhn's idea of the paradigm shift is spot on," but we'll save that conversation for a rainy day. Next, I posed this question to Granger:

-----Original Message-----
Subject: Thomas Kuhn &Karl Popper
From: Matt Funk <mfunk@upei.ca>
Date: Sun, 28 Oct 2007 23:22:50 -0300
To: Clive Granger <cgranger@ucsd.edu>

Greetings Dr Granger…I am researching the conjecture that the rejection of Karl Popper's logic and methods, and the general acceptance (in a popular sense) of Thomas Kuhn's logic and methods have been detrimental to science, especially social sciences such as economics.

Nearly a dozen Nobel Laureates have thanked Popper and acknowledged his great influence upon their work: most notably, naturally, was his great friend and kindred spirit, F.A. von Hayek's Prize Lecture[10] (and of course Popper's influence may be easily distilled in Hayek's beautiful banquet speech as

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[8] My goal is to defend what one might call a scientific worldview -- defined broadly as a respect for evidence and logic, and for the incessant confrontation of theories with the real world; in short, for reasoned argument over wishful thinking, superstition and demagoguery. And my motives for trying to defend these old-fashioned ideas are basically political. I'm worried about trends in… [America]… -- particularly here in academia -- that at a minimum divert us from the task of formulating a progressive social critique, by leading smart and committed people into trendy but ultimately empty intellectual fashions, and that can in fact undermine the prospects for such a critique, by promoting subjectivist and relativist philosophies that in my view are inconsistent with producing a realistic analysis of society that we and our fellow citizens will find compelling (Sokal 1996).

[9] I uphold the ancient theory of truth… according to which truth is the agreement with the facts of what is being asserted. Kuhn's views on this fundamental question seem to me affected by relativism; more specifically, by some for of subjectivism and of elitism, as proposed for example by Polanyi. Kuhn seems to me also affected by Polanyi's fideism: the theory that a scientist *must* have faith in the theory he proposes (while I think that scientists--like Einstein in 1916 or Bohr in 1913--often realize that they are proposing conjectures that will, sooner or later, be superseded). There are many other such points of difference, of which perhaps the most important is my emphasis on objective rational criticism: I regard as characteristic of ancient and modern science the critical approach towards theories, from the point of view of whether they are true or false. Another important point seems to me that Kuhn does not seem to see the great importance of the many purely scientific revolutions that are *not* connected with *ideological* revolutions [all italics Popper's 1982, pp xxxi-xxxii].

[10] It is often difficult enough for the expert, and certainly in many instances impossible for the layman, to distinguish between legitimate and illegitimate claims advanced in the name of science…. If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass (Hayek 1974b).

well).

Peter Doherty is the only Laureate who acknowledged (in either a banquet speech or Nobel lecture) Kuhn's influence and, curiously, Doherty acknowledged both Popper and Kuhn ("I was influenced early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper and Thomas Kuhn").

Naturally, I was very intrigued by a comment in your lecture, and was hoping you might be willing to expand a bit on this topic; of course I'd also be curious to know if your if your position on Popper and/or Kuhn has changed since the receipt of your award.

I thank you very much for your time and consideration regarding this matter, as I am inclined to believe prospects for human existence hang in the balance to the ultimate answer to important questions relating to this debate.

Any words of wisdom you are able to offer would be greatly appreciated. A pot of fresh North Atlantic lobster will be prepared on a moment's notice if you should ever visit Prince Edward Island!
Sincerely…Matt Funk

Much to my chagrin, a UPEI IT glitch decimated my email-box, including two generous replies from Professor Granger, but, in a nutshell, he was very gracious, and, if I remember correctly, remarked, alas, that there was "no sign" of Popper's lasting influence in New Zealand. Granger also kindly reviewed an abstract of my early methodological development of 'island' economic models, and in fact related that, along these lines, he had once sought funding to conduct island-based economic analysis in the Falklands, but the funding was not forthcoming, and thus he abandoned this line of methodological development. The other curiosity, was that Granger was and apparently remains a visiting professor at the University of Canterbury in New Zealand at the time, and thus it was interesting to correspond with him about islands while he was within the cradle of New Zealand's relative insularity. Although I suspect he may not concur with many of my conjectures regarding probability theory, he may find my use of islands intriguing, and, perhaps even of some value.

I will follow-up with Professor Granger and keep you apprised of my progress or lack thereof.

And, in consideration for your patience with these critical, yet no doubt dry methodological issues, I'll offer a few poetic words of inspirational thanks for enduring this discursive letter:

Once upon a time, Michel de Montaigne's grandfather bought land at the top of a wooded hill in Bordeaux and built a yellow stone castle, which offered a fine measure of evolutionary stable insularity for a young scholar. There was a circular library on the third floor of a tower at one corner of the castle with three windows, a desk, a chair, and over a thousand volumes on five semicircular shelves. As Alain de Button related in his most excellent and highly recommended *The Consolations of Philosophy* (2000), Montaigne reminisced, "I spend most days of my life there, and most hours of each day," and this is where he concluded, in agreement with Popper, Hayek, Soros, Einstein, and Russell, that Socrates was "the wisest man that ever was." Montaigne's circular library also held a copy of Cicero's *Tusculan Disputations,* in which Cicero offers in words what I have merely glimpsed in lost dreams:

> There is no occupation so sweet as scholarship; scholarship is the means of making known to us, while still in this world, the infinity of matter, the immense grandeur of Nature, the heavens, the lands and the seas.

Naturae Discere Mores!

Thanks again, Jason!

Yours very truly…Matt

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On the Problem of Sustainable Economic Development: A Theoretical Solution to this Prisoner's Dilemma

Funk, Matt
The Linnean Society of London

01. June 2008

On the Problem of Sustainable Economic Development I:

The Funk-Zweikampf Solution to this Prisoner's Dilemma

Introducing a Unified Theory of Value for the Biological and Social Sciences
in an Open Letter to the
Åland International Institute of Comparative Island Studies[1]

> . . . will hold. There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness helping to make the situation truly non-cooperative.
>
> (John Nash, NON-COOPERATIVE GAMES, 1950)

For my Mother, my Father, my Son, & my Wife!

1 May 2008
v1.1, 8 June 2008

Matt Funk, *Naturalist*
Funk Island,[2] Vinland[3]
matt@funkisland.org

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1 AICIS… is an Åland based, international and *independent*, research institute which explores the economic and institutional aspects of insular entities - mainly from a comparative point of view. It operates, on a network basis, in close cooperation with other island institutes and academic institutions, as well as with a variety of economic and policy milieus, all over the world. AICIS…. is an independent foundation, set up by a number of leading Ålandic companies: Åland Mutual, Alandia Corporations, Bank of Åland, and Åland Investment Ltd. [italics mine AICIS 2008].

2 Funk Island…, 60 km east of Fogo Island off the northeast coast of Newfoundland, is home to more than one million common murres, numbers that make it the largest colony of common murre in the western North Atlantic….

As a seabird ecological reserve, Funk Island is now known for its ability to protect seabirds. This was not always the case. In previous centuries, Funk Island was one of the major nesting areas of the Great auk, and people came regularly to hunt the birds and take their eggs…. The Great auk—large, flightless birds—were eventually hunted to extinction.

This loss shows how human activity can result in the extermination of a wildlife species. Making Funk Island an ecological reserve has helped other seabird species recover from similar exploitation and near extirpation from the island….

At 5.2 km^2 (5 km^2 of which is the marine component), the reserve is the smallest seabird ecological reserve in Newfoundland and Labrador, but it's also one of the most important. To protect the nesting seabirds, only scientific research activities are allowed on the island [Italics mine, Newfoundland & Labrador 2008].

3 We had come to believe that 'Vinland' had never existed as a precise geographical location in North America. The name itself—'Vinland the Good'—carries too many overtones of romance and fable: fables of the Hesperides, of the Fortunate Isles… 'Vinland the Good' smacks much more of a wistful and wishful concept than of a geographical reality. *To the Norse explorers, Vinland was always somewhere beyond the next horizon—tantalizingly near, but always just out of reach* [italics mine, Magnússon 2003, pp 125-126].

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TOUCHSTONE[1]

Nothing is easier than to admit in words the truth of the universal S*truggle for Life*,[2] or more difficult—at least I have found it so—than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.

—Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life,* 1859

1 Every man carries about him a touchstone… to distinguish… truth from appearances [Locke 1706, as cited in Popper 1963, p 3].

2 Our objective here is not to come up with a ponderous definition of war, but rather to capture its essence: *Zweikampf, The Struggle for Life*. War is actually nothing but a series of struggles. It may be most helpful to think of the countless struggles that make up war as a single unit, to imagine two wrestlers locked in a hold, each s*truggling* to impose his will, to attack, to defend against counter-attack, to render his opponent incapable of further resistance, and, both generally and ultimately, to S*truggle for Life* [General Carl von Clauswitz, *Vom Kriege,* 1832. The author would like to thank Simone Stahel-Webster for her assistance with this English translation; naturally, any errors or omissions may be attributed singularly to the author.].

ABSTRACT

This paper offers a solution to *The Problem of Sustainable Economic Development,* and a universal theory of value.[1] We introduce axioms which serve as the first of two independent derivations of our solution, and note our axioms falsify the central thesis of *ecological economics*. We introduce our methods, the genesis and evolution of our theory, field notes from Mustique, Iceland, and Prince Edward Island, and set the stage for a more thorough discourse, of which this paper represents the first of three segments. We demonstrate that *value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$, then model economic development by dividing the world into geo-political islands: P_1: *Relatively Insular States* (RIS), and P_2: *Global Economic Military Superpowers* (GEMS). Our axioms deduce two dominant development strategies: S_1: *Maximum Economic Development,* and S_2: *Maximum Ecological Preservation*. We clarify this by applying our *Theory of Value* within geo-political contexts which reveal divergent, optimizing strategies for GEMS and RIS economic development. We discover pure GEMS (i.e. low I_R) and pure RIS (i.e. high I_R) strategies are antithetical, yet also discover these naturally opposing strategies represent the most tenable, rational solution-set possible. In light of the inherent and inescapable human and planetary uncertainties our axiom reveal, we discover the optimal RIS strategy = S_2 and GEMS = S_1. We note our solution represents the Prisoner's Dilemma. We also note, that, ceteris paribus, based upon revealed 20th and 21st century preferences, RIS strategy has been sub-optimal/irrational (S_1). Strategic Equilibrium/ESS[2] is attained when players pursue respective rational, opposing development strategies. Equilibrium, however, offers windfalls: surplus value is created (RIS-driven ecological preservation, and GEMS-driven *Global Security* and *Planetary Protection*). In essence, this non-cooperative, strategic equilibrium paves the way for rational, mutually beneficial, cooperative behaviour, and yields surplus ecological and planetary insularities, and thus surplus economic and biologic value: RIS cooperate, form coalitions, and struggle for greater *ecological insularity* (ecological preservation). At the same time, GEMS fight for economic development and *planetary insularity* (planetary preservation, i.e. financing national and global defence, extraterrestrial exploration, and searching for solutions to mission-critical, extra-planetary threats to human existence). Surplus value is maximized through strategic transparency: *If* all players recognize the value of respective, opposing, and antithetical, rational strategies, *then* all players negotiate more rationally, efficiently, and peacefully. We refer to our solution based upon two opposing, rational strategies as *The Funk-Zweikampf Solution*.[3] Moreover, we demonstrate our solution is as powerful at local and individual levels as it is at the national level, including its use as a tool for strategic decision-making under uncertainty and variable insularity. Furthermore, our *Theory of Value* illuminates an entrenched, systemic, strategic RIS error which reflects the false application of widely misunderstood economic principles, and fundamental constitutional defects[4] which promote *The Tragedy of the Commons.*[5] We detail the role of relative insularity, the principles of rational pure RIS development strategy, and cite Åland, Iceland, and Japan as ideal island models for RIS/GEMS mixed-strategies. Our theory also suggests that it is no coincidence that the island which best exhibits optimal pure RIS economic development strategy (S_2) is not a *democratic nation*, but rather the uniquely independent, autonomous, privately-controlled island of Mustique. All RIS, however, may optimize with our counter-intuitive solution through individual, regional, and state coalitions. Furthermore, our *Theory of Value* promotes self-organization, constitutional amendment, self-sufficiency, independence, and thus places stones along the illusive path to a tenable solution to *The Problem of Sustainable Development*.

1 See ABBREVIATIONS & DEFINITIONS: *Theory of Value*.

2 See ABBREVIATIONS & DEFINITIONS: *Equilibrium, Strategic Equilibrium, & Evolutionary Stable Strategy*

3 See ABBREVIATIONS & DEFINITIONS: *Funk-Zweikampf Solution*

4 Is there a greater tragedy imaginable than that, in our endeavour consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving? (Hayek 1944, p4).

5 Lloyd 1833, Hardin 1968.

Matt Funk – 46.3° N – 63.1° W

Åland International Institute of Comparative Island Studies 1 May 2008
Ålandsvägen 26
AX - 22 100 Mariehamn
ÅLAND

Dear Ålanders:

I love islands. But I do not love all islands equally, I do not love all islands unconditionally, and there are in fact countless islands which I don't even like, much less love.

I love the islands of the Stockholm archipelago, Amager, Zealand, the Faroe Islands, Île aux Coudres, St. Pierre & Miquelon, Newfoundland, Fogo, Anticosti Island, Mackinack Island, the islands of Wisconsin's Northern Highland District,[1] Chiloe, Lanai, St. John, St. Lucia, Necker, and Puerto Rico—but I am not so fond of Key West.

Yes, I love some islands, don't care for others, and many of the islands I do love are not typically considered islands,[2] such as the island-like Canadian province of Quebec, the U.S. state of Alaska, Patagonia, Gibraltar, the land-locked nations of Switzerland, Lichtenstein, Austria, and Andorra, the city of Vancouver, the pedestrian village of Zermatt, the Gaspé and Kamchatka peninsulas,[3] Great Slave Lake,[4] the Engadin and Coachella valleys, a mile-long stretch of undeveloped shoreline along Lake Gogebic, Yellowstone National Park, Katmai National Park, the Naknek River, Norway, the Himalayas, the Pacific basin,[5] and the Alpine Convention Region.[1]

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1 See Brock & Carpenter 2007.

2 See ABBREVIATIONS & DEFINITIONS: *Island*

3 Nobody knew until 1991 that the Kamchatka region possesses the highest concentration of brown bears in the world. One of the reasons it stayed a secret: A nearby Russian deep-water submarine base prevented entry anywhere near the area....

Some fisheries biologists believe that the Kamchatka Peninsula represents the birthplace of 70 percent of the world's salmon population (Kelly 2008, p 33).

4 Great Slave Lake is massive, the 10th largest lake in the world, and forms part of the headwaters of the Mackenzie River. It lies smack in the middle of Canada's boreal forest, a 1.4 billion-acre swath of woods and waters that mantles northern America like a green crown, from Newfoundland all the way to the Yukon. *"The boreal," as it is known, is one of the planet's last healthy and whole landscapes. It holds a quarter of the planet's intact forests and freshwater resources* [italics mine, Nickens 2008, p 83].

5 Many thousands of islands, totally more than one million square miles of land area, are strewn over the third of the earth's surface that comprises the Pacific basin. In no other ocean has it been easier for a bit of land to be entirely surrounded by water to become an island....

Any consideration of Pacific islands must begin with the immensity of the water area that surrounds them, the largest single earth feature, whose area is greater than all the land above sea level on the face of the globe (Thomas 1963, p 7).

Some of my favourite islands happen to be islands within islands, such as Lyford Cay, The Ocean Reef Club, the National Park on the north shore of Prince Edward Island—and the three cottages tucked within the borders of this national park on Hummingbird Lane—and thus, essentially, three islands within an island on an island!

But at the pinnacle, above all others, there is a very special class of islands which I love the most: Iceland, Greenland, Catalina Island, Vancouver Island, Skorpios, a few small islands in Lake Zurich, many Micronesian islands, Unalaska, Kodiak Island, Baffin Island, Victoria Island, the Queen Elisabeth Islands, the equally noble Elisabeth Islands, Mago, Molokai, Niihau, the big island of Hawaii, the diminutive Entry Island, Tasmania, the Cook Islands, Niue, Forsythe Island, the south island of New Zealand, the entire island nation of Japan, the British Isles, the Azores,[2] San Marino, the Moonsund archipelago, Mustique, Lofoten, Gotland,[3] the Koster islands, Fårö, Ljusterö, Ekerö, Orust, and each and every one of the six thousand five hundred independent[4] Åland Islands. [5]

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1 AWARE that the Alps are one of the largest continuous unspoilt natural areas in Europe, which, with their outstanding unique and diverse natural habitat, culture and history, constitute an economic, cultural, recreational and living environment in the heart of Europe, shared by numerous peoples and countries, RECOGNIZING that the Alps constitute the living and economic environment for the indigenous population and are also vitally important for extra-Alpine regions, being the site of important transport routes, for example, RECOGNIZING the fact that the Alps constitute an essential habitat and last refuge for many endangered species of plants and animals AWARE of the substantial differences existing between national legal systems, natural conditions, population distribution, agriculture and forestry, the state and development of the economy, the volume of traffic and the nature and intensity of tourism, AWARE that the evergrowing pressures caused by man are increasingly threatening the Alpine region and its ecological functions, and that the damage is either irreparable or rectifiable only with great effort, at considerable cost and, as a rule, over a long period of time, CONVINCED of the need for economic interests to be reconciled with ecological requirements (Alpine Conference Ministers, 1989).

2 "Not a beach destination or otherwise susceptible to mass tourism; indeed, its capricious climate probably impedes the flow of tourists. The islands' green volcanic mountains and picturesque black-and-white towns look set to remain unspoiled."

"Wonderful place. Built environment in good shape. Locals are very sophisticated as most have lived overseas."

"Remote and temperate, the Azores remain lightly touristed.... The ecosystem—from the beautiful hydrangea-covered hills of Flores to the rock-bottomed bays of Terceira—is in great shape" (Tourtellot 2008).

3 Throughout the Viking Age, one historic island can claim to have been the true centre of the Viking world – the Baltic island of Gotland, off the east coast of Sweden. Although it is now a province of Sweden, it has always prided itself on its independence of view and action (Magnússon 1980, p 91).

4 (a) Åland... is an unsuspecting place, a small province of neighbouring Finland. Home to 26,000 Swedish-speaking islanders, the island functions uniquely as an autonomous, self-governing, demilitarized region....

'I don't define myself as Finnish or Swedish,' smiles Susanne Eriksson.... 'I am an Ålander' (Steen 2008, p1).

(b) Åland functions... similar to an independent state with its own legislation and administration. Its health statistics are good. The average life expectancy is 2–3 years higher than in the rest of Finland. For women it is the highest in the Nordic countries... In 2003, the [per capita GDP] was €34 193 (£22 556, US$44 423), the highest in the Nordic countries (Eriksson et. al. 2007, p 684).

5 The Åland Islands (60°00' to 60°30'N, 19°30' to 20°30'E)... [are] situated on the SW coast of Finland in the northern Baltic Sea.... 6500 islands... forming a pattern of zonation ranging from inner sheltered bays to open sea areas. Average water depth is 20 to 25 m, with a shoreline of over 8000 km, emphasising [sic.] the importance of littoral, nearshore shallow areas for the functioning of the ecosystem.... The sea is non-tidal but influenced by strong seasonality in hydrography (Perus & Bonsdorff 2004, p 46).

And so I thank you for the opportunity to present this paper and my forthcoming seminar at your second annual conference, *Islands of Competence – Branding Identities in a Globalized World*. It will be a great privilege and honour to visit Åland and the Baltic Sea, which, do date, I have only been able to admire from afar.

Why do I love Åland?

Why do I love some islands and dislike others?

This is the story I would like to share with you.

It is the story of a small, wind-swept, desert island tucked in the far windward corner of the lesser Antilles, a story which began on a small, troubled island in the cold waters of the North Atlantic, sailed the Gulf Stream north to an island named Ísland, a story which, in turn, began long ago, on a small rural island in the vast green sea of the great American cornbelt.

In his 2001 *Sveriges Riksbank Prize* Lecture, Joseph Stiglitz recollected that

> when I began the study of economics some forty one years ago, I was struck by the incongruity between the models that I was taught and the world that I had seen growing up, in Gary, Indiana, a city whose rise and fall paralleled the rise and fall of the industrial economy. Founded in 1906 by U.S. Steel, and named after its Chairman of the Board, by the end of the century it had declined to but a shadow of its former self. But even in its heyday, it was marred by poverty, periodic unemployment, and massive racial discrimination. Yet the theories that we were taught paid little attention to poverty, said that all markets cleared—including the labour market, so unemployment must be nothing more than a phantasm, and that the profit motive ensured that there could not be economic discrimination. If the central theorems that argued that the economy was Pareto efficient—that, in some sense, we were living in the best of all possible worlds—were true, *it seemed to me that we should be striving to create a different world.*[1]

In his *Sveriges Riksbank Prize* autobiography, Stiglitz elaborated on this theme, adding that

> growing up in Gary Indiana gave me, I think, a distinct advantage over many of my classmates who had grown up in affluent suburbs. They could read articles that argued that in competitive equilibrium, there could not be discrimination, so long as there are some non-discriminatory individuals or firms, since it would pay any such firm to hire the lower wage discriminated-against individuals, and take them seriously. I *knew* that discrimination existed, even though there were many individuals who were not prejudiced. To me, the *theorem* simply proved that one or more of the assumptions that went into the theory was wrong; my task, as a theorist, was to figure out which assumptions were the critical ones.[2]

1 Italics mine, p 473.

2 Italics Stiglitz's 2001.

Although I grew up in a small farm-town in the vast sea of the great American cornbelt, 41 miles due south of Gary on U.S. Highway 41, my Indiana was not nearly as instructional as Stiglitz's Indiana. But I have come to believe that islands, especially small islands with big problems, may offer even more distinct advantages than those offered by in Gary, Indiana.[1] I have come to believe there are distinct advantages of being an "outsider"[2] as well.

As fellow islanders, I imagine you are all well aware that islands are lighthouses—beacons far brighter, far more representative, and far more descriptive than mathematical models.[3] Although our island-based approach to economics employs a few mathematical tools, more often than not our approach to mathematics is in the *opposite direction*[4] commonly utilized in "continental" economic analysis.

Darwin's powerful and effective *island-based analysis* enabled us to break through *attendant myths*[5] and illusions and grasp global complexity and uncertainty that was beyond our reach. And "although it is often said that his *Origin*

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1 Islands are synecdoches: their understanding facilitates a 'coming to grips' with a more complex whole. They also act as advance indicators or extreme reproductions of what is future elsewhere. Crucial, new insights into evolutionary theory, and the realization of so much species differentiation on islands in modern zoogeography, are primarily due to the unwitting and haphazard stumbling of what, at first sight, may have appeared to be inconsequential, island-based, island-specific fieldwork. This includes such investigations as the study of Darwin's finches on the Galapagos Islands (Darwin 1859…) or Alfred Wallace's study of birds-of-paradise on the Aru Islands (Wallace, 1880)… The forays of Bronislaw Malinowski amongst the Trobriand (or Kiriwina) Islanders of Papua New Guinea (1922), Margaret Mead to Samoa and the Admiralty Islands (1928; 1934) and Raymond Firth to Tikopia (1936) led to the birth of ethnography (Baldacchino 2007b, p 9).

2 *It is often outsiders who see a problem first.* This may be because an inventor is rightly keen to have his invention applied, and may therefore overlook its possibly undesirable consequences. Thus, certain chemical inventions proved very successful against mosquitoes and other insects, but with the undesirable result that songbirds died of starvation. The American naturalist Rachel Carson reported all this in her excellent book *Silent Spring* (Popper 1999, p 101).

3 (a) Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds (Maxwell 1873, p 400).

(b) Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up (Hayek 1945, pp 519-530).

4 Mathematics is a study which, when we start from its most familiar portions, may be pursued in either of two opposite directions. The more familiar direction is constructive, towards gradually increasing complexity : from integers to fractions, real numbers, complex numbers ; from addition and multiplication to differentiation and integration, and on to higher mathematics. The other direction, which is less familiar, proceeds, by analysing, to greater and greater abstractness and logical simplicity ; instead of asking what can be defined and deduced from what is assumed to begin with, we ask instead what more general ideas and principles can be found, in terms of which what was our starting-point can be defined or deduced (Russell 1919, pp1-2).

5 See ABBREVIATIONS & DEFINITIONS: *Myths*

convinced people of evolution because it provided an easily-understood mechanism (natural selection) for evolution, the deluge of articles and books published in 1909, 50 years after the origin, show clearly that *it was principally the facts of geographical distribution that had convinced the majority*."[1]

In other words, Darwin was able to *describe a very large complex, semi-closed system* (earth) by modelling it with *much smaller, simplified, semi-closed systems* (islands).[2] Island processes are amplified through compression[3] and thus, relative to continents, exhibit explosive rates of evolution.[4] Thus, islands enable us to yield insights which often elude practitioners of the continental approach.

~~*Island Bioeconomics*~~ *Problem Solving,* our solid *physique générale* foundation for economic analysis, supports a useful field instrument: a tripod made up of (1) Evolutionary Game Theory,[5] (2) a theory of value based upon relative insularity,[6] and (3) Sir Karl Popper's solution to *The Problem of Induction*.

Although time will presently not enable us to scratch the surface of most of the beloved islands noted above, we will cover specific aspects relating to several, and, moreover three fundamental qualities which relate to them all: (1) The inhabitants of these islands have demonstrated exceptional preferences for relative insularity, (2) they have maintained these preferences through fierce independence and relative autonomy, and (3) these islands are thus relatively *valuable*.

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1 Italics mine, Baldacchino 2007, p 202.

2 Compared with continents… [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range… their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (Wallace 1880, pp 241-242).

3 It appears almost all ecological and evolutionary processes…are amplified on islands; generally speaking, the smaller the island, the more amplified these processes are. Small size and low diversity seem to be the main factors. With populations existing in miniature, they are prone to stochastic, or random, processes.… Such a mosaic of habitats in a tiny area promotes evolutionary radiation. Conversely, the small size of islands means that they are exquisitely vulnerable to biological invasion and disturbance as there are few distance barriers to dispersal, and few areas are immune to disturbance by inaccessibility. On the plus side, 'amplification by compression' makes islands particularly useful…on islands, process that may be subtle on continents tend to be more clearly exposed (Baldacchino 2007b, p 193).

4 Carlquist 1974, p 20.

5 See ABBREVIATIONS & DEFINITIONS: *Evolutionary Game Theory*

6 See ABBREVIATIONS & DEFINITIONS: *Funk-Zweikampf Solution*

As noted in my previous correspondence, the title of my seminar is *On the Problem of Connectivity: Branding Insularity*, and I am especially keen for this discussion for a myriad of reasons, including the fact that two of my four favourite boats happen to represent two strong global brands which have deep cultural, maritime, evolutionary, and, most importantly, *insular* connections to Åland: the Hallberg-Rassy 54[1] and another German Frers design, the Swan Club 42.[2] In fact, briefly considering these brands may help us navigate two challenging, deep-water currents which run the course of this paper.

The Hallberg-Rassy 54 review in the current issue of *Premier Cruising Boats of the World* captures the essence of this brand exquisitely:

> Over the last few years something big has started to happen every August on the *remote isle* of Orust off the west coast of Sweden. Cruising sailors and yachtsmen from all over Europe and North America congregate for the weekend in a celebration of fine yachts and raise their glasses to the pleasures of owning and cruising some of the best yachts built anywhere in the world. It is a kind of *old fashioned* happening where you will see *more blue blazers in the crowd than tie-dyed T-shirts* because the sailors who come are there to look at, admire and possibly buy a Hallberg-Rassy. The happening takes place in the Hallberg-Rassy marina and boat building facility in the *small town* of Ellös, which is a good hour's drive north of Gothenburg. It all started years ago as a simple open house at which the boat builder entertained its customers, vendors and friends. But such is the HR *mystique*, and the worldwide attention that soon followed, that the simple open house became a boat show that then grew into the happening it is today.
>
> In a smart, egalitarian gesture, HR invites its competitors to show their boats at the weekend event, making this one of the best boat shows in Scandinavia. Over that weekend in August roughly 24,000 sailors attend the event, which is almost equivalent to the number of people who attend the America's largest sailboat show in Annapolis, Maryland, each October.[3]

Although there are several branding elements at play here, the most significant – *leveraging insularity* – is an element I suppose you all know well, since I came to understand this principle through a lecture given by Bjarne Lindström, and thus began to see how Åland has leveraged insularity, by capitalizing upon your strategic maritime position between Sweden and Finland, two regions with significantly lower levels of relative insularity, yet more insulated from one another than to Åland.

Before moving on to the beautiful Swan, however, we should take a few moments to consider *cultural*

1 See: www.hallberg-rassy.com

2 See: www.nautorgroup.com

3 All italics mine, 2008, pp 14-15.

evolution, as this problem is central the entire discourse. The second paper in this three-part series explores the benefit of an *evolutionary world view*, which, to some, may seem rather unnecessary, nearly 150 years after Darwin's *Origin*. Unfortunately, however, the emphasis seems necessary. In 2004, sixty percent[1] of Americans *still* did not believe in evolution, but the worst part of it is, that I suspect the *majority* of the forty percent of people who *do* believe in evolution may still be unable to adopt an evolutionary world,[2] as the strangle-hold religion and culture continues to impose upon *social norms* seems nearly inescapable. And of course many have a firm grasp on evolution when it comes to many of the species inhabiting the Earth, the great majority seem to be unable to recognize these mechanisms when it comes to humans. Indeed, the general failure to grasp the relevance of evolution, especially *cultural evolution* is a key concept in our discourse, and the Dragonfly offers a portal to this problem. Although Quorning's Dragonfly 35 isn't manufactured by a well-recognized, global brand, this award-winning, Danish, island made, Skíðblaðnir[3] shares the same Nordic pedigree as the Hallberg-Rassy and the Swan.

For comparison's sake, let's go back and take a look at what I suspect you may agree is a handsome[4] HR 54:

1 Americans are certainly capable of belief, and with rocklike conviction if it originates in religious dogma. In evidence is the 60 percent that accept the prophecies of the *Book of Revelation* as truth, and yet in more evidence is the weight that faith-based positions hold in political life. Most of the religious Right opposed the teaching of evolution in public school, either by an outright ban on the subject or, at the least, by insisting that it be treated as 'only a theory" rather than a "fact" (Wilson 2006, pp 1479-1480).

2 Many who accept the fact of evolution cannot, however, on religious grounds, accept the operation of blind chance and the absence of divine purpose implicit in natural selection (Wilson 2006, p 1480).

3 In Norse mythology, the god Frey counted among his greatest treasures a magic ship called Skíðblaðnir which had been built by those consummate craftsmen of legend, the dwarves; according to Snorri Sturluson it always had a following wind, and it was so ingeniously constructed that it was large enough to carry the entire pantheon of the gods…, yet could be folded up and tucked into a pouch when not in use (Magnússon 1980, p 21).

4 The new Frers-designed Hallberg-Rassy 54 is 54 feet, 11 inches LOA, so we could call it a 55-footer.… This design looks very much like the rest of the Frers-designed HR series, i.e. *conservative in proportions and relatively free of contour-driven styling tricks. In short, this design is free of eye candy and relies upon overall carefully controlled proportions* for its good looks. I would not call it a sexy looking boat but it is *handsome* [All italics mine, Perry 2007, p1].

Quorning's dashing Dragonfly 35, however, shares relatively few design traits with this boat, namely because the Dragonfly is not a keel-boat, it is a *trimaran*, and, I submit that the principles of cultural evolution dictate that, *by design*, it may prove extraordinarily difficult - *if not impossible* - to elevate Quorning (a manufacturer of strictly trimaran designs) to the enviable pantheon enjoyed by the Swan and Hallberg-Rassy brands for at least the *next several decades, if not several hundred years*. Why so long? Because evolution works *very* slowly. In short, the trimaran design is far from proving itself (as in hundreds of years) as an evolutionary stable strategy (hereafter ESS).[1] For those unfamiliar with trimarans, let's take a look. Although you may find many pictures of the lightning-quick Dragonfly on Quorning's website,[2] I'll offer a photograph of an even faster trimaran in hopes that it might entice you to turn the pages of my OPEN LETTER TO PARTHA DASGUPTA, which includes the story of a self-sufficient, fiercely independent sailor who helps us frame *The Problem of Sustainable Economic Development*.

1 See ABBREVIATIONS & DEFINITIONS: *Evolutionary Stable Strategy*

2 See: www.dragonfly.dk

Although three of my four favourite boats have evolved through the strong Norse boat-building tradition, I must confess my very favourite boat on Earth happens to be French: Francis Joyon's Nigel Irens & Bernard Caberet designed *Idec II*:

If trimarans represent two of my four favourite boats, one of which happens to be my very favourite boat on Earth, you may, once again, wonder why I suggest it might take as long as a *century* to build a strong brand around trimaran designs?

In 1908 "French philosopher Alain (E´mile -Auguste Chartier) proposed that boat design would be subject to natural selection,"[1] and although it turns out his logic and intuition was right on the mark, for the past 100 years, the validity of his theory has been consistently rejected. This past December, however, two great explorers in the biology department at Stanford confirmed Alain's theory in a PNAS publication[2] (an outstanding research source, I might add) by demonstrating that functional boat designs evolve much more slowly than decorative ones:

1 Rogers and Paul R. Ehrlich 2007, p 3417.

2 Proceedings of the National Academy of Sciences of the United States of America [PNAS] is one of the world's most-cited multidisciplinary scientific serials. Since its establishment in 1914, it continues to publish cutting-edge research reports, commentaries, reviews, perspectives, colloquium papers, and actions of the Academy. Coverage in PNAS spans the biological, physical, and social sciences. PNAS is published weekly in print, and daily online in PNAS Early Edition. The PNAS impact factor is 9.64 for 2006 (PNAS 2008).

> It has been claimed that a meaningful theory of cultural evolution is not possible because human beliefs and behaviors do not follow predictable patterns. However, theoretical models of cultural transmission and observations of the development of societies suggest that patterns in cultural evolution do occur. Here, we analyze whether two sets of related cultural traits, one tested against the environment and the other not, evolve at different rates in the same populations. Using functional and symbolic design features for Polynesian canoes, we show that natural selection apparently slows the evolution of functional structures, whereas symbolic designs differentiate more rapidly. This finding indicates that cultural change, like genetic evolution, can follow theoretically derived patterns.[1]

Although we will not presently head further off-shore, into the deep blue waters of cultural evolution, I might merely note a bit of irony: the trimaran design history – a genetic descendant of the ancient Polynesian outrigger design, is actually much *older* than keelboat history – but this historical curiosity is largely irrelevant, since, over the past five centuries, global keel-boat production has dominated, and thus - statistically speaking - almost all research & development (hereafter R&D) has refined this design far more than the older outrigger designs (including modern-day catamarans as well, for example). Thus *evolution* has put keel-boats to a far greater test than it has to trimarans. And this may be more important than one may suspect when weighing the importance of ESS. One of the most critical points in an excellent evolutionary game theory overview out of the Stockholm School of Economics, Jörgen W. Weibull's WHAT HAVE WE LEARNED FROM EVOLUTIONARY GAME THEORY SO FAR?[2] A sub-chapter entitled "*Why imitate,*" may represent of the most important tools evolutionary game theory may have to offer:

> Schlag (1998) analyses the question what imitation rules an individual should choose, when she now and then has the opportunity to imitate another individual in the same player position but is otherwise constrained by severe restrictions on information and memory. He finds that if the individual wants a learning rule that leads to non decreasing expected payoffs over time in all stationary environments, then the individual should (a) *always imitate* (not experiment) when changing strategy, (b) never imitate an individual whose payoff realization was worse than her own, and (c) imitate individuals whose payoff realizations are better than her own with a probability that is proportional to this payoff difference.[3]

With Schlag's insight in mind, I'll attempt to synthesize the relevance of cultural evolution by framing this strategic evolutionary approach to boats, blue blazers, glass bottles, Coca-Cola, and Tupperware.

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1 Ibid, p 3418.
2 2002.
3 2002, p 9.

Recall that Perry's review of the Hallberg-Rassy 54 noted she was *conservative in proportions and relatively free of contour-driven styling* tricks, which meant, essentially, that the boat was very, very similar to every other Hallberg-Rassy design throughout their *long history* (Indeed, the most consistent criticism in Hallberg-Rassy reviews is that they look *old fashion*, which, in terms of ESS, we may discover, represents a compliment rather than criticism). Why might a brand which deployed this ultra-conservative product development path appeal to *blue-blazored, old-fashioned sailors*? Why might *blue-blazored, old-fashioned* sailors make more money than tye-dyed sailors? Why might this approach lead to the *natural* development of *dominant* brands?

Consider the following Coca-Cola case study in light of evolutionary game theory: The original 1886 recipe remained unchanged until the infamous corporate debacle of the 1985, the disastrous introduction of New Coke, a beverage nobody wanted to buy. The Coca-Cola Co. quickly reverted to *imitation*, putting their original recipe back on the market, and watched their sales numbers rebound.

Is it possible that the Coca-Cola case and the evolution of Hallberg-Rassy naval architecture represent the ESS Weibull brought to our attention? As far as the Hallberg-Rassy brand is concerned, hundreds of these *safe*, *stable*, blue-water cruisers have made thousands of successful trans-Atlantic voyages without *one* sending its Captain and crew to Davey Jone's locker. *Most of the time*, trimarans offer safe, stable trans-Atlantic passage as well, but *sometimes*, when pushed too hard, they bury their omas in waves, pitch-polling end-over-end, dismasting, and scattering her crew in the chill waters of the Atlantic.

In my seminar I will suggest that the lone path to branding success is total policy alignment, be that within a corporation or a relatively insular state.

Although I will dedicate some of my seminar to this topic, here's one small way in which policy disharmony is slowly but surely contributing to the bankruptcy of a fairly strong brand. On 3 May 1984, the Prince Edward Island (hereafter PEI) provincial government outlawed canned beverages, stating that re-fillible glass bottles were more environmentally friendly (which, of course, they are), and this indeed helped build PEI's "Green Island" brand.

Tourist loved it. On the sunny second day of September, 2007, your author sat outside on the deck of the Stanhope Golf Clubhouse, overlooking Covehead Bay, visiting with his father and his wife, drinking Coca-Cola's from glass bottles as we watched my brother Luke and sister Katya hit golfballs on the range. At one point my father smiled and said, "I love drinking a Coke from a bottle."

Why do you think he likes drinking Coke from a bottle? Merely for nostalgia's sake? A trip down memory lane to Midwestern America in the 1950's?

On the psychological surface, perhaps, but may I suggest there were genetic mechanisms at work beneath the psychological frosting. I believe my father's comment – a comment once often uttered by PEI tourists – offers a brief glimpse of evolution at work. Drinking from glass bottles is an ESS with a relatively long track record, and that makes it a powerful branding tool for both Coca-Cola and PEI. Please imagine, if you will, a sweet grandmother, well into her eighties, putting left-overs away after a big family meal. She spoons mashed potatoes into a heavy glass bowl, covers it with aluminum foil, then struggles to lift it from the counter. Her daughter rushes to assist with the heavy bowl, exclaiming, "God, Mom, I wish you'd let me buy you some Tupperware!"

But Grandma doesn't want Tupperware, never has wanted Tupperware, and never will. She, like so many other grandmothers, *likes things just the way they are, just the way they always have been*. They like to do things in the same way, *because the same way has always worked in the past*. Grandma's strategically sound ESS has helped her survive for more than eighty years. And, perhaps some day when her daughter discovers that the plastics in Tupperware and the linings in cans (including cans of Coca-Cola) are known carcinogenics, perhaps she'll know why her mother was always right. And the greatest part of it is this: Grandma didn't even need to know or have reason to believe that Tupperware could cause cancer. Again, intuitively – through the gift of evolution – *she subconsciously held a three-stage learning rule that lead to non-decreasing expected payoffs over time in all stationary environments*:

> (a) *always imitate* (not experiment) when changing strategy, (b) never imitate an individual whose payoff realization was worse than her own, and (c) imitate individuals whose payoff realizations are better than her

own with a probability that is proportional to this payoff difference.[1]

The reason the stereo-type of *old fashioned* elders is so strong is largely due to survival bias: More *old fashioned* people survive to grow old!

But the problem with PEI's can-ban was that it was *not* aligned with policy and it was not enacted with environmental health and branding consideration, for it was in fact a lie. A local businessman by the name of Seaman had a bottling plant and a beverage brand, since he seems somewhat aware that he was a member of species believed to be extinct for many years: a dodo,[2] a living, breathing dodo produced in a dodo factory; although dodos were not previously believed to have developed the capacity of self-awareness, this one knew that he would not survive once the billion dollar bridge was built (of which, more to follow), and more fit competitors (Coca-Cola, Pepsi, Walmart, etc.), which have been far more rigorously tested and adapted to merciless global markets, are able to drive their transport trucks ashore. So Seaman asked for a hand-out. And since "always cooperate" is a game theoretical strategy employed by dependent people, the PEI legislature concocted a passable lie, and enacted the can ban.

And it all worked out just fine for Seaman and fine for PEI until Pepsi bought out Seaman (and Seaman escaped the constitutionally constructed evolutionary filter, sailing to Nova Scotia with a chest full of dodo dollars). But since dodos do not possess evolutionary worldviews, and are unable to derive dominant ESS, they couldn't see the evolutionary stable value of the can-ban. So, last month, *after 34 years*, they simply lifted the ban!

> *Environment Minister* George Webster has said there are environmental advantages to cans over bottles. In 2007, he told CBC News that while glass bottles require cleaning and refilling, cans can be crushed, hauled to a recycler, melted down and recycled into another product.
>
> *But most environmental groups say the suggestion that recycling cans takes less energy than refilling bottles is wrong. The provincial government itself has for more than 20 years argued the environmental advantages of the bottle.*
>
> Later Saturday, Charlottetown police will escort a Pepsi truck to the street party, where Webster - who some have dubbed the "minister of pop" - will officially open the first can of soda sold legally on P.E.I. in a generation.
>
> "*That the minister of environment is opening the can of pop, I think he should be ashamed of himself,*" *Labchuk said*.[3]

1 2002, p 9.

2 Refer to the tale of the Great Auk in footnote 2 on the Cover page (of which, more to follow).

3 CBC 2007.

One other policy/branding misfit I might mention is that PEI Environment Minister George Webster also happens to be large *potato farmer*. But since we're not finished with boats, I'll save this curious anecdote for later.

In the meantime, for more on imitation as an ESS, see Schlag's *Why imitate, and if so, how? A bounded rational approach to multi-armed bandits.*[1]

Now let's move on to a snapshot of the Swan brand:

> The story of Nautor's Swan has its roots 300 years ago in a landscape where temperatures can fall to –30°C in the depth of winter and the sea may be frozen five months of the year.
>
> *The unforgiving landscape around the small town of Jakobstad in Finland is an unusual birthplace for a company whose products have come to embody luxury and quality in the sailing world….*
>
> In 1966 this unique environment inspired Nautor's Swan's founder, Pekka Koskenkyla, to initiate serial production of fibreglass yachts, taking advantage of Jakobstad's long history of boat and ship building that started in the 17th century.[2]

Now this is where things may start to get a bit tricky, because I submit that *unforgiving* landscapes are *not* unusual *birthplaces* for *valuable* Swans and *valuable* brands; in fact, I submit this is the *only* way to create value, that value is in fact a *derivative function of relative insularity*. And the reason this is tricky is due to the fact that this analysis is based upon our hereto *unpublished* theory of value based upon relative insularity. Thus you may begin to understand that the length of this letter is merely a matter of form following function. Although my twenty-minute seminar will merely cover a very small fraction of the material presented herewith, I believe presenting branding strategies without the underlying theory would not offer much utility.

Thereby this paper offers a *relatively* brief description of a simple solution to a very complex problem. As Robert Aumann noted, "economics teaches us that things are not always as they appear,"[3] and although I will naturally leave it up to you to decide if this is the case with *The Problem of Sustainable Economic Development,* it is certainly the lesson that I have learned. When I completed this discourse in May it was over 400 over pages, and, alas, this full-length manuscript represents the best description for our simple solution to this very complex problem. Naturally,

1 *Journal of Economic Theory 78, 1998, 130-156.*

2 Nautor 2008, p 1.

3 Ibid, p 351.

however, I realized this manuscript was too panoptical and consilient for this forum, and thus divided the discourse into three parts; this paper represents the first instalment of a trilogy, and I will be happy to provide the second and third papers upon request. Furthermore, acknowledging individual preferences and time constraints, I have placed as much of this discourse as possible into optional appendices and detailed footnotes; I have also orchestrated two additional, abridged reading strategies for those interested in grasping the essence of this first discourse in as few pages as possible. The good news for these readers is that this abridgement is nearly complete! If you're able and inclined to invest five more minutes, head directly to our theory of value and axiomatic[1] solution to *The Problem of Sustainable Economic Development*. This theory, I submit, not only offers a unique solution, but also maps the *range* of scientific knowledge relating to our problem, namely (1) the lower limit of what *must* be known, and (2) the upper limit of what *may* be known. This axiomatic treatment enables us to arrive at our solution by filtering out the wrong solutions. As Feynman stated in one of his famous lectures, "the laws of nature are approximate: ...we first find the 'wrong' ones, and then we find the 'right' ones,"[2] and I propose our axioms guide us through this very process. Though these axioms are detailed in the second paper, the five-page abridgement of our solution is found in APPENDIX I: A UNIFIED THEORY OF VALUE FOR THE BIOLOGICAL AND SOCIAL SCIENCES.

Those with more time to read, however, may benefit from a more gradual introduction to this discourse.

As an institute dedicated to comparative island studies, I suspect many may value the remainder of this letter the most, since it retraces our methodological steps which lead to the development of our theory, and furthermore embodies its essence; I might only humbly suggest spending a moment re-considering the TOUCHSTONE, the critical inter-relationship between Darwin's *Struggle for Life* and Clauswitz's *Zweikampf,* as

1 *One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely* (Italics mine, Nash 1953, p 129.

2 1963, p 2.

this relationship illuminates the philosophical foundation[1] of our unified theory. As Darwin emphasized, "When we reflect on this struggle, we may console ourselves with the full belief, that the war of nature is not incessant, that no fear is felt, that death is generally prompt, and that the vigorous, the healthy, and the happy survive and multiply."[2] Anecdotal evidence seems to suggest that meditation upon this fundamental truth is this critical to understanding Clauswitz's analogue description of human behaviour. Indeed, Aumann grasped this truth completely and expressed it eloquently in his 2005 *Sveriges Riksbank Prize* in memory of Alfred Nobel:

> Can war be rational?... The answer is yes, it can be. In one of the greatest speeches of all time – his second inaugural – Abraham Lincoln said: "Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came." It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. *If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem.*[3]

Or, as he stated more directly: "Pray for the welfare of the government, for without its authority, man would swallow man alive."[4] I submit our theory of value will elude comprehension without this fundamental understanding, and with the exceptions of my colleague, Jordan Walker, Dr Barry Bartmann, and perhaps Godfrey Baldacchino (I'm not certain on Godfrey's position on this point, I'd advise the curious to take up this point with the man himself), I have found this concept especially difficult for many (if not most) inhabitants of PEI to grasp (of which, more to follow). However, since war is no stranger to the Norse, I suspect this is a truth you may be willing to accept, but I'll not assume so much; although I'm not a gambling man, I'd wager a Spanish doubloon that any doubter willing to set sail from Cape Town (for the sake of our example, in that handsome HR 54), and cruise north along Africa's coastal waters toward the Arabian

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1 The logical structure of the Darwinian foundation remains remarkably intact—a fascinating historical observation in itself, and a stunning tribute to the intellectual power of our profession's founder. Thus… I believe that the best way to exemplify our modern understanding lies in an extensive analysis of Darwin's basic logical commitments, the reasons for his choices, and the subsequent manner in which these aspects of "the structure of evolutionary theory" have established and motivated all our major debates and substantial changes since Darwin's original publication in 1859. I regard such analysis not as an antiquarian indulgence, but as an optimal path to proper understanding of our current commitments, and the underlying reasons for our decisions about them (Wilson 2006, p 1433).

2 Darwin 1859 as cited in Gould 2002, p 137.

3 Italics mine, p 351.

4 Ibid, p 254.

peninsula, would be willing to accept Aumann's conjecture long before reaching Saudi Arabia. In fact, I might even be willing to wager that they would not make it to Saudi Arabia at all.

Those readers with more time and deeper interests, especially those familiar with game theory and problems associated with *The Problem of Induction* may reap much of the philosophical fruit this discourse has to offer with a preview of the road ahead, the introduction to the second instalment of this trilogy, which you will find in APPENDIX II: AN OPEN LETTER TO PARTHA DASGUPTA. This introduction, in conjunction with the axioms previously mentioned in APPENDIX I, provide a condensed description of our philosophical, game theoretical foundation.

Those less familiar with these arenas, however, may benefit from the entire discourse, which I might add is not nearly as long as it may appear, as the copious, nutritious, content-rich footnotes and appendices represent quite optional supplements. I should also offer a special note to those readers unfamiliar with game theory (see APPENDIX III: THE PRISONER'S DILEMMA for an excellent 2-page introduction to this conceptual tool), and those whom may doubt its usefulness: You may all be pleased to know I share your scepticism (and address it in detail in the final segment of this discourse),[1] and, despite the necessarily condensed and thus perhaps esoteric *abstract* which preceded this introduction, I have endeavoured to maintain a straightforward course.[2]

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1 This paper reviews the introduction to our solution for *The Problem of Sustainable Economic Development*, and discusses the origins and justifications of its game theoretical basis. We review the axioms and *Theory of Value* from Part I, then move on to our demonstrative falsification of the central thesis of "Ecological Economics." Rubenstein shares our suspicion of applied mathematics, and our scepticism regarding game theory; thus, we test: *Can game theory to improve real-life strategic interactions? To* do so, we play 2-person, non-cooperative games which tests a widely held, influential theory: "Driving small, fuel-efficient cars s good for the environment (and thus good for you)." We refute this theory and conclude that driving small, efficient cars is neither good for you nor, in *the long run,* good for the environment, and thus we refute Rubenstein's conjecture, accepting tentatively, that game theory may, afterall, improve the world (Funk, forthcoming, abstract).

2 (a) Knowledge is guesswork disciplined by rational criticism.
This turns the struggle against dogmatic thinking into a duty. It also makes the utmost intellectual modesty a duty. And above all, it makes a duty of the cultivation of a simple and unpretentious language: the duty of every intellectual (Popper 1992, p 40).
(b) The ordinary citizen is struck dumb with awe when he is told about gold reserves, note issues, inflation, deflation, reflation, and all the rest of the jargon. He feels that anyone who can converse glibly about such matters must be very wise, and he does not dare to question what he is told....It will be necessary, if this sate of affairs is to be remedied, to...find ways of simplifying the principles...so that they can be widely understood (Russell 1935 pp 61-62)

I will also note that this relatively exhaustive discourse may strike some readers as explicitly personal and highly opinionated. I suggest that there is a *method to the madness*: As Godfrey Baldacchino observed after generously critiquing the first draft of this discourse:

> Yes, there is clearly a method to the madness. It will be exasperating to most readers, because you really walk the talk when it comes to *dismantling disciplinary boundaries*. Your treatise does range from 'astronomy' to 'zoology'.[1]

Though I will address the seemingly "exasperating" nature of the *data cascade* this discourse unleashes, it would be disingenuous to offer an apology, since *every* truthful treatise *must* range from astronomy to zoology. The only true way to completely embrace *the unity of nature*,[2] the truly inter-disciplinary nature of economics, political science, psychology, evolutionary biology, physics, philosophy, nissology, and every other so-called "subject matter," is to recognized that subject matters do not in fact exist, and it is our hope that this discourse demonstrates this reality. And this recognition comes with considerable responsibility, for once the blinders of subjects are removed, the great mass of widely-accepted assumptions dogmatism once had to offer, evaporate like powdered sugar in the sea. Suddenly, we are unable to utilize jargon and short-hand to take the same short-cuts which have consistently lead us down dead-end paths. We are no longer able to communicate to an audience of "experts" since there are in fact *no* experts of *anything*,[3] much less *any* experts of *everything*. All assumptions must be carefully defined, and all positions must be meticulously developed.

I also submit that this somewhat maddening data cascade has been effectively utilized in the past:

> [Darwin] granted even more importance to his relentless presentation of dense documentation for the factuality of change - for only such a *cascade of data* would force the scientific world to take evolution seriously.... Facts literally pour from almost every page of the *Origin*....In some parts, the *Origin* reaches

1 Personal Correspondence 2008.

2 For Humboldt, "the unity of nature" meant the interrelation of all... sciences... which the scientist unraveled by discovering patterns in myriad, painstakingly collected data. This ambition to view nature as a whole wasn't unique to Humboldt, though. It was a quest that historians believe had begun with the ancient Greek philosopher Thales of Miletus, in the sixth century B.C. Recognized as the founder of Greek geometry, Thales also taught that all matter is ultimately composed of water. Though dead wrong, the theory was still an intellectual turning point, since it marked the first time anyone had tried to explain natural phenomena without appeal to religious dogma. It was also the first time that anyone had tried to explain the whole, divergent physical world in one grand unifying principle (Helferich 2004, pp 23-24).

3 Popper 1959.

an almost frenetic pace in its cascading of facts, one upon the other....

Whenever he introduces a major subject, *Darwin fires a volley of disparate facts, all related to the argument at hand*... This style of organization virtually guarantees that Whewell's "consilience..." must become the standard method of the *Origin*. Darwin's greatest intellectual strength lay in his ability *to forge connections and perceive webs of implication* (that more conventional thinking in linear order might miss). When Darwin could not cite direct evidence for actual stages in an evolutionary sequence, he relied upon consilience - and sunk enough roots in enough directions to provide adequate support for a singe sturdy trunk of explanation.[1]

In other words,

like Humboldt, Darwin was a synthesizer, one of those... who propel science forward through their compulsion to create order (cosmos) out of the apparent disarray (chaos) of natural phenomena. The result in Darwin's case..., single-handedly propelled the science of biology from a collection of disparate facts into a "system of knowledge."[2]

I will have a bit more to say about the methods of Charles Darwin as they map priceless methods for comparative island analysis. I will also suggest that our seemingly unusual style is perhaps not so unusual and, moreover, fitting, as this essay falls into a well

recognized category of essays, a literary genre defined, ever since Montaigne's initiating 16th century efforts, as the presentation of general material from an explicitly personal and opinionated point of view - although the best essays (literally meaning "attempts," after all) tend to be forthright in their expression of opinions, the basis of authorial preferences. On the other hand, technical treatises in science do not generally receive such a license for explicitly personal expression. I believe that this convention in technical writing has been both harmful and more than a bit deceptive. Science, done perforce by ordinary human beings, expressing ordinary motives and foibles of the species, cannot be grasped as an enterprise without some acknowledgement of personal dimensions in preferences and decisions – for, although a final product may display logical coherence, other decisions, leading to other formulations of equally tight structure, could have been followed, and we do need to know why an author proceeded as he did if we wish to achieve our best understanding of his accomplishments, including the general worth of his conclusions.

Logical coherence may remain formally separate from ontogenetic construction, or psychological origin, but a full understanding of form does require some insight into intention and working procedure. Perhaps some presentations of broad theories in the history of science – Newton's *Principia* comes immediately to mind – remain virtually free of personal statement (sometimes making them, as in this case, virtually unreadable thereby). But most comprehensive works, in all fields of science, from Galileo's *Dialogo* to Darwin's *Origin*, gain stylistic strength and logical power by their suffusion with honorable statements about authorial intents, purposes, prejudices.[3]

And finally, I will add that if it were possible to condense this communiqué to twenty or thirty pages, or if

1 Gould 2002, p 109.

2 Helferich 2004, p xxi.

3 Ibid, p 34.

it were possible to accurately and effectively communicate a tenable solution to *The Problem of Sustainable Economic Development* in the type of academic paper or journal you may accustomed to reading, then it seems likely that a tenable solution would have been tabled long before this letter.[1]

Thus, in short, this letter was written in the best and only way which it could be honestly written. I will also note that I fully embrace the charge that "our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth."[2] However, conjectures and refutations herewith may be ridden with error,[3] they are open to criticism, and my aim is not to convince or even to sway.[4] This final point seems rather critical in light of the contemporary prevalence and popularity of normative[5] practices.

> My present design... is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own.... This tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all. It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgements of our friends are to be suspected when given in our favour.[6]

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1 If the problems of land degradation could have been solved by research and reports alone, they would have disappeared long ago. It has been [sixty] years since some of the first seminal works on environmental degradation were written (for example, Jacks and Whyte 1939; Osborn 1948; Carson 1962; Commoner 1972), and perhaps [twenty] to [twenty-five] since the high-water mark of environmental movements in the United States and Europe was reached (Blaikie & Brookfield 1987, p xxvii).

2 Popper 1992 p 4.

3 Our knowledge, as well as our ignorance, at any time and on every issue, tends to be opportunistically conditioned, and thus brought to deviate from full truth (Myrdal 1975, p1).

4 The genuine discipline of the Enlightenment, the true rationalist, does not even want to persuade, nor even to convince. He remains always aware that he may err. Thus he esteems too highly the independence of the other person to try to sway him in important matters; rather he wants objections and criticisms. He wants to arouse and stimulate the cut and thrust of argument. This is what is valuable to him. Not only because we may approach truth better with the free exchange of opinion, but also because he values this process as such (Popper 1999, pp 206-207).

5 These days, one commonly asserted imperfection in the science-policy interface is that some so-called "science" is imbued with policy preferences. Such science may be labelled as normative and it is potentially an insidious kind of scientific corruption. By normative science, I mean "information that is developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices." In some forms, normative science is not obviously normative to policy makers or even to many scientists. Such "science" has become a serious problem. I believe that use of normative science is stealth policy advocacy. Science, of course, is not value free because it is a human enterprise, but this fact does not make all science normative. Policy-neutral science is a way of learning about the world and it is characterized by transparency, reproducibility, and independence. Consider the simple but fundamental difference between scientific "is" and the policy "ought." Science deals with the "is" world (and the "was" and "will be" states of the world) as does the policy world, but the policy world also deals with the "oughts" and "shoulds." Science is, or should be, bounded in the "is" world (Lackey 2004, p 2).

6 Descartes 1637, pp 1-2.

With these objectives and disclaimers in mind, consider the following account of my exploration of three islands with the purpose of discovering a solution to *The Problem of Sustainable Economic Development*.

I travelled to Iceland[1] twice last summer, in search of the indefatigable and unconquerable spirit Halldór Laxness captured in *Independent People:*[2] I wanted to come to understand people who were willing to fight to protect their natural resources (I was thinking primarily of the cod-wars), as I was beginning to suspect the lesson of Icelandic independence and, more broadly speaking, the Nordic *Struggle for Life* may offer solutions to problems I was observing on PEI and, more generally, across Atlantic Canada (including Newfoundland).[3] Several notable writers echo this conjecture,[4] and, as Francios Doumenge[5] noted while reflecting upon the 1992 North Atlantic island conference on PEI which "sought to understand the critical problems currently facing small islands"[6]:

Looking back at all the different island problems, my understanding is that most of these could be best solved

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1 (a) Iceland is an island of some 103 100 km^2 located in the North Atlantic just south of the Arctic Circle. Iceland's central point is approximately 65 North and 19 West. The country's exclusive economic zone (EEZ) is 758 000 km^2 or more than seven times the surface area of the mainland. Shortest distances to neighbouring countries are: to Greenland 290 km, to the Faroe Islands 435 km, to Scotland 812 km and to Norway 970 km (Arnason 1995, p 5).
(b) Settled by Norwegian and Celtic (Scottish and Irish) immigrants during the late 9th and 10th centuries A.D., Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated, mostly to Canada and the US. Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. *Literacy, longevity, income, and social cohesion are first-rate by world standards* [italics mine, *CIA World Factbook*, updated 1 November 2007].

2 Laxness 1946.

3 The fishery in Newfoundland, and in other parts of Atlantic Canada is part industry, part social-welfare program, in contrast to Iceland where the fishery is organized almost exclusively as an industry....Iceland lands slightly more fish than all of Atlantic Canada with one-tenth the number of people fishing. It uses about 60 per cent fewer people to process the fish (Simpson 1995).

4 The relative success of the Icelandic fisheries suggests that other fishing nations may have something to learn from the Icelandic experience (Arnason 1995, p x).

5 I worked in the fisheries and aquaculture in Micronesia, Polynesia, and melanesia for fourteen years (1960-1973), the last two years as Project Manager for the South Pacific Islands Fisheries Development Agency (FAO/UNDP). During this period my investigations also concerned coral reef conservation for the French National Research Council and small islands socio-economic development for the South Pacific Commission. Next, I was for three years (1976-1979) head of the educational system for the three American overseas French departments (Martinique, Guadaloupe, and French Guiana) as Rector of the University of Antilles-Guyane. Lastly, I served from 1987 to 1988 as President of the University of Antilles-Guyane. Lastly, I served from 1987 to 1988 as President of the Council of Administration of the French Overseas Scientific and Technical Research Institute for Cooperation and Development (ORSTOM).

Along the way, I have compiled extensive reports and written books on these experiences..., plus the report commissioned by UNCTAD on the "Viability of small island states"... for the Belgrade conference.
More than thirty years of familiarity with the Mediterranean and tropical islands world, where I visited and surveyed more than a hundred entities related to eleven independent states and twenty dependent or associated territories with Australia, France, New Zealand, Portugal, Spain, the United Kingdom, and the USA..., have enabled me to develop personal views integrating ecology, natural resources, and ethno-history..., as well as politics and socio-economy (Doumenge 1998, pp 227-339).

6 Doumenge 1998, p 337.

if the island community develops and sustains a sense of unity, which may manifest itself in civic mobilization. Iceland won the cod war because all the Icelanders were prepared to fight against the British fishing fleet and thus conserve their basic resource. Had there been any disagreement on this within the Icelandic population, they would never have won, and they would never have reached their present envious economic situation.[1]

This consensus also reverberates throughout *The North Atlantic Fisheries: Success, Failures & Challenges*:

While Iceland is probably better poised to respond to the future, it has the distinction of being the only fully sovereign state amongst those societies discussed in this volume. Could this be mere circumstance? If not, what are the connections between full political independence and successful fisheries development?

We think there is a link, for two reasons. The first relates to the concrete advantages nation states have over societies politically subordinate to larger nation states in pursuing economic development....

There is no doubt that full control over the relevant levers of national policy can be an enormous advantage to a small, geographically isolated society. One obvious advantage is that priorities that directly address concerns at the local level need not compete with other concerns and priorities from regions more populous and politically dominant in the larger society. In the case of both Newfoundland and PEI, fisheries concerns typically receive little attention on the national Canadian scene.[2]

And thus I also submit that

it is possible that political *independence engenders a certain resolve to make the most of available resources and opportunities*. Such resolve might manifest itself in concrete ways such as programs and policies, and in less obvious forms such as its effect upon collective attitudes. There is some suggestion that Iceland was able to pursue a *highly rationalized* strategy of fisheries modernization, *at least in part because of the collective realization that the society's future well-being was linked to a prosperous, efficient fisheries. The collective sentiment that there was no larger political unit to fall back on might very well have been instrumental in the pursuit of such a strategy*.[3]

Perhaps you're wondering why I wanted to come to understand people who were willing to fight to protect their natural resources? The answer is, as I have previously hinted, is that I was searching for a solution to problem: In January of 2006 the Fraser Institute ranked PEI the worse Province in Canada for business investment. Though I heartily agree with this assessment (in fact I have recently completed research which suggests the economic prospects on PEI have fallen precipitously since), this is by far the least of PEI's problems: PEI has rapidly emerged as the worse place in Canada—perhaps all of North America—for human life. In fact, by European and North American

1 Ibid p 342.

2 Arnason and Felt 1995, p 300.

3 Italics mine: Arnason & Felt 1995, p 301.

standards, the island is essentially uninhabitable.[1]

In short, I had an island which modelled *The Problem of Sustainable Economic Development* exceedingly well, and I was looking for an island which could model a the solution.

After returning to PEI, I distilled what I had discovered in a working paper entitled: *On the Problem of Dependent People: Natural Resource Valuation Errors in Atlantic Canadian Island Jurisdictions,*[2] and the abstract sums up my general conclusions at this juncture:

> This paper focuses upon deficient constitutional constructs and natural resource valuation methods, especially as they generate *The Problem of Dependent People*. Solutions are presented by contrasting the failure of fishery management methodology and practice amongst dependent Canadian islanders, and the relative success of fishery management amongst independent Icelandic islanders. The possibilities that independent people enjoy higher levels of rationality, efficiency, happiness,[3] economic sustainability, general well-being, and are thus, ceteris paribus, less likely to commit errors associated with *The Problem of Induction* are taken into consideration. Likewise, consideration is given to the notion that dependent people are more likely to exhibit irrational behaviour, develop deeper dependencies[4], self-destructive behaviours and political policies, and to contribute to a wide-array of systemic errors, such as those which exacerbate *The Tragedy of the Commons*, maladaptation, and, ultimately, extinction.

In this research endeavour, I discovered two wise and observant Icelandic economists found that the "measurements of the economic importance of the fishing industry in Iceland are also indicative of the importance of

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1 This gives me little comfort to report, as my wife was born and raised on this island, her respective families (MacDonalds and Campbells, descendants of island Scots from the Hebrides) have inhabited the island for five generations, and we presently call this island home.

2 Funk 2007c.

3 One can be independent, or one can be subject to decisions made by others… This difference, embodied in the institutional distinction between the decision-making procedures 'market' and 'hierarchy', affects individual wellbeing beyond outcomes. Taking self-employment as an important case of independence, it is shown that the self-employed derive higher satisfaction from work than those employed in organizations, irrespective of income gained or hours worked. This is evidence for procedural utility: people value not only outcomes, but also the processes leading to outcomes (Benz & Frey, pre-publication release, abstract).

4 (a) The perverse effects frequently attributed to the welfare state are easy to interpret from a behavioural perspective. If people overestimate the magnitude of immediate benefits relative to more distant ones, you can actually–on net–harm them by offering them additional immediate benefits. They already tend to under-invest. Making their present more livable with cash gifts only amplifies this tendency. Similarly, if individuals systematically overestimate their own abilities, you could easily harm a student by admitting him to a program for which he is under-qualified. Blinded by over-confidence, he would be likely to select the best school that accepted him, scarcely considering the possibility that he will be out of his league. Looking at the welfare state from a behavioral standpoint lays the groundwork for a stronger claim: Potential welfare recipients' deviations from neoclassical assumptions tend to be especially pronounced. If the average American falls short of the neoclassical ideal, the average recipient of government assistance does not even come close (Beaulier & Caplan 2007, p 487).
(b) Once you accept the idea that you can hurt people by giving them more choices, you cannot dismiss the idea that you can help them by taking some of their choices away. In practise, of course, the latter is much more costly and intrusive than the former (Ibid, p 503).

the fishing industries in similar fish-based economies across the North Atlantic,"[1] and that they expect "similar multipliers to apply,"[2] and, based upon this insight, I presented[3] a strong case that the *relative* importance of the PEI fishery (that is, relative to agriculture and tourism) may in fact exert an even *greater* multiplier effect on the PEI economy: A New York food critic made a trip to PEI last fall, and his article relating this journey appeared in the travel section of the *New York Times*.[4] Note the article was titled *PEI: Beckoned by Bivalves*, not *PEI: Beckoned by French Fries*, also note the article's sole photograph was a lobster fishing boat in Naufrage Harbour, not a potato truck in the middle of a muddy field. Visitors to PEI go deep sea fishing, not deep potato digging, and then head for a bite to eat at *New Glasgow Lobster Suppers*, not *New Glasgow Tator Tots*, et cetra!

The essence of the relevance of this *New York Times* article is at the heart of *The Problem of Sustainable Economic Development on PEI*: An *increase* in agricultural production translates to *decreases* for both the fishery and tourism (when *The Globe and Mail* headlines *PEI's Killing Fields,* it's bad for business, of which, more to follow). A *decrease* in *industrial* agricultural production, however, would result in *increases* for both tourism and the fishery—not to mention lower health-care costs, tastier water, higher standards of living, lower infant mortality, greater life expectancy, et cetera!

For example, Cairns reported that

> PEI's economic mainstay is agriculture, followed by tourism and fishing.[5]

Indeed, this erroneous conclusion appears to be held universally on PEI without exception. In fact, I have not found a single piece of economic analysis that uncovers this error. I might add, however, that Cairns was right on the mark with another, related conjecture:

> The fisheries industry… *was relatively late in developing and has never gripped Islanders' culture and consciousness in the way that farming has.*[6]

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1 Ibid.
2 Agnarsson & Arnason 2003.
3 Funk 2007c.
4 Bruni 2007.
5 Italics mine: Cairns 1995, p 98.
6 Italics mine: Cairns 1995, p 98.

In short, gross miscalculation of the fishery resource has resulted in a disastrous economic inversion on PEI: *The tail (agriculture) is wagging the dog (fishing), and it is wagging it so hard that the dog and its owner (the islanders) are not well*.

Although our Icelandic economists[1] conjecture that *a more complete understanding of the true economic significance of the fisheries* may help policy makers *in Iceland,* this position may not be applicable in Canada. For example, although it seems remotely possible that this dissertation could be of some very limited use to a provincial or federal politician.[2] Baldacchino concurred with our position:

> Of course, it is all very disturbing—and all the more so because we expect ISLANDERS to be even more aware of the eventual folly that capitalism/growth/development economics has led them to—and take appropriate action—BUT NO![3]

As noted, the fundamental problem[4] I had identified on PEI was that its inhabitants were not willing to fight to protect their natural resources and were thus, not willing to fight to protect themselves, but, again, prior to my expeditions to Iceland, I still I did not understand *why*. A 900% increase in the application of potato fungicide over the past decade has turned the island into a very curious laboratory for the study of rare and exotic cancers (a 30% increase over the past five years). This set-up becomes even more bewildering when considering the fact that (1) potato farmers have teetered on the verge of insolvency and bankruptcy for over a decade; they receive the same price for their crop which they received 17 years ago, (2) these farmers are only able to continue to pollute the island with their cash-flow negative enterprises with financial assistance gained through democratic mechanisms (provincial and federal aid), and (3) the agricultural sector makes up only 5% of the island's voting population; yet the island

1 Agnarsson & Arnason 2003.

2 See ABBREVIATIONS & DEFINITIONS: *Politician*

3 Personal correspondence 2007.

4 Small-island plantation economies have some structural characteristics, related to their size, which differentiate them from large continental plantation economies. Namely, they are more specialized, more dependent and less flexible than the latter. Those economic characteristics generate a particular political structure in which the plantation interest is predominant. This makes their adjustment to the present decline of some of the main traditional plantation crops difficult and painful, since most of their economic policy measures are not long-run policies to insure competitiveness, but are short-run expedients to save uncompetitive crops. The Caribbean islands, where one finds some of the oldest plantation economies, are a case in point. While the traditional export crops of the area, i.e. bananas, cane and pineapple, have been declining over the last 15 yr or so, the policies adopted by government towards the agricultural sector have proved inoperative (Crusol & Crusol 1980, Abstract).

continues to vote to, essentially, kill themselves, kill their children, and kill their economy (pesticide externalities are destroying the other two leading sectors of the economy as well: the in-shore fisheries and tourism). Though I had originally considered the possibility that the inhabitants were simply on the losing team in a game of group selection, under Dawkin's influence and a deeper reading of Darwin's original works, I rejected the group-selection premise. Furthermore, I began to suspect the constitutional mechanism, the problem of dependent people. And not only did I come to understand that dependency begets deeper dependencies, I also began to suspect that dependency begets illiteracy. Here are a few assorted illiteracy indicators: for 2008 children on PIE rank at the very bottom on national scholastic aptitude tests, a greater percentage of men on PEI smoke cigarettes than anywhere else in Canada (women are the third-highest smokers), PEI doctors are less likely to cure islander cancers than those fallen ill and treated by doctors in other provinces (which, as my friend, Dr Andy Roberts notes, likely says more about the aggressive, pesticide-induced PEI cancers than it does about the inabilities of PEI doctors), and there are more traffic fatalities per 10,000 drivers on PEI than anywhere else in Canada.

Moreover, Prince Edward Islanders are also *water illiterate*.

Wendell Berry introduced me to the concept of *Land Illiteracy,*[1] and I have borrowed this concept to describe a related phenomena I refer to as *Water Illiteracy*, one of the most significant problems on Earth, since

> the health of the oceans depends on the health of rivers; the health of rivers depends on the health of small streams; the health of small streams depends on the health of their watersheds. The health of the water is exactly the same as the health of the land; the health of small places is exactly the same as the health of large places. As we know, disease is hard to confine. Because natural law is in force everywhere, infections move.
>
> We cannot immunize the continents and the oceans against our contempt for small places and small streams. Small destructions add up, and finally they are understood collectively as large destructions. Excessive nutrient runoff from farms and animal factories in the Mississippi watershed has caused, in the Gulf of Mexico, a hypoxic or "dead zone" of five or six thousand square miles.[2]

Moreover, the amplified nature of island biogeographies renders this problem far more vexing for islanders.

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1 The principle problem is that we are "land illiterate." When it comes to "reading" a landscape, we might as well be studying a foreign language. Too many of us don't know our perennials from our annuals, what the signs of poor water cycling are, what an incised channel means, or, simply by looking, whether a meadow is healthy or not (Berry 2005, pp 164-165).

2 Berry 2005, p 7.

Regular reports of massive fish-kills numbering 10,000 or more readily make PEI headlines, generate cries for concern, and prompt politicians, yet again, to hire "consultants" search for the *cause* of problem; yes, the inhabitants reveal (through democratic mechanisms) to be utterly unable to grasp what (1) commercial agricultural production and (2) being 100% dependent upon ground water means: it means the same water feeding the fish-killing streams is feeding people-killing wells. Indeed, the water illiteracy rate on PEI is, at the very least, well-over 50%.[1] Toronto's *Globe and Mail* ran an interesting cover-story in the winter of 2006: CANCER: PEI'S KILLING FIELDS, and the article noted

> PEI would be a good place to shed more light on the health effects of agricultural chemicals because areas such as Kensington have some of the highest airborne concentrations of pesticides around farm fields in the world, and a sizeable rural population literally living on the doorstep of the spraying.[2]

PEI is the smallest Canadian province with a population of just 130,000 people. However, due to the island's relatively small size, it is the most densely populated province in Canada, and it is *the* most densely populated commercial agricultural region in North America. And I'm afraid this problem gets worse: PEI is also the only province in Canada that is 100% dependent on its groundwater resource, and, quite sadly, it is the only Province in Canada that does not have regulated municipal water oversight. Over one in five wells on this island pumps water into homes which fails to meet Canadian water safety guidelines (which are more liberal than FDA requirements for bottled water; in other words, you're able to drink water at home that would be illegal to sell). More troubling is the fact that neither federal nor provincial governments test (the provincial water testing lab here on the island is the most limited provincial lab in Canada) or provide safety guidelines for pesticides[3]. It may be reasonable to conclude

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1 (a) See ABBREVIATIONS & DEFINITIONS: *Politician*.
(b) It may be laid down as a general rule to which there are few exceptions that, when people are mistaken as to what is to their own interest, the course that they believe to be wise is more harmful to others than the course that really is wise. Therefore anything that makes people better judges of their own interest does good. There are innumerable examples of men making fortunes because, on moral grounds, they did something which they believed to be contrary to their own interests. For instance, among early Quakers there were a number of shopkeepers who adopted the practice of asking no more for their goods than they were willing to accept, instead of bargaining with each customer, as everybody else did. They adopted this practice because they held it to be a lie to ask more than they would take. But the convenience to customers was so great that everybody came to their shops, and they grew rich (Russell 1928, p 10).

2 Mittelsteadt 2006 p 1 ; also see Delaney 2006.

3 Barlow said the big problem on P.E.I. will be an agricultural one with pesticides and nitrates leaching into groundwater.

that PEI has the lowest quality ground-water source in Canada, with the possible exception of northern Alberta (see Dominion 2007).

I will not delve too deeply into this quagmire, but consider the fact that the entire south shore lobster fishery collapsed over five years ago, and to date, focus has been solely upon the *economic consequences* of this collapse, not the infinitely more important *environmental implications* of this collapse (my conjecture, which I believe is a rather solitary position on the matter, is that this in-shore fishery was, *at the very least*, significantly weakened by pesticide run-off.

Given the fact that Sweden is often cited as a fine example of producing a lightning-fast solution to the pesticide problem, I do not suspect this discussion is of much use to Ålanders, but last winter Godfrey Baldacchino kindly invited me to lead a discourse on scientific methods for his island studies graduate course on methodology, and I delivered a discussion based upon my working paper entitled *On the Problem of Breathing, Eating, & Drinking Poison—A Brief Introduction to Problem Solving with Karl Popper on PEI in an Open Letter to Premier Robert Ghiz,* and I will forward this work upon request.

And what, you may ask, are the people of PEI doing about this grave situation?

The answer is, of course, quite naturally, *nothing*, because that is what dependent people do.

But they are fighting hard to keep their churches.[1]

Now that the nature of our problem has been thoroughly introduced, let's get down into the heart of the matter, the conceptual and intellectual mechanism which served as the genesis of our solution: It all began with a single word: *islandness*.

Islandness is a vague term, yet often summonsed by scholars. The problem of *islandness* occurred to me while reviewing *Crossing that Bridge: A Critical Look at the PEI Fixed Link,*[2] a work which chronicled the ten-year debate on PEI

"For you, it will be an issue of preserving your way of life" (Stewart 2007).

1 The Roman Catholic Church on P.E.I. is preparing to close churches as congregations shrink, but participants at a public forum Thursday night were ready to fight for them (CBC 2007b).

2 Begley 1993.

which culminated in what may be honestly referred to as *a billion dollar bridge bamboozle*,[1] the construction of a bridge spanning the 13 kilometres from PEI to New Brunswick. The bamboozle began with rhetoric like this:

> Decisions we as Islanders make on this momentous and grave matter must be the right decisions. We owe this to ourselves, to our children and to all future citizens of this province. Mr. Speaker, there is no room for error, no opportunity for second guesses and little latitude for corrective action if our planning is inadequate and unable to meet the test of time. Simply put, Mr. Speaker, we must know what we are doing [Former Premier Joseph Ghiz, 20 March 1987].[2]

From this auspicious beginning, Ghiz maintained throughout the ten-year process that the province would defer to, and follow the guidance of the one and only impartial *Report of the Environmental Assessment Panel,* which was commissioned and published in August of 1990. The report,

> which resulted from over a year of study and public hearing into… [the] bridge proposal… is quite explicit and clear-cut about the proposed bridge: On two occasions the report said, in bold print, "**The Panel recommends, therefore, that the project not proceed**."[3]

Then the great caper commenced in full force. It hindsight, it surfaced that there were considerable political incentives (and quite likely personal financial incentives) for Ghiz to build a bridge. Additional, biased reports (reports from the construction consortium which eventually was paid the one billion dollars to construct the bridge, for example) were quickly commissioned which, shocking-as-it-may-seem, supported construction, and these reports were presented to the public in the form of a balanced pro/con debate, which included a shock-and-awe media blitz campaign, peppered with yet more rhetoric:

> You pay a price for progress and economic change. And I believe the best interests of the Island are served by the most efficient, modern communications with the mainland in every respect; transport, telecommunications and so on. And there's bound to be some changes as a result of this but I believe they'll be positive. *They may change the way of life to some extent but governments can compensate for this* [Elmer MacKay, Minister of Public Works 3 December 1992].[4]

One significant fear, as previously noted, was that the building of the bridge may lead to the collapse of the south-shore fishery, a prosperous fishery in which a fisherman could feed his family like a king, work just two months

1 The machinations of the federal and provincial governments and the development consortium comprise a saga of deceit, dishonesty and undemocratic action (Ibid, p 4).

2 Ibid, p 1.

3 Ibid, p 6.

4 Ibid, p 6.

of the year, and could boast of owning a license worth one million dollars. The threat to this fishery was concluded by every biologist who reported on the proposal, including Irene Novaczek, the current director of the Institute of Island studies.[1] Within a decade after completion of the bridge, the south shore fishery, which was one of the most productive fisheries in Atlantic Canada, collapsed. All commercial species on the south shore are presently commercially extinct. And, despite MacKay's promise noted above, no such compensation has nor seems likely to be offered, as we have yet to discover a mechanism for resurrecting extinct species.

What is truly interesting and revealing in this story, however, relates back to our vague concept of *islandness*.

In *Islandness*, David Weale observed:

> Economically, socially, psychologically, the construction of *a fixed link will reduce our insularity* [italics mine]. It moves in the direction of peninsularity, which as the work itself expresses, is a state of being almost an island.[2]

It sure seemed to yours truly, Dear Ålanders, that Weale was on to something, but unable to express himself fully. It appeared that Weale was struggling to describe an *evolutionary stable degree of relative insularity*, and mechanisms, communities, individuals, and biologies this degree of relative insularity engendered. Your author herewith suspected that Weale's fear was based upon a genetic, intuitive understanding that a drastic reduction in relative insularity represented a highly unstable evolutionary strategy.

Furthermore, I began to wonder if relative insularity could be *quantified?*

What if Weale had been able to *quantify* what this loss of insularity might mean? For example, the primary objective of building the bridge was to overcome the fundamental location-theory hindrance to PEI's *perceived* primary industry: potato farming. Quite simply, a bridge would facilitate a shift in production to the mono-crop, industrial production of potatoes. Indeed, it worked: In the decade following the bridge completion, potato production was up 700%. The problem, however, is that vicious blight fungicides also increased (900%), and thus, presently, the PEI

1 Ibid.

2 Ibid, p 82.

"economic development plan" has generated a 26% increase in cancer rates over the past four years.[1]

Moreover, I began to understand that a dramatic reduction in relative insularity was indeed an evolutionary unstable strategy. In short, islanders most often fail to recognize they are Dodos, that they had evolved and adapted to live within niches of high insularity (and being a dodo , I submit, is *not* a bad thing (in fact, my preference is to live the life of a dodo), as long as dodos are able to (1) recognize what it means to be a dodo, and (2) understand that dodos require relatively high levels of relative insularity.

And so I set off, and with much strum und drang, eventually derived the formula and solution presented in our axioms (APPENDIX I).

And then I set off to map the strategic implications.

As I noted in one of Dr Nagarajan's excellent Island Studies seminars last winter, ceteris paribus, every RIS has two *pure* development strategies to choose from (*mixed strategies*, such as those you have successfully executed and the successful strategies executed by the innovative Japanese and Icelandic islanders are covered in the third installment to this series). Once a pure strategy has been selected and put into motion, it is extraordinarily difficult to switch development strategies once the corresponding industries, institutions, and dependencies develop and become entrenched:

RIS Pure Strategy	**Short-term (10-50 years) Payoff**	**Long-Term (30-100 years) Payoff**
Max Economic Development	Cash Rich/Land Poor	Cash Poor/Land Poor
Max Ecological Preservation	Land Rich/Cash Poor	Land Rich/Cash Rich

Since I intend to cover this metric in my seminar, I will say as little as possible about it for now, for a quick example by way of an illustrative snapshot, consider the biogeographic distribution of Estonian crime. Here we have 1998 figures for Estonia, the capital (Tallinn), and the far more insular island of Saaremaa:

1 Funk 2008.

	Number of crimes per 10,000 inhabitants	% of crimes solved
Tallinn	491	13.2%
Estonia	314	28.3%
Saaremaa	91	61.7%

Is this a coincidence?

When relatively insular islands pursue GEMS economic development strategies (detailed in the third installment) which lower relative insularity (building airports, hotels, bridges, commercial agriculture, manufacturing, etc.), one critical consideration (other than the obvious location-theoretical disadvantages with commercial agriculture and manufacturing) is the fact that cooperative behaviour will decrease (which will be reflected in all social behaviours, including, for example an increases in crime rates. Let us, for example, travel back in time and climb onboard the 'ol *Spray* with Captain Slocum:

> It was the season for fruit when I arrived at the Azores, and there was soon more of all kinds of it put on board than I know what to do with. Islanders are always the kindest people in the world, and I met none anywhere kinder than the good hearts of this place. The people of the Azores are not a very rich community. The burden of taxes is heavy, with scant privileges in return, the air they breathe being about the only thing that is not taxed....
>
> The day after my arrival at Horta was the feast of a great saint....The deck of the Spray was crowded from morning till night....On the day after the feast a kind-hearted native harnessed a team and drove me a day over the beautiful roads about Fayal, "because," said he, in broken English, "when I was in America and couldn't speak a word of English, I found it hard till I met someone who seemed to have time to listen to my story, and I promised... that if ever a stranger came to my country, I would try to make him happy."[1]

Presently, we'll fast-forward several months of intense theoretical development, skipping innumerable variables, insights, criticisms, and considerations which lead me to discard Iceland as the *ideal* economic model to the solution to *The Problem of Sustainable Economic Development* (though Iceland models this ideal quite well, complexities, such as geothermal resources, strategic position in the Atlantic, lack of comparative islands with a similar level of relative insularity, and the unique economic development advantages gained by the previously relationship with the U.S. armed forces, for example), and turn my focus to a smaller, more descriptive, more controlled experiment:

1 1900, p 56.

the island of Mustique. (There are 32 islands in the Grenadine archipelago, for example, which have possess very similar levels of relative insularity, and all fall under the umbrella of the SVG government). I will also suggest we may safely pass lightly over this period since you may find the detailed desiderata relating to this intense developmental research period in **APPENDIX VIII: FIELD NOTES FROM MUSTIQUE.**

I had conducted an intensive literature review of the Caribbean, including, naturally, every one of the dozen or so papers I could find focused specifically on St. Vincent and the Grenadines and Mustique. After several weeks of preliminary research, I discovered a treasure chest, a paper out of the University College, London, which was accepted for publication in April of I973 in what seems to this writer to be the single most appropriate Journal for any such gem: The *Biological Journal of the Linnean Society.*[1] This paper is F.B. Goldsmith's *The ecologist's role in development for tourism: a case study in the Caribbean,* a discourse Goldsmith had offered as a course in conservation in the Department of Botany and Microbiology:

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1 (a) The *Biological Journal of the Linnean Society* is a direct descendant of the oldest biological journal in the world, which published the epoch-making papers on evolution by Darwin and Wallace. The *Journal* specializes in evolution in the broadest sense and covers all taxonomic groups in all five kingdoms. It covers the whole range of techniques used to study evolution, including whole-organism, molecular, theoretical and practical.

The *Biological Journal of the Linnean Society* publishes papers concerned with the process of organic evolution in the broadest sense. It particularly welcomes contributions that illustrate some of the unifying concepts of evolutionary biology with evidence, either observational or theoretical, from the fields of genetics, systematics, biogeography, or ecology. The *Biological Journal* succeeded (in 1969) the Proceedings of the Society, the journal in which Darwin and Wallace published their seminal papers in 1858.

The Linnean Society of London, founded in 1788, takes its name from the Swedish naturalist Carl Linnaeus, whose botanical and zoological collections and library have been in the Society's keeping since 1829, having been purchased from the executor of the Society's first President, Sir James Edward Smith.

(b) Linnaeus was born in 1707… in Sweden. He began to study medicine at the University of Lund in 1727, transferring to the University of Uppsala the following year. Linnaeus headed an expedition to Lapland in 1732, travelling 4,600 miles and crossing the Scandinavian Peninsula by foot to the Arctic Ocean. On the journey he discovered a hundred botanical species. In 1734, he mounted another expedition to central Sweden….

He undertook his medical degree in 1735 at the University of Harderwijk… (which no longer exists), thence going to the University of Leiden for further studies….

In his publications, Linnaeus provided a concise, usable survey of all the world's plants and animals as then known, about 7,700 species of plants and 4,400 species of animals. These works helped to establish and standardize the consistent binomial nomenclature for species which he introduced on a world scale for plants in 1753, and for animals in 1758, and which is used today. His *Systema Naturae* 10th edition, volume 1(1758), has accordingly been accepted by international agreement as the official starting point for zoological nomenclature. Scientific names published before then have no validity unless adopted by Linnaeus or by later authors…..

In 1738, he went to Stockholm to practice medicine and lecture, and became a professor at Uppsala University in 1741, attracting students from many countries to his often crowded lectures. Twenty-three of Linnaeus' students themselves became professors and this spread his methods widely, as did his extensive correspondence with leading naturalists all over Europe. He was granted nobility in 1761, becoming Carl von Linné (Linnean Society 2008).

This paper describes an advisory study conducted on the Caribbean island of Mustique prior to development for tourism. It is argued that the ecologist uses biological as well as physical indicators to assess suitability of different areas for development and to anticipate possible problems. In this study the primary environmental determinants and biological and human factors have been interpreted to identify the distribution and degree of seriousness of exposure, erosion potential and water yield and quality. The compatibility of physical and ecological factors with different categories of proposed development have been assessed, and maps of vegetation, soil and exposure transferred onto gridded overlays. The use of these overlays combined with a consideration of the compatibilities permitted the degree of restraint to the various categories of development to be presented in map form. The problems that are likely to be encountered as a result of development are discussed, and finally it is suggested that the development be subjected to regular ecological monitoring.

Upon review of this paper, I suspected I may be on to something extraordinary. The foundation to any proposed plan for RIS sustained economic development *must* begin by determining carrying-capacity, and not only did this plan indicate that the developers of Mustique had commissioned one (please keep in mind how unusual this would have been in the late 1960's), they had done so *from day one*. PEI, for example, has never conducted a carrying-capacity study.

Mystique seemed to offer one of the best possible laboratories for a relatively controlled experiment in economic development:

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Thirdly, land-use is considered, and the identification of past and present demands on the area and their relationship with the existing vegetation structure helps predict future carrying capacity. The factors determining carrying capacity must be identified in order to plan and regulate future growth (Dower, 1966). These include the availability and quality of water supplies, availability of building materials, liability to erosion and exposure, the problem of waste disposal, and the environmental quality required. Many of these require specialist advice, but the ecologist is able to indicate possible environmental effects resulting from each recommendation and to predict the results of their combined application.

Not only was this paper a true treasure, the end-notes seemed to offer a map to another, perhaps even more valuable, hidden treasure:

LLEWELYN-DAVIES, WEEKS, FORESTIER-WALKER & BOR, 1970. *Mustique: proposals for a development study*. Unpubl. Rep.

Now let's consider the original, unpublished, LLEWELYN-DAVIES, WEEKS, et. al. (1970) *Mustique Development Plan*. This plan is truly extraordinary, and, to my knowledge, unprecedented, as it marks the only known instance of the ecologically planned development of an uninhabited, relatively insular island from day-one. I will also note that the document also serves as an illuminating contradistinction to *The PEI Development Plan*, which was written only one year prior (1969). These two antithetical approaches demonstrate the game matrix noted above: The PEI plan set the path for intense economic development with no regard for the ecology. The result was short-term economic gain shortly followed by both ecological and economic collapse. The Mustique plan, however, mandated ecological preservation with very little emphasis upon economic development. Again, referring back to the matrix above, it should come of little surprise that The Mustique Co. was cash-flow negative from 1958-1988! However, based upon my current estimates, this small, water-less, nearly resource-void island member of one of the most impoverished Caribbean nations, commands undeveloped (bare-land) values amongst the highest *anywhere* in the world: $2,000,000/acre! Moreover, Mustique's ecosystem is perhaps the healthiest in the Caribbean.

Presently, my dear patient Ålanders, I will offer a surprise, optional ending, and token of thanks for travelling this far with me. It is, in essence, the embodiment of the pure RIS development strategy. It is collection of key excerpts from the original, unpublished, and naturally beautiful LLEWELYN-DAVIES, WEEKS, et. al. (1970) *Mustique Development Plan*. Although the discourse presses on following these excerpts, this preview of our conclusion for this segment may offer yet another jumping off point for readers running short on interest or time:

> Since Mustique is a small island under single ownership..., development will be inherently expensive. But it will also offer the opportunity of preserving an especially high quality of environment ....
>
> Although we have found some indications from the regional demands and projections, it is the nature of the island itself that must determine the actual quality and quantity of the potential demands that should be accommodated, firstly in terms of environment, secondly in terms of service problems and costs....
>
> The charm of Mustique derives largely from its hilly topography. These hills, acted upon by the sea and the prevailing winds have divided the island's 1400 acres into a number of distinctly different

microclimates, and have given rise to a curving coastline that is long (12 miles) in relation to the area it encloses....

The variety of these separate places, with their interplay of forest, rocky headland, sandy bay and turquoise sea, creates an impression that makes the island seem much larger than it actually is. The hills also afford fine views of the white beaches and out over the neighbouring islands....

In order to discover the most suitable use for the land and achieve the best fit between the activities of man and the natural systems, an ecological survey was undertaken..., for it is obvious that the varied geology, vegetation and wild life of Mustique and the sea around are crucial to the attractiveness of the island....

The aim of this study was to identify areas of special interest for conservation, and to find ecological indicators for the degree of intensity and type of use for which the land is best suited....

It is necessary to ensure that no unique species or features of outstanding natural beauty are destroyed by development. Similarly the extent and variety of the vegetation on Mustique contributes greatly to the-charm of the island, and must be preserved.....

Mustique is an extremely beautiful island and one which is very rich biologically. At the same time, the natural resources of the island are in limited supply or extremely sensitive to development. The challenge that must be met by the developers is to utilize its charm and habitat richness whilst maintaining its delicately balanced ecosystems in as natural a state as possible....

Several primary physical features of the island combine to determine the range of possibilities for development. These are, most notably, the availability of water, the pronounced alternation of wet and dry season, the physical make-up of soils, wind velocity, salt spray and soil salinity. These same features also determine the kind and distribution of the naturally renewable resources of plant and animal communities and, at the same time, determine their response to various kinds of development. Careful exploitation and management will be required to ensure that the biological habitat-types represented in the island's ecosystems continue to contribute to the beauty and interest of the environment...

The biotic component of the island's ecosystems is seen as a resource in its own right. It contributes to the quality of the landscape and contains plants and animals in a little-disturbed, semi-natural environment which justify conserving in their own right. It is difficult to make an assessment of the conservation status of Mustique from a scientific point of view without a more extensive survey of neighbouring islands and literature. However, it is clear that some individual species obviously deserve protection and these include the turtles and iguana. More important, in the context of the proposed future development, and as an important contribution to the island's character, is the conservation of a range of habitat types and these should include more mature areas of forest, coastal scrub, sea-grape communities, and mangrove swamp...

There appears to be universal agreement that the scenery on Mustique is superb and this beauty is derived from an interplay of forest, rocky headland, sandy bay and turquoise sea. The quality is partly the result of the small scale of this heterogeneity and the feeling of being on a small, secluded island and yet one so little exploited that an excursion to any beach or headland requires a half-day expedition. This sensation of being on both a very small and a very big and varied island is important to preserve.

Secondly there is a smaller scale of beauty and interest. This is totally attributable to biological components of the environment such as the widely distributed solitary cacti, the palm plantations, epiphytic plants, windswept distorted trees, and the occasional tortoise, humming-bird or butterfly. Thirdly there is interest that derives from past and present forms of land-use. Relics of the past include an abandoned village, Fort Shandy, Carib remains, a solitary cannon, a sugar-cane press, old wells and water-tanks. Present day activities also contribute to the interest of the landscape and most visitors will appreciate seeing cattle and ponies, fields of pigeon pea and cassava, scattered mangoes and tamarinds. citrus groves and banana plantations....

> The case for maintaining and developing the agriculture of the island partly rests on the importance of preserving the feeling for the visitor of being part of a functioning system as well as to open-up views and increase diversity in the landscape....
>
> Most visitors would appreciate interpretative facilities to enable them to understand more of the variety and richness of the flora, fauna and history of the island. We suggest that an information centre be provided and short, self-guided nature trails from natural focal points such as beaches and the lagoon. These should not be *too* arduous and should provide an alternative route back to the starting point....
>
> Mustique is a special and unusual place. The natural resources of this beautiful island must be safeguarded, and all development carefully designed to complement the landscape. We have tried in this report to create a planning framework of which the principles are comprehensible as a kind of language of "the way things are done here".
>
> In this report we have particularly concerned ourselves with the relationship between peoples and places. We feel that for the charm of the present day Mustique to grow into a special identity that can be comprehended by people arriving on the island, the development of tourism must be seen to enhance the landscape and benefit the local islanders. Only if the planning framework is administered by people who care about this, will visitors wish to belong there and participate in the island's plan for growth. For when people belong to a place and feel that they can interact with it, the place will grow fruitfully. We hope that the principles outlined in this report, both physical and methodological, will help ensure a harmonious and profitable future for Mustique.[1]

For those signing off, thank you and farewell!

For those hearty wayfarers marching on, thank you, naturally, too; let's press on without further ado:

For the sake of brevity, we'll simply indicate that the Mustique Development Plan represents a nearly ideal application of the *Funk-Zweikampf* solution for dominant RIS economic development strategy, and thus represents a qualitative description of one half of the complete *Funk-Zweikampf Solution,* our solution to *The Problem of Sustainable Development*. Again, the other half of this solution, the GEMS development strategy – though outlined in our axioms, is detailed in our third discourse.

Presently I will emphasize that *The Funk-Zweikampf Solution* was largely achieved on Mustique through (1) Colin Tenant's initial vision and *privatization,* (2) the acquisition of *asymmetrical rights,* (3) two independent men named Money-Coutts and von Neumann, (4) the commissioning of a comprehensive *ecological* development plan, (5) the prudent, evolutionary stable management and execution of this development plan by the Hon. Brian Alexander, and, presently, (6) the relative insularity protected, fostered, and insured by the controlling partners of The Mustique

1 pp 7 – 43.

Company.

Given the inherent weakness in constitutional construction (national constitutions were all drafted without considering the possibility that natural resource consumption could outstrip natural resource renewal), a democratic majority will invariably choose present consumption over future preservation and inevitably degenerate into *The Tragedy of the Commons*. Brian Alexander was kind enough to offer a critique of my positions regarding Mustique (see APPENDIX VI), and his single, yet fundamental critique was that Mustique's success was only possible with extraordinary capital reserves. I completely agree that, given media's extraordinary influence upon human rationality and behaviour, it may be very difficult to accomplish this otherwise today, but there is another way: A relatively insular population of cooperative[1] agents must either have (1) excess capital/natural resources at their disposal, (2) be willing to choose to live with *much less conspicuous consumption and conspicuous leisure*[2], and/or (3) willing to amend constitutions accordingly.

The Hawaiian archipelago offers an excellent example of this solution. Although, our theory of value suggests that these islands are naturally endowed perhaps the highest level of relative insularity on Earth, decades of hyper-intensive development and rapidly diminishing levels of relative insularity have sparked some of the highest crime and drug addiction rates *anywhere* in the United States. This archipelago, however, also demonstrates that a homogenous, close community of independent, self-sufficient, cooperative individuals (in this case the residents of Molokai), may elect to fight to retain high levels of relative insularity. Consider the remarkable story of Molokai, reported Sunday, March 30, 2008:

> Molokai, the least-touristy of the major Hawaiian islands, is about to lose much of what little tourist infrastructure it had.
>
> After a five-year battle with island residents over the construction of luxury beach homes, the owners of Molokai Ranch said they would cease all operations Monday and would "mothball" the 22-room Molokai Lodge, the 40 "tentalows" at the Kaupoa Beach Village and the 18-hole Kaluakoi Golf Course, among other

1 The word cooperative is used because the two individuals are supposed to be able to discuss the situation and agree on a rational joint plan of action, an agreement that should be assumed to be enforceable (Nash 1953, p 128).

2 See Veblen 1899.

properties.

They also planned to shut down their 60,000 acre cattle ranch and lay off 120 employees.

"The decision is purely a business one," said Peter Nicholas, chief executive officer of Molokai Properties Ltd., in a press release.

Last year, as island residents sought to block the plan to build multimillion-dollar beach homes, a Molokai Ranch spokesperson warned that the opposition could force it to shut down entirely.

"We don't think this is a bluff," said Terryl Vencl, executive director of the Maui Visitors Bureau, which oversees tourism on Molokai. "We think it's for real, and that's what we're preparing for."

The closure of the Molokai Ranch properties leaves only about 100 rental units on the island - the Polynesian-style Hotel Molokai and a handful of small condominium complexes, all in the town of Kaunakakai.

Tourism has never managed to gain a solid foothold on the island that dominates the view from Kapalua on Maui. Even plans for visits by cruise ships have sparked protests by some island residents.

But Molokai has always welcomed visitors willing to take the island on its own terms, sharing a relaxed lifestyle that doesn't move to the rhythms of large commercial resorts. It attracts those looking for a glimpse of Hawaii as it was before it was colonized by the Hyatts and Hiltons.

Last year National Geographic Magazine ranked Molokai the sixth-best island in the world (in terms of sustainable development), citing its "rugged coast and minimal beach-front preventing big-resort development and protecting Hawaiian cultural ways." It was the only Hawaiian island to make the top 10.

It may be fair to state that the overwhelming continental economic doctrine practiced and preached on RIS has been detrimental for RIS, GEMS, and thus the entire planet. I will briefly note that I have departed from the generally accepted usage of SIDS[1] due to the potentially misleading connotation this acronym may confer: this designation freights the similar, vexatious connotation that “third-world” carries (I have yet to discover evidence of a second-world), and personally, I find it more useful and far more honest to refer to contrasting economies and ecologies as “over-developed” and “relatively pristine.” *Small Island Developing States* seems to impart the connotation that so-called *economic development* is lacking, necessary, and/or a foregone and necessary conclusion whereas, when

1 Small Island Developing States (SIDS) include low-lying coastal countries that share similar sustainable development challenges, including small population, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, and excessive dependence on international trade. Their growth and development is often further stymied by high transportation and communication costs, disproportionately expensive public administration and infrastructure due to their small size, and little to no opportunity to create economies of scale.

empowered with a theory of value based upon relative insularity, this is almost always *not* the rational, dominant economic development strategy for RIS. Indeed, it is a significant challenge to find a single working paper or journal article that does *not* prescribe RIS remedies *as if these relatively small islands and "poor nations" ("poor" in terms of GNP, that is) had the continental resources and warfighting capabilities necessary for the successful deployment of such economic agendas!* Moreover, these so-called remedies are being prescribed without taking into consideration the true value propositions the *relative* riches RIS generally possess in their pristine, undeveloped states: pure water sources, no pollution, cooperative behaviour (and thus low crime rates), independent, self-sufficient inhabitants, cultural homogeneity, relatively high life expectancies, relatively happy inhabitants, etc.

Consider the following conjecture:

> Small Island Developing States (SIDS)... share similar sustainable development challenges, including small population, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, and excessive dependence on international trade. Their growth and development is often further stymied by high transportation and communication costs, disproportionately expensive public administration and infrastructure due to their small size, and little to no opportunity to create economies of scale.
>
> Now consider our alternative conjecture:
>
> Relatively Insular States (RIS)... share similar sustainable development *opportunities*, including small population, limited, *unpolluted* resources, remoteness, relative *immunity* from economic development vulnerabilities (shocks which result from excessive dependence on international trade). Their natural resource preservation is facilitated in part by economically infeasible high transportation, communication, and infrastructure costs (and thus these costs are not elected and *not* incurred) associated with GEMS development strategies. Thanks to their small size and little to no opportunities for economies of scale, pollution, crime, trade dependence, and other related negative externalities are generally avoided.

Most of the institutionalized free-trade, maximum economic development-focused development plans were put into play on islands (especially the Caribbean) and in other small, developing economies during the late 60's (such as the PEI development plan) and early 70's, popularized by influential theorists such as William G. Demas. This continental approach is great for short-term growth, but disastrous for long-term sustainability. Without exception, UN economic working papers directed toward the economic development of insular economies continue to exhibit dysfunctional ignorance of this issue. And this amplified and continues to amplify the situation, since "the UN is the

most important international organisation for all small states,"[1] as the Commonwealth Secretariat reported in their aptly (and erroneously) entitled *Overcoming Vulnerability: A Future for Small States*. Briguglio's *Small Island Developing States and their Economic Vulnerabilities* demonstrates how a continental economic approach utterly fails to grasp the counter-intuitive island-based value of insularity: "SIDS... face special disadvantages associated with small size, insularity, remoteness."[2]

Briguglio imparts that "the idea of constructing a vulnerability index developed in international fora during discussions dealing with the *disadvantages faced by island developing countries,*"[3] and it was in fact this fundamental error, the *inability to see the extraordinary long-term value in small size, insularity, remoteness, inaccessibility, etc.* which inspired the author of this discourse to formulate an economic *Theory of Value* based on relative insularity.

Briguglio et al.[4] have been churning out these papers for decades for the UN and so-called SIDS, and their influence has been extraordinary. On his home island home of Malta, for example, Briguglio teaches economics at the University of Malta, directs the "Islands & Small States Institute," and continues to generate and broadcast his fatally flawed approach to students, the UN, the World Bank, and beyond: "Professor Lino Briguglio... was commissioned... by the World Bank and the Commonwealth Secretariat to write a report on the strategy that small states *should*[5] adopt in the coming years."[6] Indeed, Malta has followed and adhered to a Continental economic

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1 p xii

2 1995, abstract.

3 Ibid, p 1615.

4 For example, see: Fischer & Encontrre, 1998.

5 Note this normative assumption.

6 (a) Professor Lino Briguglio, the Director of the Institute, was commissioned, together with Professor Bishnodat Persaud and Mr Richard Stern by the World Bank and the Commonwealth Secretariat to write a report on the strategy that small states should adopt in the coming years. The [2006] report is entitled 'Toward an Outward-Oriented Development Strategy for Small States: Issues, Opportunities, and Resilience Building' (UM 2007, p1).

(b) *Conclusions and Recommendations.* Taken together, the above challenges suggest that efforts to prolong reliance on preferences do not have promising or productive prospects. Instead, small states should shift their attention to designing and implementing aggressive outward-looking export based development strategies. Indeed, for preference-dependent small states, nothing less than a repositioning of their economies is required. This entails increased emphasis on efforts to exploit and create comparative and competitive advantage in the service sectors, including tourism, finance, insurance, health, education, internet services, and e-commerce, while at the same time not neglecting scope for competitiveness in other sectors, including agriculture and niche markets. By their nature, the service sectors are less vulnerable to the high transport and other infrastructure costs faced by many remote small states, and, in contrast to traditional commodity exports, have robust long term market prospects. However, scale disadvantages, especially for the very small states, remain

development approach since gaining independence:

> Within the United Nations, the issue of the special problems faced by island developing countries was first specifically raised during UNCTAD III in 1972, where the focus of attention was the disadvantages associated with insularity and remoteness. Subsequently, other fora within UNCTAD identified additional disadvantages peculiar to island developing countries. By 1988 a wide array of such disadvantages were recognized, as evidenced by a comprehensive document prepared by UNCTAD in preparation for a meeting of a group of experts on Island Developing Countries, held in Malta in May 1988.' The deliberations of the Malta meeting led to a UN resolution recognizing that in addition to the general problems faced by developing countries, island developing countries suffer additional handicaps arising from the interplay of such factors as smallness, remoteness, geographical dispersion, vulnerability to natural disasters and a highly limited internal market.[1]

And to be sure, Malta is regularly cited as an *extraordinary economic development success story*.

But it has been neither a success nor a failure, for a sufficient time series has not yet come to pass. Although some may see success, I submit this is the problem of myopia: in terms of geologic time, even in evolutionary time - Malta has not successful for *any* significant time at all. And Malta's future prospects seem rather unappealing: with a population several times over the island's carrying capacity, no fresh water, and a mountainous landfill which dominates the landscape (visible from *all* vantage points on the island!), Malta appears to teeter upon its breaking point. Briguglio's emphasis is misguided, for his approach leads to continental economic solutions and consequences: short-term economic gain and long-term, ecological *and* economic destruction. RIS face very special, counter-intuitive *advantages* associated with small size, insularity, remoteness! The free-trade continental economic development plan is certainly taking a serious toll on the Caribbean (indeed, the value proposition in the Caribbean diminishes daily, and, the problem is, there's no turning back now; these economies are *dependent* upon the economic activities which are rapidly driving the majority to ecological (and, naturally, economic) ruin.

Take for example, a paper delivered as the third *William G. Demas* Memorial Lecture at the Caribbean Development Bank by José Antonio Ocampo, Executive Secretary, Economic Commission for Latin American and the Caribbean in the Cayman Islands, on 14 May 2002:

These trends suggest that very small developing states are able to strive and compete internationally on the basis of a

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significant, and will require special attention (Briguglio 2006, p v).

1 Briguglio 1995, p 1615.

> *narrow specialization*, based on their natural advantages. For developed countries, the size of the domestic market is no longer an obstacle for building up a modern economy and successfully competing in international trade, as the example of small European countries indicates (p 6).

Yes, *trends* have suggested a great number of irrelevant things to many misguided individuals, including the correlation between sunspots and corn prices,[1] and film revenues and sub-atomic particles,[2] and this magic trick is especially easy to pull off since economics, as we have asserted, has had no a *meaningful* theory of value. This Demas Memorial lecture embodies perhaps the most common misguided mantra: given diseconomies of scope and scale, *you must find your niche*, or simply, *specialize*. I must report some very important news: That is bad advice. For every success lies a hecatomb of failure, and what few success stories there are typically *over* not long after they're discovered. *A Taste of Small-Island Success: A Case from PEI* captures the essence of this problem:

> Smallness and insularity have been traditional markers for the absence of economies of scale, viable markets, labour power and expertise, and business know-how. Loaded with such structural handicaps, small-island societies often are seen as clearly doomed by the accident of geography to eke their way as bastions of protectionism and as targets of interventionist bale-out and hand-out programs.[3]

The spirit in this paper is on track—for it represents a quest for the elusive unicorn known as 'Sustainable Economic Development'—but the sound logic and methods of the theorems of continental economics backfires on islands. Consider: *Small-island societies often are seen as clearly doomed by the accident of geography*. This notion is widely

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1 Jevons' romance with statistical investigations unfortunately carried him to the most fanciful and, unfortunately, the most ridiculed idea of his life, the explanation of commercial crises on the basis of the periodic alteration of spots on the sun. The "sunspot theory" integrated Jevons' earlier work on the prices with his lifelong interest in astronomical and meteorological phenomena. In "The Solar Period and the Price of Corn" (1875), he put the matter succinctly:

> If the planets govern the sun, and the sun governs the vintages and harvests, and thus the prices of food and raw materials and the state of the money market, it follows that the configurations of the planets may prove to be the remote causes of the greatest commercial disasters (Ekelund and Hebert 1997, p332).

2 (a) Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's 'Nobody knows anything' theory and advance our replacement theory: George Lucas knows something (Funk 2007b, abstract).

3 Baldacchino, 2002, p 254.

held because, from a *Continental Economics* perspective, it *is doomed*! And yes, quite naturally, *The PEI Preserve Company*, that savvy, successful, resourceful firm that, against all odds, *found its niche*... filed for bankruptcy in May of 2007.

However, from an *Island Economics* perspective, small-island societies are clearly *saved* by the *miracle* of geography, by the miracle of *insularity*. How are they saved? By realizing it may be better *not* to find your niche!

When RIS recognize with the *true nature*, *reality*, and *rationale* of the *insular geographical* cost/benefit equation: *insulation from* violent crime, *insulation from* toxic externalities (including both industrial and consumption based externalities, such as traffic noise, pollution, and congestion), cooperative, other-regarding behaviour, innumerable intangible and unquantifiable benefits from insularity and living close to the land, and, ceteris paribus, *less potential for monetary gain, fewer employment opportunities,* and *less significant economic development possibilities!*

Although I refuse to assert what one should or should not do, that's the dominant, pure RIS strategy, take it or leave it! (Again, however, a mixed strategy is another story: imagine, if you will, a relatively insular island in the Baltic Sea, which happens to have leveraged a competitive, geo-strategic advantage: its position between Sweden and Finland. The dominant, mixed strategy for economic development *on* these particular islands is simply a pure RIS strategy. However, the dominant, rational economic development *off* the island is a pure GEMS, maximum economic development strategy: Transport as many tourists possible, sell as much alcohol as possible, sell as many duty free goods as possible, ship as many containers as possible – and let these and related businesses grow naturally, and make certain as few negative externalities as possible land *on* the islands. When a corporation on the relatively island of Japan wanted to be the number one pick-up truck manufacturer in the world, they did not build the plant on Japan, they built it in the middle of Texas. *RIS may effectively employ GEMS strategy when they are able to execute the strategy in a GEMS territory* – this is the essence of our dominant mixed economic development strategy.)

Insulation from toxic externalities is a fairly straightforward value to understand and appreciate, but I will briefly hint at the extraordinary value other-regarding behaviour has to offer. Other-regarding behaviour, it is well

understood, increases as eye-to-eye contact increases, thus, ceteris paribus, other-regarding behaviour increases as the size of an island decreases (and population density increases), and as Stiglitz[1] noted:

> As in Darwinian ecological models, the major determinant of one's environment is the behaviour of others, and their behaviour may in turn depend on their beliefs about others' behaviour... As Darwin noted after his visit to the Galapagos:
>
> > How has it happened in the several islands situated within sight of each other, having the same geological nature, the same height, climate, &c... This long appeared to me a great difficulty: but it arises in chief part from the deeply-seated error of considering the physical conditions of a country as the most important for its inhabitants; whereas it cannot, I think he disputed that the nature of the other inhabitants, with which each has to compete, is at least as important, and generally a far more important element of success.[2]

I should also highlight that the aforementioned *intangible benefits from relative insularity and living close to the land* are unquantifiable because, as we will soon consider, economics does not offer a *Theory of Value*. For example, when a fisherman on the north shore of PEI takes cod or lobster or mackerel from the sea, handles them with great care (using only a trap or a line and his or her own two hands), then brings home, cooks them, and feeds them to the family within three hours time, how much is that *worth*? First of all, in terms of National accounts, it worth nothing, as it is generally not accounted for. Secondly, no British queen, no Saudi prince, no Manhattan media mogul can acquire such a meal *at any price*. Certainly, they may have the means to procure a great French chef schooled in extraordinary sauces, and although it will not be readily apparent when the sterling silver dome is lifted from the antique Chinese porcelain, it will be almost certain that, beneath the sauce lies a 'fresh' sockeye salmon (for example) that was caught at least three days prior, sat in the sun for several hours on the deck of a boat in the mouth of the Naknek river, sat in hold of a shore-based processor for 12 to 18 hours, was processed by many relatively indiscriminate hands along a conveyor belt in a processing plant in King Salmon (or Dutch Harbour or Kodiak), flown to Anchorage, flown to Los Angeles, flown to London, then arrived at the marketplace where the *Le Cordon Bleu* trained chef procured it and took it to the palace to prepare a sauce succulent enough to mask any hint of foul taste or

1 2001, p 521-522.

2 Darwin 1859, p 400, also see Fehr & Fischbacher 2004 ; Fehr & Rockenbach 2004.

odour.

Coming to grips with this hereto unquantifiable *asset* (unquantifiable, that is, until we employ our theory of value) is critical to coming to grips with the essence of sustainable economic development. If these ecological resources are lost or diminished, the economic loss is equally unquantifiable, but almost certainly catastrophic: RIS lose the primary advantage they truly possess (Ferrer-i-Carbonell & Gowdy 2007). Consider the collapse of the Newfoundland cod fishery, for example. Economists have *mistakenly* valued the collapse of one of the most valuable fisheries on earth at approximately $30 Billion CAD. Imagine, for the sake of this example, that Warren Buffet had endowed the people of Newfoundland with $30 Billion CAD instead of endowing it to the Bill and Melinda Gates Foundation: Would this endowment offset the loss? For one, I submit this endowment would have *actually made things worse,* (by begetting greater dependency), but what we're considering here is that $30 Billion CAD doesn't remotely approximate the collapse of perhaps the most valuable fishery on earth; to do so would require a valuation of life on earth, because in losing this fishery we have lost life on earth, the prospects of our collective survival are thus also diminished. Also, speaking regionally, $30 Billion CAD would not come close to compensating thousands of families whom have lost *generations of social learning*. Fishing knowledge, seamanship, navigation, and survival skills in general, which were acquired over the past three hundred years, will not be passed down to future generations in Newfoundland. A dramatic loss of evolutionary fitness has also befallen the people of Newfoundland. I'd be curious to see an economist attempt to quantify that.

If we accept Axiom I (see Appendix I), as time moves forward, the few RIS willing to employ our counter-intuitive *Theory of Value* (meaning an economic sacrifice in the present for economic and ecological value in the future), stand to watch the value of their ecological assets increase and become ever-more sought after as healthy, inhabitable environments, tourist destinations, etc. Why is tourism the largest industry on Earth? Because humans consistently reveal a preference for relative insularity: An investment banker struggles and pays a heavy physiological price for toiling on the insignificantly insular island of Manhattan, then gladly trades hard earned dollars for relative

insularity: two weeks of the year in Hawaii, a house in a *gated-community* in Connecticut, a summer house in the Hamptons, a *private* school for genetic offspring, etc. Quite often, however, the highly sought-after relative insularity proves to be an illusion. Although our investment banker may not (yet) be able to quantify it, somehow he feels his week in Barbados or Bermuda or Key West didn't offer the insularity he was looking for. In fact, he feels that he needs a vacation – *he needs to get away from it all* – more afterwards than before. Indeed, *if he had been able to run the numbers*, he may have actually discovered that Manhattan offers greater relative insularity than Key West and Bermuda and Barbados! But he'll need our theory of value based upon relative insularity before he's able to run those numbers.

When islands chase continental economic mirages, such as the pursuit of commercial agriculture (CBC 2007a, CBC 2007c), sooner or later, they lose money *and* the benefits their island ecology once offered: through amplification-by-compression, they experience *greater* pollution-related effects than continental counterparts, and do not have other industries to fall back on, unless, that is, they are unfortunate enough to have a co-dependent federal parent willing and able to enable their march down the road to self-destruction.

In *On the Problem of Dependent People: Natural Resource Valuation Errors in Atlantic Canadian Island Jurisdictions,*[1] I noted the largest bankruptcy in PEI history (-$24 MM CAD) was a welfare-funded (Ottawa) fish-plant which was built, of course, with the mad delusion of *stimulating economic growth*. I added that 'Delusion' may not even be a strong enough word for it, because rational agents would not build a plant to process a fishery that it was simultaneously endeavouring to destroy. Three years ago, the Federal government also funded a beef plant for this dependent province, which has lost $12 MM CAD to date. Unnaturally, but quite like the parent of a dependent child who has become unable to stand on his or her own, the federal government recently bailed this plant out as well. I added that, although I refused to commit the prosaic *Economists' Error* of issuing predictions,[2] I wouldn't be surprised if these doors

1 Funk 2007c.

2 The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the

close soon as well. And as it turned out, I was right, they did.

The simple solution for pure RIS economic development is this: Do as little as possible, disturb as little as possible, foster the healthiest environment possible, for that *is* and *should always* be an island's greatest asset! This prescription is not a call to return to the dark ages, but a call to scrutinize, very carefully, what industries, what economic development projects, imported goods, &c are actually required for (and promote) a relatively high standard of living. In most situations, island governments *should* represent small, manoeuvrable speedboats amongst an armada of cruise ships (continental bureaucracies), and be thus able to provide unusual, perhaps even radical protection and benefits that continental analogues can not (due to the extraordinary property rights proxied to corporations and their lobbyist). For example: what are the costs and benefits of cigarette consumption? The strain on the healthcare system alone is onerous, and every additional export carries high externality costs. People will emigrate; that will actually *help*. With very little assistance (but a great deal more environmental protection) the island will reach its bio-equilibrium (for all species, including humans): "Institutional adaptation and resource conservation can be critical in achieving population stability" (Erickson & Gowdy 2000, abstract). Worried about so-called *brain-drain*? Brain drain is exactly what you want, since these *brains* have been schooled in the principles of continental economic development. Staying home and practicing what they've been taught will likely make matters worse! The only cure is to teach the principles of island economics, the value of relative insularity, the value of independence, and the value of self-sufficiency. Otherwise, they're better off – for themselves, the island, their fellow islanders, and the world at large – practicing what they've been taught on the island of Manhattan.

Moreover, scaling down instead of up inhibits financial shocks. During the late-1920's and 1930's here in PEI, for example, when approximately 50% of the 100,000 inhabitants were small-scale, sustenance farmers and fishermen: While the rest of North America spiralled into the Great Depression, *island life* marched forward in a farming-and-fishing-as-usual fashion, well *insulated* from the effects of the depression. Those independent islanders

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actual participants in an economy, the consumers and the producers (Hayek, Bartley, & Kresge, 1991, pp 8-9).

were more than able to make it on their own. This finding was initially based upon conversations with north-shore fishermen, including my father-in-law, Ronald Campbell, who has fished off the north shore for the past 50 years; his father fished, farmed, and lived a comfortable, almost entirely subsistence-based (including barter) life on the north shore throughout the depression (also see Larkin, 1990). More recently, however, it was confirmed by Steward Shepherd, one of the five economists hired to develop and write the PEI economic development plan of 1969. Shepherd noted the plan was initiated, essentially, because *per capita income* was lower on PEI than in the other provinces of Canada, *but life expectancy and the standards of living were not lower*. This is the crux of the problem: per capita income was almost completely irrelevant because economic had no *theory of value*. Shepherd, whom I have discovered to be a truly wise economist and a gentleman, readily concedes the PEI development plan failed to consider ecological factors. And although he was almost entirely correct when he rightly defended this error by noting that there weren't any economists on Earth factoring ecological considerations in 1969, there was one economic development plan being drafted – nearly concurrently with the PEI plan – which did: The Mustique Development Plan.

But let's return to PEI for a moment. If, let us consider, hypothetically, a North American financial shock approximating the magnitude and duration of Great Depression occurred tomorrow (which, contrary to popular belief, becomes *more likely* as time moves forward),[1] the present-day, *dependent* inhabitants of PEI may be more predisposition to starve right along with the rest of the continent; in fact, it is likely much of the island population (primarily the 97% of the population who no longer fish nor farm (edible and thus barterable produce *other* than potatoes) would fare far poorer than the significantly more affluent and *perhaps* more liquid (and thus more mobile)

1 (a) Ever since the beginning of modern science, the best minds have recognized that 'the range of acknowledged ignorance will grow with the advance of science.' Unfortunately, the popular effect of this scientific advance has been a belief, seemingly shared by many scientists, that the range of our ignorance is steadily diminishing and that we can therefore aim at more comprehensive and deliberate control of all human activities. It is for this reason that those intoxicated by the advance of knowledge so often become the enemies of freedom… The growth of our knowledge of nature constantly discloses new realms of ignorance… The more men know, the smaller the share of all that knowledge becomes that any one mind can absorb. The more civilized we become, the more relatively ignorant must each individual be of the facts on which the working of his civilization depends (Hayek 1945).
(b) Also see Buffet (2003), Danielsson (2000), and Shiller (2000).

continental counterparts.

Consider the fact that

> the 17th century saw several attempts to develop the PEI fisheries through grants made by the French crown for monopoly fishing or sealing rights... *Because of PEI's remoteness, its poor north shore harbours*, and political squabbling, *none of these projects was ever realized*.[1]

Now I am able to truly illustrate the counter-productive and destructive nature of employing continental economic development strategies on RIS. From an *Island Economics* perspective, this was actually an *economic miracle*. The relative access to the deep water harbours on PEI's south shore have helped turn the Northumberland Strait into a lifeless sewer, but the *poor north shore harbours* have *preserved* the north shore's ecology *and* its economy! PEI's most productive fishery, most desirable tourist destinations, most desirable (and valuable) real estate, most healthy water-sheds (and thus most pure domestic well-water), are a direct result of these *poor north shore harbours*![2]

The world-class, economically viable, deep-water harbour in St. John's, Newfoundland served as a fantastic port to facilitate all kinds of rapid growth and development, including a manufacturing facility for factory trawlers. The harbour was so economically stimulating, in fact, that Canada was able to fish the most productive cod fishery on earth to commercial extinction.

The inverse situation, meanwhile, played out to the north:

> Compared to Newfoundland, Iceland's domestic fisheries remained at very low levels of effort and catches until the early 20th century... In the period 1905-1909, Icelandic groundfish landings averaged only 48.4 thousand metric tonnes, or about a quarter of those of Newfoundland.[3]

So, you may wonder, as a naturalist, explorer, economist, strategist, problem solver, and living organisms, fully engaged in his own *struggle for life*, what insight might I offer the Ålanders pertaining specifically to Ålanders challenges?

Well, I trust that you have already found my discoveries on other islands have helped framed struggles of your

1 Arnason & Felt 1995, p 101.
2 Benson, Van Leeuwen, Sanchez, Dohoo, & Somers 2006.
3 Jónsson 1995, p 271.

own. Other than that, I should say as little as possible. Though I believe I have gained a rather thorough working knowledge of island life on PEI, I have been living on this island for three years now, and it seems I had merely scratched the surface after one year, and came to understand economic, biogeographical, geological, political, constitutional, psychological, and evolutionary mechanisms, and the role of relative insularity after two years. Thus, at *this* juncture, most of what I have to offer Ålanders are the trials, tribulations, successes, and failures I've observed on *other* islands, because the highly idealized methodological approach I have adopted began with Alexander von Humboldt and the great explorers he has inspired,[1] and thus, like these restless searchers, I believe that

> only through travel, despite its accompanying risks, could a naturalist make the diverse observations necessary to advance science beyond dogma and conjecture. Although nature operated as a cohesive system, the world was also organized into distinct regions whose unique character was the result of all the interlocking forces at work in that particular place. To uncover the unity of nature, one must study the various regions of the world, comparing and contrasting the natural processes at work in each.
>
> The scientist, in other words, must become an explorer.[2]

Thus, once again, I look forward to exploring Åland. And if I should happen discover a few upon your shores – as I will endeavour to do – I will be pleased to turn over what I find.

In the meantime, however, I will merely offer a few preliminary ideas which I have formulated from afar. In short, hold your course, do as you have done throughout the centuries: follow your instincts, maintain you fierce independence, interfere with the evolutionary process as little possible, but do everything possible to maximize ecological preservation and resist all temptation for economic development which compromises the ecology in any way. Also, I will suggest Ålanders helped *teach me* the dominant mixed RIS/GEMS economic development strategy: situate negative externality intense economical development capital investments *on the sea* and on *other* shores. Las Vegas gladly receives gambles from all 50 U.S. states and nations all around the world, but as for the heavy negative

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1 In the vast army of those who felt Humboldt's impact, perhaps one stands out above the others. He was a young, dreamy British naturalist who was so moved by Humboldt's accounts of his journey that he committed whole passages to memory and longed to make a similar voyage one day. When he was offered a post aboard a ship of scientific discovery in 1831, the young man quickly accepted, packing in his seabag his copy of Humboldt's Personal Narrative. The ship was the *Beagle*, the young man Charles Darwin (Helferich 2004, p xx).

2 Ibid, p 27.

social externalities (gambling, drug, and alcohol addictions, quite literally *the gambler's ruin*), Las Vegas largely defers these costs to the gambler's homeport to contend with. The province of PEI, for example, in yet another attempt to apply continental economic principles on a relatively small island, constructed an enormously expensive harness racing and gambling complex. Needless to say, it has bled dollars since day one and will never turn a cent of profit. To make matters worse, the province sought to off-set losses by adding slot-machines. When this proved insufficient to ease the haemorrhaging, it added card tables. Not only is the "Racino," as it is deftly branded, still losing money, if some great misfortune should bring you to PEI and you should happen to pass through the Racino doors, you will pay witness to a macabre PEI, day-of-the-dead, smoking, EI (welfare) nightmare reminiscent of Michael Jackson's *Thriller* video. The only customers losing money at the Racino are the already down-and-out
Inhabitants of PEI, and upon their homeport's doorstep do they fall.

Needless to say, I am a bit nervous about your casino. The strategic locale for alcohol sales and casino revenues are on the battlefields of continental economic development, and that includes the open waters of the seven seas.

I will also note that two million visitors per year may be high – but then again, this figure may largely represent transit passengers who do not alight on island soil. Needless to say, I submit a carrying-capacity study and regular assessments are in order.

The fact that your per-capita income ranks so highly is admirable, but largely irrelevant - pay as little attention to this essentially meaningless figure as possible, for if it should rise to number-one, in reality you may be worse off, and if it should fall precipitously, you may in fact be better off. The best indicator of your great success is plain for all to see: Your "health statistics are good… Average life expectancy is 2–3 years higher than in the rest of Finland. For women it is the highest in the Nordic countries."[1] As the years pass, keep an eye on this benchmark, for, ideally, it must *always* be on the rise. If it should remain flat, be concerned. If it should fall, be alarmed. The

1 Eriksson et. al. 2007, p 684.

basis for this conjecture is detailed in the third instalment of this trilogy, but in the meantime I would refer you to a recent, extraordinary paper out of the University of Chicago: Murphy & Topel's 2008 *The Value of Health and Longevity*. I might also refer curious readers back to Axiom I, and I might also add that human life expectancy is the figure used to calibrate values within the formula for our theory of value. I will also highlight the results from another important study:

> Save the Children's ninth annual Mothers' Index compares the well-being of mothers and children in 146 countries more than in any previous year. The Mothers' Index also provides information on an additional 27 countries, 22 of which report sufficient data to present findings on children's indicators. When these are included, the total comes to 173 countries. Sweden, Norway and Iceland top the rankings this year. The top 10 countries, in general, attain very high scores for mothers' and children's health, educational and economic status. Niger ranks last among the 146 countries surveyed. The 10 bottom-ranked countries – eight from sub-Saharan Africa – are a reverse image of the top 10, performing poorly on all indicators.
>
> Skilled health personnel are present at virtually every birth in Sweden, while only 33 percent of births are attended in Niger. A typical Swedish woman has nearly 17 years of formal education and will live to be 83 years old, 72 percent are using some modern method of contraception, and only 1 in 185 will lose a child before his or her fifth birthday....
>
> Sweden performed as well as or better than other countries in the rankings on all the indicators. It has the highest ratio of female-to male earned income, the highest percentage of women with seats in the national government and – along with Iceland – the lowest under-5 mortality rate in the world.[1]

I contend that these results are more important and more revealing, especially in light of the prospect that they may begin to bring our unified theory of value for the biological and social sciences into yet sharper focus. Take a closer look at the top-ten and bottom-ten places to be a mother (and thus, moreover, to be a human):

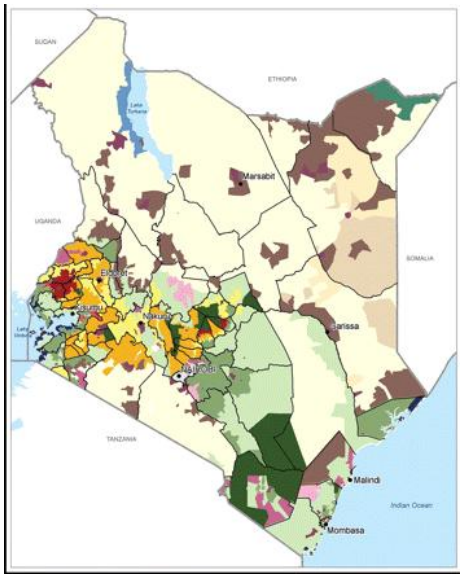
1 Sweden	**137 Ethiopia**
2 Norway	**138 Mali**
3 Iceland	**139 Djibouti**
4 New Zealand	**140 Eritrea**
5 Denmark	**141 Guinea-Bissau**
6 Australia	**142 Angola**
7 Finland	**143 Sierra Leone**
8 Ireland	**144 Yemen**
9 Germany	**145 Chad**
10 France	**146 Niger**[2]

1 SOWM 2008, p 39.

2 Conditions for mothers and their children in the bottom countries are grim. On average, 1 in 21 mothers will die from pregnancy-related causes. More than 1 child in 6 dies before his or her fifth birthday, and roughly 1 child in 3 suffers from malnutrition. About 50 percent

Is it a coincidence that Nordic countries dominate the top-ten, and African nations (especially sub-Sahara) are at the bottom?

One of the most illuminating features of our theory of value is that it clearly demonstrates that political philosophies and economic development theories are *neither* matters of personal preferences nor philosophical debate, but rather *biogeographical realities*. Please take a moment to consider the *Economic map of Kenya:*[1]



Map: *Economic map of Kenya. Poverty is not uniform across the country but depends on a host of geographic factors such as soil type and elevation. Okwi et al. analyze the effect of Kenyan geography on income.*

This map illuminates

> the link between poverty incidence and geographical conditions within rural locations in Kenya. Evidence from poverty maps for Kenya and other developing countries suggests that poverty and income distribution are not homogenous. We use spatial regression techniques to explore the effects of geographic factors on poverty. Slope, soil type, distance/travel time to public resources, elevation, type of land use, and

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of the population lack access to safe water and only 3 girls for every 4 boys are enrolled in primary school. The gap in availability of maternal and child health services is especially dramatic when comparing Sweden and Niger....

At the opposite end of the spectrum, in Niger, a typical woman has less than 3 years of education and will live to be 45. Only 4 percent of women are using modern contraception, and 1 child in 4 dies before his or her fifth birthday. At this rate, every mother in Niger is likely to suffer the loss of a child and 9 out of 10 mothers are likely to lose two children in their lifetime.....

Forty-four percent of Niger's children are malnourished and 54 percent lack access to safe water. Only 47 percent of children in Niger are enrolled in primary school, and within that meagre enrolment, boys outnumber girls 4 to 3 (SOWM 2008, p 7).

1 My first visits to the developing world in 1967, and a more extensive stay in Kenya in 1969, made an indelible impression on me. Models of perfect markets, as badly flawed as they might seem for Europe or America, seemed truly inappropriate for these countries (Stiglitz 2001, p 473).

> demographic variables prove to be significant in explaining spatial patterns of poverty. However, differential influence of these and other factors at the location level shows that provinces in Kenya are highly heterogeneous; hence different spatial factors are important in explaining welfare levels in different areas within provinces[1]

Perhaps contemporary economists should beg the Austrians for forgiveness for failing to recognize the complete relevance of one of their simplest, yet most powerful insights: *Location Theory*.

I might also add that, thus based on my primary criteria for economic and biological values alike, Sweden's economy/biogeography ranks 26 places above The United States.[2]

And although it might seem intuitive to conclude that organisms inhabiting the Nordic region, for example, as the *lucky* winners of some stochastic biogeographical lottery, this process was far from random; and understanding this process requires an evolutionary world-view.

Ask yourself if you were *lucky* to be born an Ålander? If you simply look back to the time of your birth, or your parents' or grandparent's birth, it is not likely that the answer to this question will be readily apparent. In order to make this assessment, you must look back more than 14,000 years, to the last time the ice sheets retreated, and left the *uninhabited* region which includes present-day Sweden and the Åland archipelago free for the taking *of the willing and of the able*. At this point in time, it is likely that your forefathers were living in the same region as my forefathers: present-day Germany. And, in the great *problem solving*[3] endeavour known as the *Struggle for Life*, it is likely that at least one of your forefathers, perhaps a nomadic reindeer hunter, (1) made the *decision* to head for this new-found land, and (2) proved fit enough to run the gauntlet of long-distance dispersal. Have countless stochastic elements played a role in this ultimately successful migration? Of course, but it has certainly not been all – I will not even say *mostly* – based upon luck; and it has certainly not been solely influenced by biogeography. And I submit we don't need to look as far as 14,000 years in the past to see why. Consider another passage from the *Save the*

1 Okwi *et al.* 2007 abstract.

2 The United States places 27th this year. Last year it was 26th.

3 See ABBREVIATIONS & DEFINITIONS: *Problem Solving*

Children's ninth annual Mothers' Index:

> Sweden is one of the best places in the world to be a mother or a child, no matter one's level of income – but it was not always so. In the 1920s, the poorest babies were up to 3.5 times more likely to die before reaching their first birthday, and the child survival gap was a source of political concern. In the 1930s, the Swedish government introduced a series of new policies, including free maternal and child health services, financial support to low-income families and general welfare and housing reforms. The preventive maternal and child health services rapidly achieved extensive coverage and particularly benefited the poor. By 1950, maternal health services covered about 60 percent of all pregnant women and child health services covered more than 80 percent of infants. These reforms led to significant reductions in social inequity and infant mortality. Today in Sweden, inequity in infant mortality has been almost eliminated and Swedish children – rich and poor alike – enjoy one of the lowest rates of child mortality in the world.[1]

Do I mean to infer that we merely need to look to the early 20th century for the origins of this fantastic survival success story? No, but I believe the fountainhead is easily seen flowing strong yet in the 10th century:

> By 1100 Denmark and Norway were largely Christianized, but in *Sweden paganism remained strong; a major cult centre continued to flourish at Uppsala, and it would be another century before the country was thoroughly Christian*.[2]

My mother always cautioned me when it came to discussing politics or religion amongst new acquaintances, and the prospect of this discussion becomes particularly unsettling in light of the fact that my mother and my wife are joining my Åland expedition. And although I've passed the bulk of this discourse off to the second instalment (which I'll gladly forward once I've safely returned to North America!), I'm afraid this topic is unavoidable, as to pass it by entirely would mark an error of omission. For now, I might merely suggest the late onset and half-hearted acceptance of Christianity has yielded similar, favourable events and institutions in Sweden as in Iceland:

> In Iceland there were no conditions for the rise of the class society elsewhere so characteristic of the Middle Ages, with its sharp contrast between Church and people, between the learned and the peasants. There books were not, as in other lands, the privilege of a few priests versed in Latin. Even in the Middle Ages literacy was far more widespread among the common people in Iceland than in other parts of Europe.[3]

With that said, that's all we'll have to say about the relative value of Christianity for now, since we have far more important, far more interesting truths to consider.

Perhaps most importantly, I shall utter perhaps the most extraordinary conjecture this discourse had to offer:

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1 SOWM 2008, p 32.

2 Haywood 1995, p 134.

3 Wessén 1995, *Laxness: The Nobel Prize in Literature Presentation Speech*.

our theory of value based upon relative insularity *quantifies* a mechanism which, in the so-called field of evolutionary biology, has, to date, been accepted as undetectable and thus unquantifiable: the *mechanism* for evolution.[1] This mechanism, I submit, is relative insularity itself. And, once this is understood, the razor-sharp, double-edged sword of island evolution becomes especially clear. Islands (i.e. relative insularity) present a double-edged, evolutionary filter (related, I submit, to the cautionary political rhetoric: *The slippery slope of isolationism*) which can act as an *fitness factory*, as it has relatively effectively done throughout the Nordic Nations, and it can alternatively act as a *Dodo factory*, as it did on Mauritius,[2] Funk Island (see cover page, footnote 2), Easter Island, Nauru, and as it may be presently acting – as my findings may suggest – on PEI.

Although Hawaii is often – and for good reasons – regarded as the finest evolutionary fitness factory on Earth for *non-human* species (far better than the Galapagos, largely due to it's great distance from the North American continent). Iceland may present the ideal model of an island fitness factory, and this is due almost exclusively to the fact that in "the days of Harald Fine-Hair, the son of Hálfdan the Black,"[3] the Norwegian Vikings were presented with a considerable evolutionary filter, a gauntlet all by impassable except by the *fittest*: Harald's tyranny and the great expanse of the cold and stormy North Atlantic lay between them and the uninhabited "*Ísland.*"

It is curious to note modern-day Icelanders muse that the Faroese are the descendants of sea-sick Vikings whom proved unable to make the remainder of the long journey to Iceland.

This evolutionary filter has been proven curiously illusive to detect, and more often than not, has proven to be completely misunderstood. Consider this passage from *The Penguin Historical Atlas of the Vikings*:[4]

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1 Indeed, without isolation new species might never evolve anywhere. If a plant or animal species formed one large interbreeding population without distinctive ecological pockets, changes would likely be wiped out and little progress toward new adaptations could be made (Carlquist 1974, p1).

2 In the year 1598 AD, Portuguese sailors landing on the shores of the island of Mauritius discovered a previously unknown species of bird, the Dodo. Having been isolated by its island location from contact with humanity, the dodo greeted the new visitors with a child-like innocence. The sailors.... dubbed the bird "dodo" (meaning... a simpleton in the Portuguese tongue) (Reilly 1999).

3 Magnússon 1980, p 60.

4 Haywood 1995, *Foreword*.

> Recent years have seen great changes in our historical understanding of the Vikings.[1] The traditional image of the Vikings as nothing more than axe-yielding pirates bent on rape and pillage or conquest has been balanced by a new appreciation of peaceful Viking enterprise in the fields of trade, crafts, exploration and settlement.... Some may feel that my approach has over-emphasized the Vikings' warlike activities at the expense of their more constructive enterprises. This... reflects my own unease at the extent to which the importance of violence in the Viking Age has been played down in many recent studies of the period. The Vikings could be a pretty rough crew when it suited them, and it suited many of them very often in the period *c.* 800-1100.

The misunderstanding this passage represents may be contributed to the general inability to behold and maintain an evolutionary world-view when it comes to its application to the human species. The problem, quite likely inadvertent, is the implicit a priori *interpretation* of what it *means* to be 'warlike' in terms of the murky waters of *social norms.*[2]

I will offer a brief evolutionary interpretation the pre-Icelandic Viking period Haywood deemed "warlike" above: Once upon a time, in the great struggle for life, a pack of hungry, land-less, *independent*, and often genetically related mammals, went foraging for food. On these missions, they engaged in highly rationalized problem solving endeavours, *learned,*[3] and recorded[4] these trials and errors which *served and continue to serve as a conduit for highly*

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1 The term "Viking" has come to be applied to all Scandinavians of the period, but in the Viking age itself the term *vikingr* applied only to someone who went *i viking,* that is plundering (Haywood 1995, p 8).

2 See ABBREVIATIONS & DEFINITIONS: *Social Norms*

3 See ABBREVIATIONS & DEFINITIONS: *Learning*

4 (a) Then Bjarni said that *the people who were to go should be chosen by lot, and not by rank.*

But everyone tried to get into the boat. The boat, however, would not hold them all and so they agreed to this suggestion... When the lots were drawn it so happened that Bjarni himself, along with nearly half the crew, drew a place, and these all left the ship for the boat.

When they were in the boat one young Icelander who had been Bjarni's companion said, 'Are you going to leave me here, Bjarni?'

'This is how it has to be,' replied Bjarni.

The Icelander said, 'But that is not what you promised when I left my father's farm in Iceland to go with you.'

'I see no other way,' said Bjarni. 'What do you suggest?'

'I suggest we change places; you come up here and I shall go down there.'

'So be it,' said Bjarni. 'I can see that you would spare no effort to live, and are afraid to die.'

So they changed places. The Icelander stepped into the boat and Bjarni went back on board the ship; and it is said that Bjarni and all those who were on the ship with him perished [italics mine, Magnússon *c.* 1000 A.D.a, pp 103-104].

(b) A great swarm of skin-boats was then heading towards them down the fjord.

Thorvald said, 'We shall set up breastworks on the gunwales and defend ourselves as best we can, but fight back as little as possible.'

They did this. The Skraelings [The term Skraeling was used in early Icelandic sources to designate the inhabitants of Greenland and North America. The Skraelings of Vinland have been tentatively identified with the Micmac or extinct Beothuk Native American tribes. The derivation of the word is uncertain, but is has contemptuous associations--something like 'wretches'.] shot at them for a while, and then turned and fled as fast as they could.

Thorvald asked his men if any of them were wounded; they all replied that they were unhurt.

'I have a wound in the armpit,' said Thorvald. "An arrow flew up between the gunwale and my shield, under my arm--here it is. This

rationalized social learning and evolution.[1] As Fehr & Gachter noted in *Fairness and Retaliation: The Economics of Reciprocity:*

> The Edda, a 13th century collection of Norse epic verses, gives a succinct description of reciprocity: "A man ought to be a friend to his fiend and repay gift with gift. People should meet smiles with smiles and lies with treachery." There is considerable evidence that a substantial fraction of people behave according to this dictum.[2]

And how does the wisdom[3] of the *Edda* compare to the Christian dictum: *to turn your other cheek?*[4]

Over time, a *Viking Theory of Value* rooted in the *Struggle for Life* (as opposed to Christian values, Nationalistic values, Academic values, Corporate values, etc.) evolved which encouraged literacy for all and fostered independent-minded, rational individuals.

On many foraging quests, these explorers encountered confused, dependent people who, through *institutionalized irrationality,* were less able to defend their food and unable understand the world in which they lived.[5] They simply could not fathom a *human being* (note the disconnect from the animal kingdom) *evil* enough to take a

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will lead to my death.'

'I advise you now to go back as soon as you can. But first I want you to take me to the headland I thought so suitable for a home. I seem to have hit on the truth when I said that I would settle there for a while. Bury me there and put crosses at my head and feet, and let the place be called Krossaness for ever afterwards' (Magnússon *c.* 1000 A.D.b,pp 60-61).

(c) *He made an agreement with his crew that everyone should share equally in whatever profits the expedition might yield....*

They put to sea and arrived safe and sound at Leif's Houses and carried their hammocks ashore. Soon they had plenty of good supplies, for a fine big rorqual was driven ashore; they went down and cut it up, and so there was no shortage of food....

The livestock were put out to grass.... *They made use of all the natural resources of the country that were available, grapes and game of all kinds and other produce* [all italics mine, Magnússon *c.* 1000 A.D.b,p 65].

1 (a) I know many examples of success or failure of island life all over the world. Earch time the "success story" involves educated populations, while the "failure story" involves the uneducated, illiterate islanders. The basic requirement of island life is a consciousness of group identity, history, and destiny. Group consciousness is the key either to destruction or to liberation (Doumenge 1988, p 342).
(b) Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated, mostly to Canada and the US. Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. *Literacy, longevity, income, and social cohesion are first-rate by world standards* [italics mine, *CIA World Factbook*, updated 1 November 2007].
(c) Also see, for example, Magnússon & Pálsson, *c.* 1000 A.D.a, *c.* 1000A.D.b.

2 2000, p 159.

3 In evolutionary game theory, this survival strategy is referred to as "tit-for-tat."

4 In evolutionary game theory, this survival strategy is referred to as "always cooperate."

5 History shows that our theories have been wrong more often than right, resulting in the demise of whole civilizations when we have misinterpreted what is happening to us....

It would be comforting to believe that humans have been prescient enough to understand what is happening to themselves and act accordingly. But... the way the mind understands the external environment—the beliefs humans construct to explain the external world are frequently incorrect, particularly if the changes are creating really novel situations. And clearly, humans have evolved environments radically different from anything that existed before (North 2007).

gazelle from God (or a gold chalice from an unlocked church). *Rational* explanations for these *devilish* deeds were simply *outside* the scope of their religious-based value system, and thus, they were not able to comprehend what was happening in the world around them.

Yes, the Vikings did eventually accept Christianity, but they do not appear orthodox in this acceptance; it seems they generally heeded Shaw's advice: "Do not give your children moral and religious instruction unless you are quite sure they will not take it too seriously."[1] Helgi the Lean claimed to be a Christian, "but invoked Thor in matters of seafaring and dire necessity."[2] In 1946, Halldór Laxness summed up Icelandic rationalism, healthy scepticism, independence, and general position on Christianity in *Independent People,* which seems current yet today:

> You should beware of believing things you see in books. I never regard books as the truth, and least of all the Bible, because there's no check on what they can write in them. They can spin lies as big as they like, and you never know, if you haven't been on the spot.....
>
> "The story can say what it likes for me," said Bjartur sceptically, "but what I'd like to know is this: Who saw Jesus rise on a Sunday?" (Laxness 1946, p 64).

Again, there is much more light to shed upon this formidable problem, but, for my mother's sake, we'll save that sermon for another day.

Although the theory of value and solution to *The Problem of Sustainable Economic Development* which I have endeavoured to present herewith pertains to all classes of assets, and any and all biogeographical jurisdictions, I hope you may discover my solution addresses the false and sandy economic assumptions which prove especially vexing to island inhabitants. But if this long letter accomplishes nothing else, I hope it has at least irrefutably demonstrated that *we are all islanders, and all inextricably intertwined and inextricably engaged in a non-cooperative game*.

Finally, on one hand I would like to thank Godfrey Baldacchino and Barry Bartmann for their excellent insights, and on the other note that I have gladly undertaken this field expedition to Ålander as an independent man, and, despite the fact that I have completed graduate coursework in Island Studies at The University of Prince Edward Island and conducted minor research for The Institute of Island Studies and the province of PEI, I am not affiliated

1 1903, ln 42.

2 Haywood 1995, p 33.

with this university, institute, province, or any other individuals in any way; my views are quite my own. In fact, I should disclose that my views, positions, and opinions quite likely *antithetical* and wholly unsupported by those most widely held at The University of Prince Edward Island, The Institute of Island Studies, and the province of PEI, and will illustrate this disparity by closing with the following disclosure: a note from one of my very few fans, sent, appropriately enough, following my first discourse on the value of relative insularity on the island of Mustique:

Subject: Your seminar
Date: Fri, 25 Apr 2008 15:13:21 -0300
From: [personal correspondence]
To: mfunk@upei.ca

> Dear Matt,
>
> I received a disturbing e-mail from [one of your good friends] in which he said that you had felt under attack for the whole of the seminar and largely from a left-wing ideological cabal among the students. I am truly sorry that you left feeling... disheartened. You are too gifted a student, Matt, to be thrown off course in any way. And it is so undeserving. You have a remarkable thirst for learning, a rare intellectual craving, and, above all the courage to navigate difficult and uncharted waters. Your intellectual energy is apparent to all and, I would say, an inspiring example to all. I replied to [your friend] that I was not aware of how pervasive this ideological left-wing view is in the programme, but I have been aware of it from time to time on particular issues such as Cuba. I regard ideology as the enemy of critical thinking. It is usually self-righteous and conspiratorial. Because it is seamless in it connections to all questions, it is thoroughly predictable. And [your colleague] is right when he complains that it is truly unsatisfying to attempt a genuine exchange with someone who is so bound by a formula. I thought your exploration of insularity was thoughtful, innovative and challenging.... I would be truly sorry if you and [your friend] were to avoid these seminars in the future because they should be one of the more exciting aspects of a graduate programme. But, above all, you should not let yourself be wounded in this way. The programme owes a great debt to your contribution. You bring energy, deep reflection and, above all, insight to every class. And everyone in that room should be grateful... It was a very lively exchange. Although I am sure that you were frustrated that it seemed to go all over the map and often far from your paper which so many had not even read. There may be a case for having a moderator to ensure that the discussion stays on course. In any case, Matt, you have a truly promising future ahead of you, including success at the Ph.D. level. Of that, I could not be more confident.[1]
>
> So, rest assured that you will not be alone if you find that you have more criticisms than praise to offer this solo circumnavigator. I will be honoured to hear any and all criticisms, and I hope that you will find some of what I have presented *valuable*. And, afterall, as F.A. von Hayek declared at the end of the finest *Sveriges Riksbank Prize*

1 Personal Correspondence 2008.

Banquet speech of all time, quoting the infinite wisdom of Alfred Marshall:[1] "Students of social science, must fear popular approval: Evil is with them when all men speak well of them".

Again, I thank you for this great honour and privilege.

May a whole whale wash up upon your shore!

Matt Funk

1 In the *Principles*, Marshall confined his use of diagrams and other mathematical notations to footnotes and appendixes so as not to allow his mathematics to detract from his economics. He was interested above all in plain communication—with businessmen as well as with students. Moreover, he was acutely aware that over reliance on mathematics "might lead us astray in pursuit of intellectual toys, imaginary problems not conforming to the conditions of real life: and, further, might distort our sense of proportion by causing us to neglect factors that could not easily be worked up in the mathematic machine" [Pigou, Memorials, p. 84 as cited in Ekelund & Hebert 1997, p 341].

APPENDIX I:

A UNIFIED THEORY OF VALUE FOR THE BIOLOGICAL AND SOCIAL SCIENCES[1]
&
SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT

> We give two independent derivations of our solution of the two-person…game. The [first] approach is by the axiomatic method. *One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps to justify and clarify the other.*[2]

AXIOM I The Ground Zero Premise

The Problem of the Struggle for Life

Survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a survival enterprise. It follows that survival is the… "problem" for human societies as well; it is a prerequisite for any other, more exalted objectives. Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely….Our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern governments… [is] either directly or indirectly related to the meeting of our basic survival needs.[3]

AXIOM II The R-3[4] Premise

The Problem of the Resource Replenishing Rate

Global natural Resource consumption is approximately three times (3x) the earthly replenishing rate. Though this problem may be soluble on local, municipal, regional, and even on national levels, in light of *The Tragedy of the Commons,* it is insoluble at the global level.

AXIOM III The Ecological Uncertainty Premise

Axiom II poses a threat to Axiom I.

AXIOM IV The Political Uncertainty Premise

The Problem of Warfighting:

(i) (1) the system is anarchic, (2) all great powers have some offensive military capability, (3) states can never be certain about other states' intentions, (4) states seek to survive, and (5) great powers are rational actors or strategic calculators.[5]
(ii) Extinction follows chiefly from the competition of tribe with tribe, and race with race. Various checks are always in action, …which serve to keep down the numbers of each…tribe, such as…famines,…wars, accidents, sickness,… infanticide, and, perhaps, lessened fertility from less nutritious food, and many hardships. If from any cause any one of these checks is lessened, even in a slight degree, the tribe thus favoured will tend to increase; and when one of two

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1 These 7 Axioms rest upon the fundamental physical laws of science, and, thus, adheres to: (i) *Fluid Mechanics* (Archimedes' Principle), (ii) *Force, Mass, and Inertia* (Kepler's Three Laws of Planetary Motion, Newton's Three Laws of Motion, Newton's Law of Universal Gravitation), (iii) *Heat, Energy, and Temperature* (Newton's Law of Cooling, Boyle's Law, Law of Conservation of Energy, Joule's First and Second Law, The Four Laws of Thermodynamics), and (iv) *Quantum Mechanics* (Heisenberg's Uncertainty Principle). Furthermore, we hereby submit our unified theory of the biological and social sciences maps the range of scientific knowledge, namely (1) the lower limit of what *must* be known, and (2) the upper limit of what *may* be known.

2 Italics mine, Nash 1953, p 129.

3 Corning 2000, abstract.

4 Resource Replenishing Rate.

5 Mearsheimer, p 112, 2006c.

adjoining tribes becomes more numerous and powerful than the other, the contest is soon settled by war.[1]

AXIOM V The Planetary Uncertainty Premise

(i) *The Problem of Supernovas*:

In light of Axiom I, an alternative inhabitable planet must be discovered, and immigration must occur within an unknowable time-frame, ostensibly as soon next year, but no later 99,000 years from present (see vi, below).

(ii) *The Problem of Ohmic Decay:*

The mechanism by which the Earth and other planets maintain their magnetic fields against ohmic decay is among the longest standing problems in planetary science. Although it is widely acknowledged that these fields are maintained by dynamo action, the mechanism by which the dynamo operates is in large part not understood. Numerical simulations of the dynamo process in the Earth's core have produced magnetic fields that resemble the Earth's field, but it is unclear whether these models accurately represent the extremely low values of viscosity believed to be appropriate to the core.[2]

(iii). *The Problem of Meteorites:*

It is widely believed that meteorites originate in the asteroid belt, but the precise dynamical mechanism whereby material is transported to Earth has eluded discovery. The observational data for the ordinary chondrites, the most common meteorites, impose severe constraints on any proposed mechanism. The ordinary chondrites are not strongly shocked, their cosmic ray exposure ages are typically <20 Myr, their radiants are concentrated near the antapex of Earth's motion and they show a pronounced 'afternoon excess' (for every meteorite which falls in the morning two fall in the afternoon). Wetherill concluded that these data could only be explained by an "unobserved source" of material... His subsequent, more sophisticated investigations have not changed this basic conclusion. Recently I have shown that there is a large chaotic zone in the phase space near the 3/1 mean motion commensurability with Jupiter and that the chaotic trajectories within this zone have particularly large variations in orbital eccentricity. Since asteroidal debris is quite easily injected into this chaotic zone, it could provide Wetherill's 'unobserved source' if chaotic trajectories which begin at asteroidal eccentricities (e<0.2) reach such large eccentricities that Earth's orbit is crossed (e>0.57)... At least some of these chaotic trajectories do have the properties required to transport meteoritic material from the asteroid belt to Earth. Combined with the Monte Carlo calculations which show that the resulting meteorites are consistent with all the observational constraints, *the case for this chaotic route to Earth is fairly strong* [italics mine].[3]

(iv) *The Problem of Chaotic Behaviour:*

There are several physical situations in the solar system where chaotic behavior plays an important role. Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behavior also seems to be an essential ingredient in the explanation of certain non-uniformities in the distribution of asteroids. The long-term motion of Pluto is suspiciously complicated.[4]

(v) *The Problem of Super-Eruptions:*

In the past 2 Myr, there have been, on average, two super-eruptions every hundred millennia, the last of which shattered the crust of New Zealand's north island 26,500 years ago. To date, no mechanisms have been discovered for predicting these events; thus an eruption of this magnitude (VE8)[5] is possible within this decade and likely within 100,000 years. Post-eruption human survival is unlikely; even smaller eruptions (VE4, VE5, VE6) present significant problems.

(vi) *The Problem of Solar Flux:*

There has been life on Earth for at least 3,500 Myr but the assumption that a comparable future lies ahead may not be justified. Main sequence stars appear to increase their burning rate as they age. Thus the Sun, if a typical star, can be predicted to have increased its output by 30% since the Earth's origin 4,500 Myr ago. The maintenance of an equable climate since life began probably required some means of planetary thermo-stasis. The Gaia hypothesis proposed by Lovelock and Margulis included an unspecified biological means for climate control. Walker... suggests an abiological automatic thermostasis in which the atmospheric abundance of CO2, a greenhouse gas, adjusts to resist the warming tendency of the increased solar flux. It is clear that whatever the mechanism, atmospheric CO2 is now close to its lower

1 Darwin 1888, p 912.

2 Kuang & Bloxham 1997, abstract.

3 Wisdom 1985, abstract.

4 Wisdom 1987, abstract.

5 Self 1982

limit of partial pressure, so the biosphere may soon, in geological terms, be exposed without protection to the predicted progressive increase of solar luminosity.[1]

AXIOM VI The Deductive Premise

The Problem of Induction[2]

Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience*.[3]

AXIOM VII The Insularity Premise

The Problem of Value[4]

The search for an economic theory of value may have begun with Aristotle. For the next half-century, however, very little progress was made,[5] and the evolutionary stable theory tabled in 1776 by Smith[6] was fully adopted by the classical school and generally accepted for nearly a century. The German school grew critical, however, and this Germanic scepticism gave birth to the Austrian School and their quest for a new *Theory of Value*, which began with a very independent professor of political economy at the University of Vienna, the Austrian School's founding father, Carl Menger (1840–1921).[7] In his 1871 *Grundsätze der Volkswirtschaftslehre* (*Principles of Economics*), Menger outlines his groundbreaking theory.[8]

Perhaps the most convoluted, self-refuting theory may have been tabled by Walras in 1886.[9] Walras, however, was certainly not alone in his approach. Indeed, all known (to this fairly well-read author, that is) attempted solutions since Menger have, essentially, followed Wieser's method,[10] and, despite the extraordinary efforts from Aristotle to Smith to Menger to Weiser, economics has remained without a theory of value. Note, however, the development of our theory has *not* followed the methodological approach consistent with previous attempts. Based upon our understanding that insularity is the key to evolutionary fitness (including, for example, *economic* evolutionary fitness) and thus life on earth,[11] our theory of value is constructed by demonstrating that *value* (V) is a *derivative function* of relative insularity; we are able

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1 All italics mine, Lovelock & Whitfield 1982, abstract.

2 See ABBREVIATIONS & DEFINITIONS: *The Problem of Induction*.

3 Italics mine, Hume 1739, Book I, Vol I, p 137.

4 See ABBREVIATIONS & DEFINITIONS: *Theory of Value*.

5 Ibid.

6 (a) Gould 2002.

(b) It has been said that one finds in Adam Smith nearly all the explanations of value which have ever been attempted. What is certain is that, in his explanation, Adam Smith has put together two views that contradict each other (Wieser 1893, p xxvii).

7 As I feel a bit of reverence building up, in the spirit of disclosure, I will take a moment to offer full transparency: since I feel a debt of inestimable gratitude for the Austrian School (Hayek and Popper in particular), I may be prone to being overly sympathetic to their positions (I will, for example, mostly ignore Walras and Jevons, whom seem to me as foolish as Irving Fisher (see Funk 2007b).

8 (a) It is in Austria, in the lineal succession to Menger, that the development of the new value theory is to be sought (Wieser 1893, p xxxiv).

(b) In Chapter III, Menger (1871) presents his groundbreaking *Theory of Value;* the essence, clarity, and promethean insight of this chapter may best sampled in Section E: *The value of the services of land, capital, and labour, in particular.*

9 That of Walras, though admirable of its kind, suffers, to my mind, from the preponderance of the mathematical element. The laws which govern amounts of the value undoubtedly allow of a mathematical expression ; nay, the more complicated of these can be expressed exactly only by means of mathematics ; and here certainly mathematics has a great task to fulfil. But in the value theory we have to do with something more than the expression of the laws of amounts. The obscure conception of value is to be made clear ; *all its manifold forms are to be described* [italics mine] ; the service of value in economic life is to be analysed ; the connection of value with so many other economic phenomena is to be shown (Wieser 1893, p xxxiii).

10 The economist who undertakes to explain value has to explain the procedure of those who value. He describes in plain language the meaning of transactions carried on, times without number, by all of us. He does, on a large scale and with a difficult subject, the same thing as one who accurately describes some trade or some mechanical operation, which every one can do, but which it is not easy, without the assistance of concrete instances, to present and follow up in all its complexity of conditions (1893, p 5).

11 Carlquist 1974, p 1.

to quantify value far more accurately *and* far more easily by quantifying it *indirectly*.[1] Aside from the originality of value based upon insular qualities, the *derivative nature* of this theory is what lends this insight elegance, simplicity, and power: $V=f'(I_R)$! The utter simplicity and descriptive power of this theory, what sets it apart from every known previous attempt, is this is the first which expressly does *not* attempt to "describe all manifold forms," and "the myriad connections of economic phenomena;" rather, this theory describes the *environment*2 in which economic value is created (from which it is *derived)!* In other words, the relative insularity of a biogeographic region itself is *not* what makes it valuable, the value is *derived* as a direct by-product of this insularity. For example, backing out to the most macro-view, a quick look at the *relative insularity* of the Earth reveals that the earth is *more valuable, relatively* speaking, than the other planets in our solar system due to the value of the relatively high level of atmospheric insularity which enables the Earth to produce both biologic *and* economic value: *Life!*

Moreover, although our quest had commenced as a search for an *economic* theory of value, in the end, our solution produced a *universal* (economic and biologic) *Theory of Value*, which presents a solution to what arguably represents the most fundamental problem in any so-called "field" of science, since relative insularity is as valuable to whales, dragonflies, and unicellular organisms as it is to man. Although this solution was inadvertent, it is a logical outcome, since it is well understood that a useful, truthful economic theory of value requires a biogeographical and political foundation which acknowledged *The Problem of Induction*, including both political and extraterrestrial uncertainties. Our theory was constructed by simply observing nauture, by simply observing the universal revealed preference for relative insularity, and thus, moreover, discovering that *value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$. Our axioms also reveal that, contrary to the central thesis of so-called "ecological economics," the Earth is not in fact a closed-system, but rather merely *semi-closed* and thus only relatively insular. Comprehending these biological and panetary realities is the cornerstone to the comprehension of our unified theory. Greater clarity may be derived with the following game theoretical application: Applying our *Theory of Value* within requisite biogeographical & political contex of the necessirily non-coopertive game (in which all the world is a stage; note the great Nash insight pasted across the cover-page) reveals divergent, optimizing rational strategies for *continental* (GEMS) and *insular* (RIS) economic development. Our theory reveals pure GEMS and RIS strategies are antithetical, yet discover, in light of *The Problem of Induction,* these naturally opposing strategies represent the most tenable, rational solution possible. How is it possible that two players may arrive at two *different*, antithetical optimal strategies when utilizing the same theory of value? Although there is ultimately only one sphere of insularity, it must be defended on two *inherently uncertain* levels: (1) insularity pertaining to the biosphere (i.e. Ecology: Axioms I-III, the "whole world" according to the principles of "ecological economics"), and (2) insularity pertaining to the semi-closed nature of the biosphere, including planetary and extra-planetary forces and uncertainties (i.e. meteorites, volcanoes, chaotic gravitational forces, supernovas, etc.: Axiom V), and geopolitical uncertainty (i.e. War: Axiom IV). Generally speaking, pure RIS strategy protects relative insularity on the first level, while GEMS pure strategy protects relative insularity on the second level. Moreover, our theory of value is as applicable and powerful at the local and individual levels as it is at the national/global level, including its use as a powerful analytical tool applicable to common problems, such as: (1) where to live (addressing both biogeographical and geopolitical insularity), (2) what to eat, (3) how to vote, (4) where to vacation, (5) what type of vehicle to drive, (6) what types of investments to make, (7) what water to drink, and, most generally, (8) understanding how relative insularity frames strategic decision-making under uncertainty.[3] Furthermore, our *Theory of Value* demonstrates systemic RIS strategic errors. These errors reflect the general misunderstanding of the derivative nature of economics, time-inconsistent preferences, hyperbolic discounting,[4] and a fundamental democratic constitutional maladaptation, *The Tragedy of the Commons*.

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1 I_R is formulated with: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year &% km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), Sovereign Status, Constitutional Balance, Cultural Homogeneity, and Military Power*. We calibrate our formulae by adjusting relative input weighting in accordance a positive, linear biogeographical correlation between I_R and the average human life expectancy for the corresponding politico-biogeographic area.

2 One of the great discoveries of game theory came in the early seventies, when the biologists John Maynard Smith and George Price realized that strategic equilibrium in games and population equilibrium in the living world are defined by the same equations. Evolution be it genetic or memetic – leads to strategic equilibrium (Aumann 2005, p 352).

3 See ABBREVIATIONS & DEFINITIONS: *The Problem of Induction* (exempli gratia: k)

4 See ABBREVIATIONS & DEFINITIONS: *Hyperbolic Discounting*

APPENDIX II: AN OPEN LETTER TO PARTHA DASGUPTA

Sir Partha Dasgupta, Fellow, St. John's College
University of Cambridge, Faculty of Economics
Sidgwick Avenue
Cambridge, England

1 May 2008

RE: A Solution to *The Problem of Sustainable Economic Development*

Dear Sir:

I am writing to inform you that you have made a great mistake.

Your error came to my attention while reviewing *Nature in Economics.*[1] I emphasize the greatness of this mistake because, upon a broad review of your considerable works,[2] I have discovered that this fundamental error is entrenched in your most fundamental assumptions, and in short, I conjecture you have committed this error for four (possibly five) primary reasons : (1) you do not understand *The Problem of Induction*, (2) you do not understand that economics is a *derivative science* (and *derivative*, in this sense, is not a reference to the well-known financial WMD's,[3] but rather to Bertrand Russell's *Theory of Economic Power*),[4] and moreover (3) you have failed to comprehend,

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1 2007.

2 See SELECTED BIBLIOGRAPHY: Dasgupta.

3 The derivatives genie is now well out of the bottle, and these instruments will almost certainly multiply in variety and number until some event makes their toxicity clear. Knowledge of how dangerous they are has already permeated the electricity and gas businesses, in which the eruption of major troubles caused the use of derivatives to diminish dramatically. Elsewhere, however, the derivatives business continues to expand unchecked. Central banks and governments have so far found no effective way to control, or even monitor, the risks posed by these contracts.

Charlie and I believe Berkshire should be a fortress of financial strength – for the sake of our owners, creditors, policyholders and employees. We try to be alert to any sort of megacatastrophe risk, and that posture may make us unduly apprehensive about the burgeoning quantities of long-term derivatives contracts and the massive amount of uncollateralized receivables that are growing alongside. In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal [Buffett 2003, p 15. Also see Jon Danielsson's (2000) *The Emperor has no Clothes: Limits to Risk modeling*].

4 (a) *Economic power, unlike military power, is not primary, but derivative.* Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but *when large issues are involved it depends upon war or the threat of war.* It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it [all italics mine, 1928, p 95].
(b) *The very nature of economics is rooted in nationalism....It would never have been developed except in the hope of throwing light upon questions of policy, but policy means nothing unless there is authority to carry it out, and authorities are national* [italics mine Robinson 1962, p 117].
(c) The hidden hand of the market will never work without a hidden fist. McDonald's cannot flourish without McDonnell Douglas... And the hidden fist that keeps the world safe for Silicon Valley's technologies is called the United States Army, Air Force, Navy, and Marine Corps." (Friedman 1999).

essentially, *the whole economy of nature;*[1] (4) you do not understand that subject matters do not exist,[2] and (5) another possible reason, I suspect, may be related to your personal religious beliefs, but since I do not know you personally, I will leave this point for your consideration. If you are a religious man, however, I recently addressed problem[3] (in conjunction with the non-existence of subject matters in APPENDIX IV: ON THE PROBLEMS OF SUBJECTS & RELIGIONS, and we will, moreover, address this problem's insidious relationship with *The Problem of Sustainable*

(d) Power Projection: The ability of a nation to apply all or some of its elements of national power - political, economic, informational, or military - to rapidly and effectively deploy and sustain forces in and from multiple dispersed locations to respond to crises, to contribute to deterrence, and to enhance regional stability (The United States Department of Defense 2001).

1 See ABBREVIATIONS & DEFINITIONS: *The Struggle for Life*.

2 As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them.* A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(1) There is no method of discovering a scientific theory.

(2) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.

(3) There is no method of ascertaining whether a hypothesis is 'probable', or probably true [Popper 1956, pp 5-6].

3 (a) The word God is for me nothing more than the expression and product of human weaknesses, the Bible a collection of honourable, but still primitive legends which are nevertheless pretty childish. No interpretation no matter how subtle can (for me) change this. These subtilised interpretations are highly manifold according to their nature and have almost nothing to do with the original text. For me the Jewish religion like all other religions is an incarnation of the most childish superstitions. And the Jewish people to whom I gladly belong and with whose mentality I have a deep affinity have no different quality for me than all other people. As far as my experience goes, they are also no better than other human groups, although they are protected from the worst cancers by a lack of power. Otherwise I cannot see anything 'chosen' about them.

In general I find it painful that you claim a privileged position and try to defend it by two walls of pride, an external one as a man and an internal one as a Jew. As a man you claim, so to speak, a dispensation from causality otherwise accepted, as a Jew the privilege of monotheism. But a limited causality is no longer a causality at all, as our wonderful Spinoza recognized with all incision, probably as the first one. And the animistic interpretations of the religions of nature are in principle not annulled by monopolisation. With such walls we can only attain a certain self-deception, but our moral efforts are not furthered by them. On the contrary (Einstein 1954).

(b) I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument, as we should thus be compelled to believe in the existence of many cruel and malignant spirits, only a little more powerful than man; for the belief in them is far more general than in a beneficent Deity. The idea of a universal and beneficent Creator does not seem to arise in the mind of man, until he has been elevated by long-continued culture (Darwin 1883, p 1242).

(c) Beware of the man whose god is in the skies (Shaw 1903, ln 83).

(d) Also see Hitchens 2007 ; Weale 2007 ; Dawkins 2006 ; Darwin 1883 ; Russell 1931 ; Hume 1777a, 1777b, & 1779.

Economic Development.

Before detailing my critique of *Nature in Economics*, I will note that, despite the impression you may have at this early stage, I admire your endeavours and I am sympathetic to your noble quest for a solution to the problem of global resource consumption, as I have also been struggling with this problem for quite some time, perhaps even longer than I am able to recall.[1]

A good friend, fellow sailor, and wise mentor once taught me that you can learn most of what there is to know about someone by sailing with them for a while; I've also come to believe that you can learn most of what there is to know about the Earth by sailing *alone* with her for a while, and I believe a brief elaboration upon this belief may prove illuminating: on April 24th, 1895, at the age of 51, Joshua Slocum[2] sailed away from Boston on his 35 ft sloop, *Spray*. Three years later, on June 27th, 1898 he returned, completing the first solo circumnavigation of the Earth. Slocum's independence, resourcefulness,[3] self-sufficiency,[4] and sage advice,[5] to "know the sea, and know that you

1 See APPENDIX III: THE SEA I.

2 Captain Joshua Slocum was born in Nova Scotia in 1844. His father was a farmer, but for many generations his had been a seafaring family and, like most small boys along that coast, he spent every minute of his holidays in and out of small boats, though like many other sailors he never learned to swim... He was eight years old when his family moved to Briar's Island and he left school and was put to work on the farm. At the age of twelve he was caught making a ship model in the cellar where he should have been grading potatoes, was given a beating, saw his model smashed and ran away from home. For the next few years he earned a living for himself, as a cook, ship's boy and what not, among the fishermen on the Bay of Fundy. At the age of sixteen he and a friend sailed before the mast in a full-rigged ship from St. John's [sic.], New Brunswick, to Dublin [Ransom's 1947 *Introduction* to Slocum 1900, p 22].

3 Although the $553.62 spent for materials seems high in comparison with Thoreau's $28.12, *Spray* had to endure storms unknown on Walden Pond. Moreover, Thoreau borrowed an axe near the end of March 1845 and began to occupy his house on the Fourth of July, while Slocum spent thirteen solid months rebuilding the old wreck of a sloop... Both constructions served equally well in carrying their amateur builders out of the world; both led to books that have long outlived the timbers (Whitehill 1957, p 541).

4 The day I appeared there was a buzz at the gossip exchange: at last someone had come and was actually at work on the old *Spray*. "Breaking her up, I s'pose?" "No; going to rebuild her." Great was the amazement. "Will it pay?" was the question which for a year or more I answered by declaring that I would make it pay.

My axe felled a stout oak-tree near by for a keel, and Farmer Howard, for a small sum of money, hauled in this and enough timbers for the frame of the new vessel. I rigged a steam-box and a pot for a boiler. The timbers for ribs, being straight saplings, were dressed and steamed till supple, and then bent over a log, where they were secured till set. Something tangible appeared every day to show for my labour, and the neighbours made the work sociable. It was a great day in the *Spray* shipyard when her new stem was set up and fastened to the new keel....The much-esteemed stem-piece was from the butt of the smartest kind of pasture oak. It afterward split a coral patch in two at the Keeling Islands, and did not receive a blemish. Better timber for a ship than pasture white oak never grew (Slocum 1900 pp 34-35).

5 After nearly sixty years, interest in Captain Joshua Slocum's single-handed voyage around the world grows rather than diminishes. The captain's own narrative, published in 1900 by the Century Company, was kept in print for forty-eight years (and seventeen printings) by them and their successor companies. It was translated into Polish, German, French and Dutch, and has been widely read in England (Whitehill 1957, p 540).

know it,"[1] has offered inspiration to sailors ever since,[2] as another soloist recently reflected:

> My interest in sustainability has developed over the years quite naturally through sailing, because when you're at sea you have to manage your resources… You take the minimum you think you can get away with because you want the boat to be as light as possible and you never waste anything, you know where your energy is coming from, you measure it and you measure what you're using, and that's very… different from every day life; you notice the change when you jump off the boat.[3]

Yes indeed, as you noted in your excellent review of Jared Diamond's *Collapse*: *How Societies Choose to Fail or Survive* (I also found Diamond's effort deficient), "scarcities lead individuals and societies to search for ways out, which often means discovering alternatives;" the uncertainties and scarcities inherent with sailing (being alone with limited resources on a merciless sea,[4] for example) also foster the development of flexible tactics.[5] It is even possible that these two powerful elements (circumnavigation and isolation), may offer something even more substantial; as E.O. Wilson noted, the *Journal of Researches into the Natural History and Geology of the Countries Visited During the Voyage of H.M.S. Beagle Round the World* (a.k.a. *Voyage of the Beagle*)[6]

> can be read from several perspectives and interpreted according to taste. One very important but seldom noticed feature is its exemplification of the *Wanderjahre* (years of wandering) in the genesis of the scientific mind. No English term conveys the exact same meaning as the German. It refers originally to the medieval custom of sending young men to other villages or towns to learn a craft and more of the world in a different setting. History has shown that there is no more fruitful way to launch the career of a naturalist than by such an interlude, during which the adventurer travels *alone*, searching, freed from domestic ties, and energized by… visceral ambition…The pages of *Voyage of the Beagle* are the diary of Darwin's *Wanderjahre*. As he proceeds around the world (England-South America-Galapagos-South Pacific-South Africa-South America-England), the young naturalist unconsciously builds the foundation of what was to be his evolutionary view of life.[7]

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1 Ibid, p 18.

2 Whether you call it "communing with nature" or "feeling at one with the world," there are times single-handing can only be described as a spiritual experience -- days when you marvel at the sea and sky and are awed and humbled by the majesty of nature, days when you savour the interaction of the boat with wind and waves and say to yourself "It just doesn't get any better than this." According to an unpublished study by Dewey, Kahn, Yu, and Howe, these moments are covered by the inverse square rule -- the intensity of the experience decreases by the square of the number of people aboard (Guenther 2004).

3 MacAurthur 2007.

4 He was an old man who fished alone in a skiff in the Gulf Stream and he had gone eighty-four days now without taking a fish (Hemingway 1952, p 9).

5 Military officers are fond of saying that few plans survive first contact with the enemy, and the same may be said for the plans of the crew of a small vessel encountering heavy weather for the first time. Such plans as have been made have to be flexible. Unexpected events are likely to occur, the weather forecast is often a simplified overview, and people's behaviour may be unpredictable under duress of prolonged exposure to blinding spray, fear, cold temperature, wearying noise and violent motion (Coles 1967, p 155).

6 Darwin 1836.

7 Wilson 2006, pp 18-19.

Wilson's conjecture meshes well with another sailor's experience: Last January, after sailing 57 days alone, averaging over 19 knots for 26,000 non-stop miles on his 97 foot trimaran, *Idec II*, Francis Joyon[1] recalled

> there were two very worrying moments... once in the south in the middle of the ice, as the storm started to blow, and in the Doldrums, when I discovered I could lose my mast... *The breaking up of the pack ice and the icebergs floating around at unusual latitudes attracted my attention*.[2]

Revisiting this theme back on shore, Joyon observed that "a boat is like an island, or, indeed, like the planet: you need to protect [it]."3

I have spun this nautical yarn because I want to impress upon you that I, like you and many sailors and searchers I admire most, also hold a deep concern for the Earth. But, as a fellow champion of game theory,[4] equally aware of the seemingly distasteful sacrifice implicit[5] in the *rational strategy* to *all Prisoners' Dilemmas*, I trust that, after reviewing the long argument in this letter, you may be willing to consent that "rational" and "optimal" natural resource consumption levels may be far more difficult to determine than you have presumed. Although it may be true that Joyon's sailboat is a small model of an island, which is, in turn, a small model of the Earth, and although it is indeed true that we do need to *protect* it, since you do not understand that subject matters do not exist, you have failed to consider fundamental principles which belong to the so-called subjects of "astronomy," "political science," and "evolutionary biology," and thus you do not comprehend all of the ways in which it must be protected.

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1 Those who witnessed his crossing of the start line off Ushant [France] on the morning of 23rd November could never have dreamt that they would be witnessing his return just 57 days, 13 hours, 34 minutes and 6 seconds later - bettering Ellen [MacArthur's] time by a solid 14 days ! Joyon, who sees little merit in the complexities of modern gadgetry, proved he could complete his epic voyage with no more power than could be provided by a small wind generator and a couple of solar-panels. He prefers to leave the weight of an engine - and most other go-fast devices ashore so he has more time to get on with the job of sailing the boat. This is ground-breaking stuff that calls into question the very basis of current thinking in this domain.... Bravo Francis! (Irens 2008).

2 Italics mine, Joyon 2008.

3 Gelder 2008, p 1.

4 See ABBREVIATIONS & DEFINITIONS: *Game Theory*.

5 Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE. We call these *choices between lesser evils*. We know that whatever we choose, something important will be sacrificed. Whatever we do, someone will get hurt. Worst of all we HAVE to choose. We cannot wait for better information or advice or some new set of circumstances. We have to decide NOW, and we can be sure that there will be a price to pay. If we do not pay it ourselves, someone else will.

These are the kinds of choices we face when dealing with terrorist threats. If we do too little, we will get attacked again. If we do too much, we will harm innocent people. In making these choices, we never have enough information. Some sources exaggerate the threat; others minimize it. Nothing we are told is reliable and nothing we do is ever likely to strike the right balance (Ignatieff 2004, Preface).

I should also note that it is possible that we possess two very different perceptions of "mistakes" and "errors," since I believe the recognition of errors or mistakes is something to be celebrated, rather than lamented,[1] since they chart courses closer to truths,[2] and although this outlook was popular in Austria at one time,[3] and popular at the London School of Economics at another,[4] it is not an especially fashionable school of thought today. However, a renaissance of sorts may be blossoming in Austria today; consider the current copy on the economics department homepage at the legendary University of Vienna:

> Economics came to the University of Vienna in 1763, when Johann Freiherr von Sonnenfels was appointed professor for Cameralwissenschaft in the law faculty by the Empress Maria Theresia. He and his followers were supposed to teach the upper echelons of the future state employees the art of rational administration. That orientation continued for about 100 years.
>
> After 1870 the University of Vienna became one of the centres of the emerging new economic theory.

---

1 This problem had been seen and solved long before; first, it appears, by Xenophanes, and then by Democritus, and by Socrates… The solution lies in the realization that all of us may and often do err, singly and collectively, but that this very idea of error and human fallibility involves another one-the idea of objective truth: the standard which we may fall short of. Thus the doctrine of fallibility should not be regarded as part of a pessimistic epistemology. This doctrine implies that we may seek for truth, for objective truth, though more often than not we may miss it by a wide margin. And it implies that if we respect truth, we must search for it by persistently searching for our errors: by indefatigable rational criticism, and self-criticism (Popper 1963, p 21).

2 In science, a mistake we make – an error – consists essentially in our regarding as true a theory that is not true… to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can *never* be *completely certain* that we have not made a mistake [italics Popper's 1992 p. 4].

3 (a) Though there is no longer a distinct Austrian School, I believe there is still a distinct Austrian tradition from which we may hope for many further contributions to the future development of economic theory (Hayek).

(b) Perhaps the most important lesson, which I have learned from Mises, was a lesson located outside economics itself. What Mises taught us in his writings, in his lectures, in his seminars, and in perhaps everything he said, was that economics—yes, and I mean sound economics, Austrian economics—is primordially, crucially important. Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics.

This is a lesson, which is located almost entirely outside economics proper. But all Mises' work depended ultimately upon this tenet. Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not identified by science as worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability calmly to ignore the sneers of, and the isolation imposed by, academic contemporaries, was his conviction that the survival of mankind depends on the development and dissemination of Austrian economics….Austrian economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race (Kirzner 2006).

4 I liked New Zealand very much, in spite of the hostility shown by some of the University authorities to my work, and I was ready to stay there for good. Early in 1945 I received an invitation from the University of Sydney. There followed some newspaper criticism in Australia about the appointment of a foreigner, and some questions were asked in Parliament. So I cabled my thanks and declined. Shortly afterwards – the war in Europe was in its last stages – I received a cable, signed by Hayek, offering me a readership at the University of London, tenable at the London School of Economics, and thanking me for sending *The Poverty of Economica*, of which he was the acting editor. I felt that Hayek had saved my life once more. From that moment I was impatient to leave New Zealand (Popper 1974, p 1380).

> Carl Menger, Friedrich von Wieser, Eugene von Böhm-Bawerk - the founding fathers of the Austrian School - were professors in our department. After World War I the influence of this school in our department declined for various reasons. One was that the intellectual climate in Austrian universities became rather conservative and hostile to liberal ideas, just at the time when a new generation of the Austrian School, namely Schumpeter, Mises, Hayek, Machlup, Morgenstern among others were becoming more liberal in the field of economic policy and hostile to state intervention. The growing anti-Semitism in all spheres of public life also contributed to the waning influence of the Austrian School at the University of Vienna. It increased the difficulties Fritz Machlup and Paul Rosenstein-Rodan faced in their academic careers. It is no wonder that nearly all so-called Austrians emigrated to the United Kingdom and the USA in the 1930s, most of them before the German occupation of Austria in March 1938. For a long period after World War II, the department remained rather closed to modern economics, particularly to its analytical methods, as was true in most other German speaking universities. Interest in modern economic theory began to increase only in the late sixties. Today we are an open, research oriented department in the faculty of Wirtschaftswissenschaften, a unit comprising the departments of economics, business administration, finance and statistics.1
>
> How often do you encounter this type of honesty at the institutional (educational) and/or corporate level?

That web-page copy wouldn't pass muster in almost any major marketing department or advertising agency, but we submit it marks exemplary courage, a high capacity for reflection, and, most importantly, a measure for the critical capacity for correction-of-error, and thus ability to derive truths. As Seneca noted long ago, in the so-called time of Christ:

> Why does no one admit his failings? Because he's still deep in them. It's the person who's awakened who recounts his dream, and acknowledging one's failings is a sign of health.[2]
>
> More contemporaneously, Sir John Eccles'[3] biography for his Nobel Prize in Medicine noted
>
> the New Zealand interlude was... notable because there Eccles met the philosopher, Karl Popper, from whom he learnt the relationship of the scientist to hypotheses; how to be daring in developing hypotheses of the greatest generality, and at the same time how to test them with the utmost rigour with the consequence either of falsification in whole or in part, or at best corroboration; but never confirmation. He feels that this relationship to hypotheses has not only increased his conceptual power, but has also greatly helped emotionally![4]

---

1 Rosner 2008.

2 *c.* A.D. 50, p 102.

3 In New Zealand I gave courses of lectures on noninductivist methods of science to the Christchurch branch of the Royal Society of New Zealand and the Medical School in Dunedin. These were initiated by Professor (later Sir John) Eccles. During my last two years at Christchurch I have lunchtime lectures to the teachers and students of the Canterbury University College. All this was hard work (today I cannot imagine how I did it) but extremely enjoyable. In later years I have met former participants in these courses the world over, scientists who assured me that I had opened their eyes – and there were some highly successful scientists among them (Popper 1974, p 138).

4 Nobel 1963.

As Eccles exclaimed, "I can now rejoice even in the falsification of a cherished theory, because even this is a scientific success."[1]

Does the concept of "joyful falsification" mesh with your central outlook? If so, perhaps you will cherish this letter.

There is no shame in acknowledging and correcting an error. Shame lies only in the refusal or inability to comprehend and correct an error. Naturally, I have made countless extraordinary errors, one of which was a two-year, heavy-artillery assault upon *The Problem of Global Warming*. Although this effort turned out to be a fantastic belly-flop, and happened to represent a failure to grasp the *true nature* of *The Problems of Sustainable Economic Development and Global Warming* (much as you have failed to grasp these problems). However, this error seems to have charted a course much closer to the truth: I submit I was only able to arrive at the conjectures and refutations presented herewith through the (1) recognition, and (2) correction of false assumptions associated with this error: see APPENDIX V: THE SEA II for a post-priori snapshot. Correcting this mistake wasn't easy for me (for I was essentially entrenched in the same, flawed assumptions in which you are presently imprisoned), and although nobody wrote me a letter to help sort it all out, I've certainly had more than my fair share of assistance; I hope that I am deft enough to help you dispel these inconvenient myths and illusions,[2] break down imprisoning doors of perception,[3] and enable you to correct your error, and, perhaps, chart a new course as well. But then again, I realize how strong these myths and doors[4] may be, and thus realize the breadth of the challenge before me. I have not written this letter to be

---

1 Eccles 1963 cited in Popper 1963, p 2.

2 (a) The results of failure in politeness, however bad from the point of view of social occasion, are admirable from the point of view of dispelling myths. There are two ways in which our natural beliefs are corrected: one the contact with fact, as when we mistake a poisonous fungus for a mushroom and suffer pain in consequence; the other, when our beliefs conflict, not directly with objective fact, but with the opposite beliefs of other men (Russell 1928 pp 17-18).
(b) The search for happiness based upon untrue beliefs is neither very noble nor very glorious. There is a stark joy in the unflinching perception of our true place in the world, and a more vivid drama than any that is possible to those who hide behind the enclosing walls of myth (Russell 1928, p 21).

3 If the doors of perception were cleansed every thing would appear to man as it is… For man has closed himself up, till he sees all things through narrow chinks of his cavern (Blake 1790).

4 (a) Festinger 1957.

cruel; it is not my intent to ridicule you. In fact, as I have stated, I do suspect you may be a great man. But, following in the footsteps of Popper, Russell, Pyrrho,[1] and Socrates,[2] I have accepted an obligation to stand my post, remain ever on the lookout, and never hesitate to table criticism. Indeed, our survival may depend upon it.[3]

Did you notice the brief outline of my "UNIFIED THEORY OF THE BIOLOGICAL AND SOCIAL SCIENCES & SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT" I clipped to the top of this letter?[4] If you considered the axioms carefully, perhaps your great mistake has already occurred to you. I did endeavour, afterall, to make this lesson as simple as possible for you to understand. If it hasn't occurred to you yet, note that your assumptions, the framework upon which all of your works have been based for at least the past two decades, are contained within axioms I through III. Although I am not a gambling man, I believe you will discover your mistakes may be directly related to the fact that you have failed to comprehend inherent uncertainties associated with axioms IV through VII (of which, more to follow). I've noted errors are nothing to be ashamed of; this error is especially free of disgrace, since *all* of your fellow practitioners of your so-called "ecological economics" (as well as many other economists, naturally) have committed, and continue to commit the exact same error. Yes, I believe you will discover that this discourse is not simply a refutation of your *Nature in Economics*, but ultimately a falsification of the theoretical framework and central thesis of "ecological economics."

(b) I began to intellectually reject some of the delusionally influenced lines of thinking which had been characteristic of my orientation. This began, most recognizably, with the rejection of politically-oriented thinking as essentially a hopeless waste of intellectual effort (Nash 1994, pp 6-7).

1 Sceptic: A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity… holds that there are no adequate grounds for certainty as to the truth of any proposition… Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet… to look out (OED 1997).

2 I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not fancy I do. In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know (Socrates 399 BC).

3 If our civilization is to survive, we must break with the habit of deference to great men. Great men may make great mistakes… Their influence, too rarely challenged, continues to mislead those on whose defense civilization depends, and to divide them. The responsibility for this tragic and possibly fatal division becomes ours if we hesitate to be outspoken in our criticism of what admittedly is a part of our intellectual heritage. By our reluctance to criticize some of it, we may help to destroy all of it (Popper 1945, inscription).

4 See APPENDIX I.

Ever since Menger's *Grundsätze der Volkswirtschaftslehre* (*Principles of Economics*),[1] conscientious economists have understood the implications of *The Problem of Value*; ever since the *Silent Spring* of 1962, conscientious people everywhere have understood *The Problem of Value*. Unfortunately, this wide understanding has culminated in an errant quest for *Sustainable Economic Development*. Over the past forty years, the landfill of literature dedicated to this misquided quest has revealed a fundamental, universal error: those most able to navigate the perilous seas[2] of economics,[3] mistakenly assert that neoclassical economic theory fails to pass the test of the second law of thermodynamics,[4] then proceed to report that, based upon this "revolutionary new perspective", we are now positioned to "reshape economic theory and policy".[5] The problems which appear to consistently elude you all is, once again, (1) economics is a *derivative*[6] science, not a *primary* science,[7] and (2) you have failed to recognize critical

1 1871.

2 There are 'perilous seas' in the world of thought, which can only be sailed by those who are willing to face their own physical powerlessness. And above all, there is liberation from the tyranny of Fear, which blots out the light of day and keeps men grovelling and cruel. No man is liberated from fear who dare not see his place in the world as it is; no man can achieve the greatness of which he is capable until he has allowed himself to see his own littleness (Russell 1928, pp 22).

3 See Bibliography for many examples; Gowdy, for example, has also consistently failed and continues to fail to make this connection.

4 Economic theory has always maintained that economic value is "generated" solely within the economy where it is fully distributed among the factors of production before being "consumed". According to this theory, the economy is an isolated system that does not need flows to pass across its boundaries in support of its steady state ("general equilibrium"). From a thermodynamic point of view this idea is unacceptable. According to thermodynamic theory, any open system, which allows flows of matter and energy to cross its boundaries, is capable of maintaining itself in steady state only because it "transport" value from its environment to restore the value that has been "consumed" within the system and dissipated. Drawing on the analogy with thermodynamics, this paper replaces the traditional systemic analog of the economy, which is the closed "circular flow" process, with the steady flow process. According to this analog, any efficient economy is an open system both physically and economically requiring a "flow" of economic value to maintain its steady state. In other words, an economically isolated system has to be inefficient and is bound to misallocate and overuse environmental resources. Whether the economy behaves as an economically isolated (inefficient) or open (efficient) system is an empirical question. However, if real economies are economically open and efficient, and environmental resources are abused due to the economy's unrestrained material growth, parts of traditional economic theory, especially those related to benefit evaluation, will have to be modified. Policy recommendations will be affected in any case because internalization, the panacea of resource misallocations, cannot be more than a temporary solution. Instead of opening the economy, internalization encloses the harmed resource and saves it by abusing excessively other environmental resources (Amir 1994, abstract).

5 The policy recommendations of most economists are driven by a view of economic reality embodied in Walrasian general equilibrium theory. Ironically, the Walrasian system has been all but abandoned by leading economic theorists. It has been demonstrated to be theoretically untenable, its basic assumptions about human decision making have been empirically falsified, and it consistently makes poor predictions of economic behaviour. *The current revolution in welfare economics offers opportunities on two related fronts for an evolutionary perspective on human behaviour to reshape economic theory and policy*.... Expanding the role of economic analysis beyond stylized market behaviour to focus on well-being (real utility) has far-reaching consequences for microeconomic policy... Abandoning the Walrasian model also means rethinking the microfoundations approach to the economic analysis of sustainability. This opens the door for economists to engage with the growing body of research on the evolution of whole societies (Gowdy 2006, abstract).

6 See page 15: footnote 3.

7 Robinson 1962, p 117.

assumptions (Axioms IV-VII), and of course this is not so unusual either. As Coase noted long ago:

> economic theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgement in choosing between rival sets of assumptions.[1]

Take, for example, a recent reformulation of ecological economics' central thesis from one of your so-called "field's" founding fathers, Herman E. Daly[2] (*ECONOMICS IN A FULL WORLD*, *Scientific American*, September 2005, Vol. 293, Issue 3):

> But the facts are plain and *uncontestable*: the biosphere is finite, nongrowing, *closed* (except for the constant input of solar energy), and constrained by the laws of thermodynamics. Any subsystem, such as the economy, must at some point cease growing and adapt itself to a dynamic equilibrium, something like a steady state.

But are the *facts plain* and *uncontestable?* Is the biosphere *finite* and *closed*? No, two strikes, wrong on both counts. Daly has failed, as you have failed, to grasp that greatest truth of all truths.[3] Go back and look at those axioms again. Pay attention to Axioms IV and (especially) Axiom V. Think about it: it's *not* a closed system, is it? The facts are not *plain* and *uncontestable*, are they? I suspect by now you may feel a bit nauseated, perhaps like an obedient sheep who has blindly followed a drunken shepherd over a cliff, in that very brief interval between terminal velocity and the rocks just below. Perhaps by now you are beginning to understand that this letter is not a joke. Please try not to take it personally (in fact, perhaps you may want to imagine that the letter has been written to Daly (or Amir or Gowdy, etc.) instead, for this critique is as applicable to their positions–and countless others–as it is to yours). Yes, I am wiser than you, and I am wiser than Daly, because I would never be so incredibly naïve to state

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1 1930, p 386.

2 DALY is a professor in the School of Public Policy at the University of Maryland. From 1988 to 1994 he was senior economist in the environment department of the Work Bank, where he helped to formulate policy guidelines related to sustainable development. He is a co-founder and associate editor of the journal Ecological Economics and has written several books (Daly 2005). Also see Daly 1971.

3 The Socratic maxim that the recognition of our ignorance is the beginning of wisdom has profound significance for our understanding of society.... This fundamental fact of man's unavoidable ignorance of much on which the working of civilization rests has received little attention. Philosophers and students of society have generally glossed it over and treated this ignorance as a minor imperfection which could be more or less disregarded.... Perhaps it is only natural that the scientists tend to stress what we do know; but in the social field, where what we do not know is often so much more important, the effect of this tendency may be very misleading (Hayek 1960, pp 22-23).

that *any* facts are *plain* and *uncontestable*. Indeed, I readily consent that all the gold and diamonds I offer herewith may be but pyrite and plexi-glass.

And since it seems that you have difficulty handling complexity and uncertainty, I will make this critical point regarding "ecological economics'" false and sandy foundation even more self-evident, with two simple pictures, which compare and contrast the theoretical framework of "ecological economics" with the theoretical framework of *The Funk-Zweikampf Solution*. My five year old son, William, drew them for you, and you will find them in APPENDIX VII: THE EARTH.

If you have entered into a state of aesthetic arrest, transfixed by the beauty of seven simple axioms (or two simple drawings by a five year old boy) which pound a wildly popular school of economic thought to dust and present a tenable solution to *The Problem of Sustainable Economic Development*, you may, upon regaining your senses, ask yourself, "How did Matt Funk come to understand an essential truth that I, Daly, Nicholas Georgescu-Roegen, William Kapp,[1] Karl Polanyi,[2] E.F. Schumacher,[3] Røpke,[4] Splash,[5] Norgaard,[6] Daily,[7] McCauley,[8] Farley,[9] Hawken,[10] Constanza,[11] Olson,[12] Gowdy, and *literally thousands* of other "economists" have failed to understand?

In short, it has been a long and eventful journey, but I will patiently endeavour to chart the course which I have followed…

And so begins the second instalment of this discourse.

Please feel free to let me know, Dear Ålanders, if you would like me to forward a copy of this paper.

---

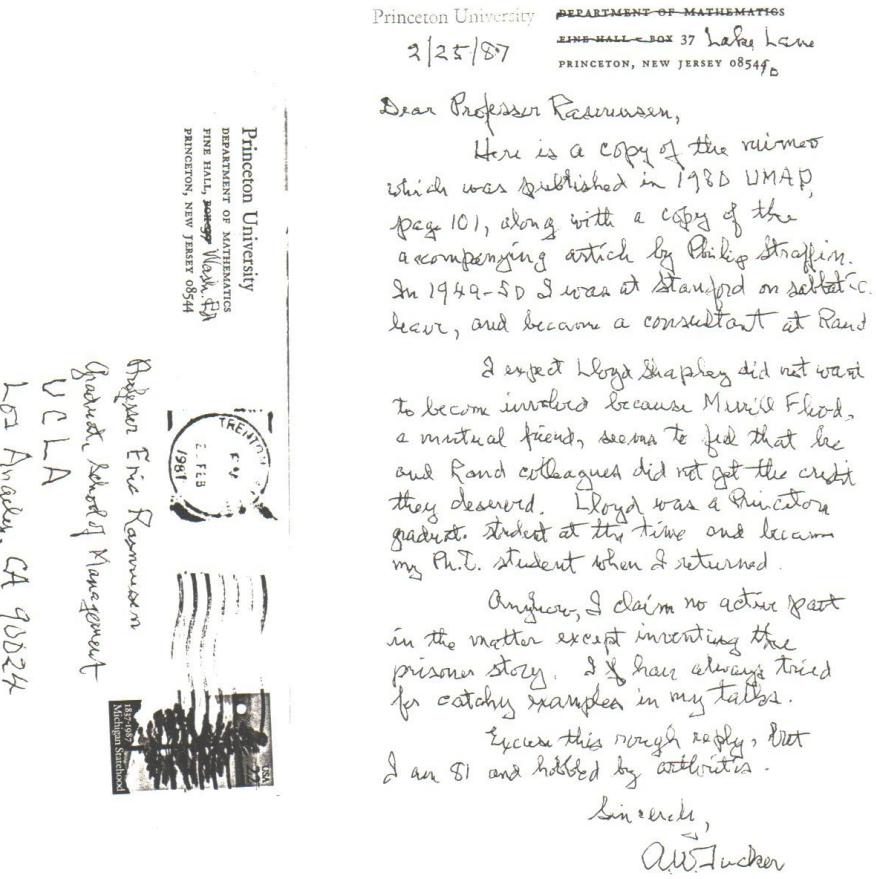
1 1950.
2 1944.
3 1973.
4 2004 ; 2005.
5 1999 ; 2007.
6 1994 ; Nogaard & Bode 1998.
7 1997.
8 2006.
9 Daly & Farley 2004.
10 1994 ; Hawken, Lovins et. Al 2000.
11 et al 1997.
12 Et al 1996.

APPENDIX III: THE PRISONER'S DILEMMA

5 June 2005 Eric Rasmusen (erasmuse@indiana.edu) notes…

Albert Tucker, "A Two- Person Dilemma," unpublished notes (May 1950)

When I was writing the first edition of Games and Information back in the 1980's I was confused by the varying citations give for The Prisoner's Dilemma. I asked Lloyd Shapley about it, since he was there at the founding, and he referred me to Albert Tucker. Professor Tucker replied with this letter [see next page] telling me about his Stanford handout [see third page] and the article by Straffin that tells the story, Philip Straffin, "The Prisoner's Dilemma," UMAP Journal. 1: 101-103 (1980). I republished both in Readings in Games and Information.[1]



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FEB 1981

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Dear Professor Rasmusen,

Here is a copy of the memo which was published in 1980 UMAP, page 101, along with a copy of the accompanying article by Philip Straffin. In 1949-50 I was at Stanford on sabbatical leave, and became a consultant at Rand

I expect Lloyd Shapley did not want to become involved because Merrill Flood, a mutual friend, seems to feel that he and Rand colleagues did not get the credit they deserved. Lloyd was a Princeton graduate student at the time and became my Ph.D. student when I returned.

Anyhow, I claim no active part in the matter except inventing the prisoner story. I have always tried for catchy examples in my talks.

Excuse this rough reply, but I am 81 and hobbled by arthritis.

Sincerely,
A W Tucker

1 (Rasmusen 2005).

See UMAP Journal 1 (1980) 101-103.

A TWO*PERSON DILEMMA

Two men, charged with a joint violation of law, are held separately by the police. Each is told that

(1) if one confesses and the other does not, the former will be given a reward of one unit and the latter will be fined two units,

(2) if both confess, each will be fined one unit.

At the same time each has good reason to believe that

(3) if neither confesses, both will go clear.

This situation gives rise to a simple symmetric two-person game (not zero-sum) with the following table of payoffs, in which each ordered pair represents the payoffs to I and II, in that order:

		II: confess	II: not confess
I	confess	(-1, -1)	(1, -2)
	not confess	(-2, 1)	(0, 0)

Clearly, for each man the pure strategy "confess" dominates the pure strategy "not confess." Hence, there is a unique equilibrium point* given by the two pure strategies "confess." In contrast with this non-cooperative solution one sees that both men would profit if they could form a coalition binding each other to "not confess."

The game becomes zero-sum three-person by introducing the State as a third player. The State exercises no choice (that is, has a single pure strategy) but receives payoffs as follows:

		II: confess	II: not confess
I	confess	2	1
	not confess	1	0

*see J. Nash, PROC. NAT. ACAD. SCI. 36 (1950) 48-49.

Stanford, May 1950

A. W. Tucker

APPENDIX IV: THE PROBLEMS OF RELIGION & SUBJECT MATTERS

Godfrey Baldacchino wrote:

> I should be there on Monday... but, if you wish, I can arrange something more 'formal' - with an invitation issued to all members of the Faculty... Even later on during next week - say, Thursday, 2 to 3.30pm - so we don't have to listen to two presentations back to back...
>
> I have asked Matt to consider a presentation comparing development policy in Barbados and Mustique...
>
> Some more good news: we may have a MAIS grad course in island biogeography on offer as from next September. Courtesy of Dr Marina Silva (Dept of Biology).

Matt Funk wrote:

A formal invite to the department would be great; I'd be happy to deliver a Barbados/Mustique/Sustainable Economic Development seminar....

Very exciting news about the Biogeograpical course offering, by the way, as the more I read on this topic, the more I understand the basis for Bowman's conjecture (1994): "Since biogeography holds the key to the survival of life, it deserves more attention." But I also believe his conjecture is ultimately incorrect, since have also become more acutely aware that "Biogeography" does not exist. And it is in fact unfortunate that there are many who mistakenly believe that it (and every other subject matter) exists. I'm sure you will all recall my emphasis on Popper's (1956) notion that subject matters do not exist; please consider this notion yet again in this light:

***I**t is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialities that perhaps should not have been separated in the first place? Early in this century the specialities of biology and chemistry were joined to form biochemistry; similarly, economics and ecology are now in the process of being combined into ecological economics.*

My first attempt at interdisciplinary analysis led to an essay, "The Tragedy of the Commons." Since it first appeared in Science 25 years ago, it has been included in anthologies on ecology, environmentalism, health care, economics, population studies, law, political science, philosophy, ethics, geography, psychology, and sociology. It became required reading for a generation of students and teachers seeking to meld multiple disciplines in order to come up with better ways to live in balance with the environment.

I did not start out intending to forge an interdisciplinary link, but rather to present a retiring president's address to the Pacific division of the American Association for the Advancement of Science. But even after six revisions, each quite different from the one before, my summary of an ecologist's view of the human overpopulation problem would not crystallize. Repeatedly, I found fault with my own conclusions (Hardin 1998).

The reason I say that it is unfortunate that "Biogeography" exists, is because its methods are absolutely *essential* to understanding "island studies," and it is very easy to see how many scholars may never dig into this "specialty". It is rather ironic that Spellerberg & Sawyer's (1999) "An Introduction to Applied Biogeography (the best introduction I have been able to discover) reaches the same conclusion (Indeed, it was rather lucky that I stumbled into it. I've attached Hardin 1998 (which contains the citation above) and Hardin 1968.

Again, *there are only problems, and our urge to solve them*. If we must insist on subject matters, there is only one subject and it is called "Nature" or perhaps "Biology," and all other problems fit into these laws, as even art and even the laws of physics must be held within the biological realm, since biological organisms form, evaluate, and utilize both the laws of physics and works of art.

Remember, Darwin was not a "evolutionary biologist" or even a "biologist," he was a *Naturalist*. One of the most influential books he read while onboard *The Beagle* was a work by a so-called economist (Malthus, whom also happened to influence Lloyd, of which more to follow). How many "economists" today take time to seek out relevant works in "evolutionary biology"? How many biologist read economics? Although I believe it is fair to say that the answer to both questions is "more than ten years ago," as Hardin noted above, perhaps these "subjects" *should not have been separated in the first place*. I will also suggest that it is no coincidence that, although "The Tragedy of the Commons" is cited by economists more often than any other specialist, Hardin was in fact a biologist.

Another important element I will briefly share is this: If a scholar does not completely understand and accept the fundamentals of what we refer to as evolutionary biology, very close to nothing else will be understood, and his or her analysis is likely to demonstrate this deficit. I believe it may be unfortunate that one may be conferred with a PhD in "Economics" (and every other social science, for that matter) without first (or concurrently) producing a PhD dissertation in Biology (and preferably evolutionary biology,[1] or perhaps at the very least, evolutionary game theory),[2] as I have discovered that economics without evolutionary biology is about as effective as letters without a language. The famous evolutionary geneticist Theodosius Dobzhansky remarked that, "nothing in biology makes sense except in the light of evolution,"[3] but he had only glimpsed the tip of the iceberg: *nothing on Earth* makes sense except in the light of evolution!

I would like you all to carefully consider the six pages which make up Hardin 1968: I submit that if, for example, we had (1) read and discussed these six pages, and (2) agreed to accept the central thesis, (which I realize may not have occurred) then (3) we would have systematically provided solutions for very close to 100% of the problems which we had grappled with many – if not most – of our seminars for the past year. Yes, it is true that one may formulate developmental arguments based upon what are essentially religious grounds (such as a belief in the redistribution of wealth and so-called "inalienable, global human" rights - just who or how the wealth is to be redistributed and how these "global" rights are to be insured is another story), but the burden of proof will be heavy on their hands, as the empirical evidence in favour of evolutionary biology is far greater than the empirical evidence in favour of the existence of god/s.

If you decide to accept and utilize the arguments I'm submitting herewith, and should find yourself criticized for being a "Social Darwinist," kindly thank your critic for essentially calling you a "biologist," because what he or she has unwittingly stated is that you are *logical* and *rational*.

Finally, please consider the following, for I have found that the deep roots of religion, nationalism, and "social norms" may combine to make *nothing more difficult* than to always bear the following in mind:

> Nothing is easier than to admit in words the truth of the universal S*truggle for Life*, or more difficult--at least I have found it so--than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood.

---

1 (a) Among the things that science does know, evolution is about as certain as anything we know (Dawkins 2004).
(b) The two basic questions in evolutionary biology are (1) how does evolution occur and (2) why does evolution occur? The first is a question of mechanisms and the second is a question of influences on those mechanisms (Grant 1998, p 1).

2 See Cressman 1996, Kolstad 2007, Sigmund & Nowak 1999, Stumpf 2001, Vincent 1996, and many excellent works by Weibull.

3 Wilson 2006, p 1479.

> We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year (Darwin 1859, p 62).

Think about this carefully, for in this light you will find *cooperative behaviour*, *kin selection*, *reciprocity*, etc, but you will not find *social justice*. For, once again, who do you propose would administer this "social justice"? The wise owl? The noble lion? Ah, but some will say, "but we are *different*!" Somehow, one single species on Earth (humans) is somehow different than all of the rest. Well, I'm afraid, once again, the burden of proof in this argument is, once again, on their hands,[1] for, again, the argument is essentially religious/irrational.[2] When Nietzsche said "God is dead," what he was trying to say was "God will not protect your nest, God will not collect insects for you, money does not grow on trees, etc. - you must *fight* for your own survival (including your family's survival, your community's survival, your nation's survival, etc.). And yes, more organisms will perish than will survive (and this holds true for *every* species, including ants, bees, birds, humans, hogs, fish, dragonflies, etc.). In evolutionary biology, this is referred to (and, moreover, accepted) as *The Ground Zero Premise*. Even Bertrand Russell, perhaps the greatest logician of the past century, was not able to fully grasp the true nature of this premise.[3]

I would also like to suggest that Hardin's "Tragedy of the Commons" serve as a required text for the Introduction to Island Studies course, as this phrase serves as useful shorthand when it is fully understood, and may help accelerate the learning process when it comes to understanding islands, and thus, understanding the world in which we live.

I Hope you all find this more interesting than tedious; I'm interested and open to any comments and criticisms you may have to offer (including comments or criticisms from Dr Silva and/or other members of our biology department!). I've also CC'd Faiz since I value his criticism and suspect he may strongly disagree; if someone is brave enough to forward to Ariana (I do not have her email), I suspect she may disagree even more adamantly…

Hope to see you all on Monday…Matt

PS: I have attached a third Hardin paper (1974) which may also brew interesting discussions over coffee, as well as an excellent PNAS paper(which I have found to be the single best source for my research purposes) from last week, which, I believe demonstrates how relevant Hardin is yet today. Note the first citation in this PNAS paper is Hardin 1968. I will also add that this citation is *incorrect*, or, at the very least, inadequate, since Hardin did *not* in fact first formulate "The Tragedy of the Commons." - Hardin's work was based upon a much earlier finding by Oxford economist, WF Lloyd (1833), whose work I have also attached; Lloyd's promethean vision was extraordinary.

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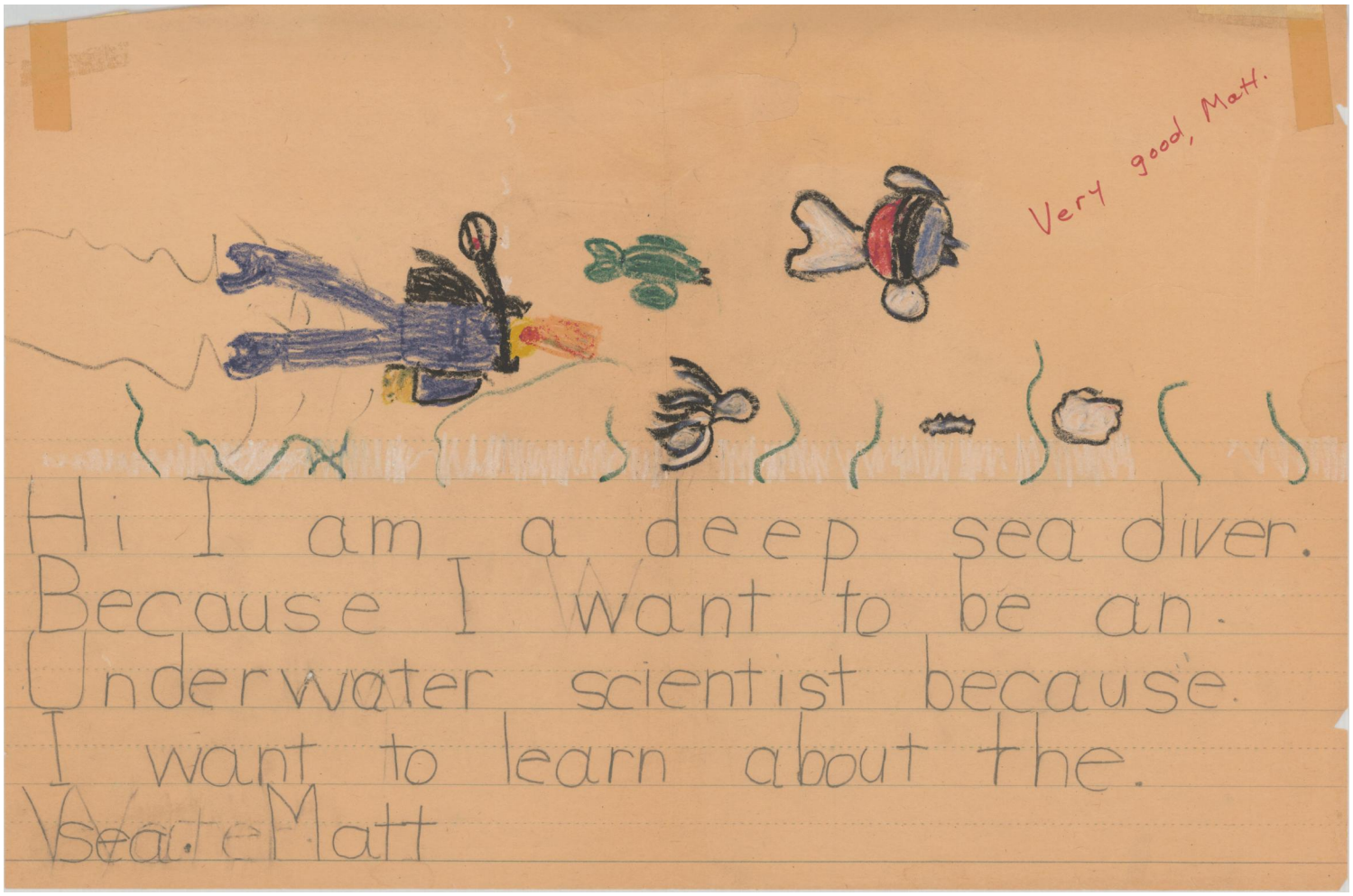
1 I am aware that the conclusions arrived at in this work will be denounced by some as highly irreligious; but he who denounces them is bound to shew why it is more irreligious to explain the origin of man as a distinct species by descent from some lower form, through the laws of variation and natural selection, than to explain the birth of the individual through the laws of ordinary reproduction (Darwin 1883, p 1242).

2 Those whom we called brutes had their revenge when Darwin shewed us that they are our cousins (Shaw 1903, ln 129).

3 Our instinctive apparatus consists of two parts -- the one tending to further our own life and that of our descendants, the other tending to thwart the lives of supposed rivals. The first includes the joy of life, and love, and art, which is psychologically an offshoot of love. The second includes competition, patriotism, and war. Conventional morality does everything to suppress the first and encourage the second. True morality would do the exact opposite. Our dealings with those whom we love may be safely left to instinct; it is our dealings with those whom we hate that ought to be brought under the dominion of reason. In the modern world, those whom we effectively hate are distant groups, especially foreign nations. We conceive them abstractly, and deceive ourselves into the belief that acts which are really embodiments of hatred are done from love of justice or some such lofty motive(Russell 1928, p 13).

APPENDIX V: THE SEA I

Matt Funk *c.* 1974



APPENDIX VI: THE SEA II

Matt,
I think Henry didn't show this to you, because he didn't necessarily agree w/ what Eric was saying here. I thought ya might want to see it though.
Best,
Jessica

9/28/2004

Dear Henry,

This letter is a response to Matt Funk's Song of the Dragonfly. As we have discussed, I think Matt has tremendous talent, and Song of the Dragonfly has the potential to be great first novel. I am very much interested in working with Funk, but in order to further consider it for publication I think I need to get a few concerns addressed. I was very confused as to what kind of story I was reading as this has all sorts of elements that make for a hodgepodge of genres. Its one part of each: fantasy, action/adventure, romance, mystery, and I was often blown away by his science. I can honestly say that I learned a lot from this book.

But the most important issue for a story like this to work is that the reader must be able to suspend disbelief, and that seems to be the hardest thing for me to do. The mass migration seems pretty implausible, even fantastical. But this happens within a very real environment---a very reality based world in which something bizarre has surfaced---filled with relationship troubles and such, and that has the reader back and forth between a fantastical underwater revolution and two people battling their personal and relationship problems. It's like a tug-of-war, with all the tension on the reader. And this tears me in two. Funk's strengths seem to be very much in the reality-based world. He has a great anecdotal style that fleshes out very real characters and offers real-life "lessons" (so to say). But I feel that for a story like this (a man coming to terms with the interconnected Earth, and learning valuable environmental lessons from abizzare gathering of marine mammals), it is best told with many fantastical twists, and would require more elements of the surreal and fantastic.

You brought up the comparison of the early Jonathan Lethem books we did here and they offer up a great example. They suck you into a world where the real has been twisted into a satirical fantasy of dreams and visions, allow you suspend disbelief (as anything in this world is possible), and drag you through philosophical wanderings. But also Funk may be carving out something entirely fresh and needed, the environmental novel. But I think in order for this to work he might need to create some very real environmental situations rather than more fantastical ones.

So I ask you this, do you think that Funk will consider revisiting the book in either a more science-based / reality-based way or maybe a more surreal, fantastic way? I'd be happy to discuss this with Funk if you want me to. I realize that this is more than I alluded to prior, but I feel it is very much necessary. Let me know what you think.

Sincerely,

Eric Raab
Assistant Editor

P.S. I'm going to try and catch up on some reading over the long weekend. Maybe we can talk next week after I read your book.

TOTAL P.01

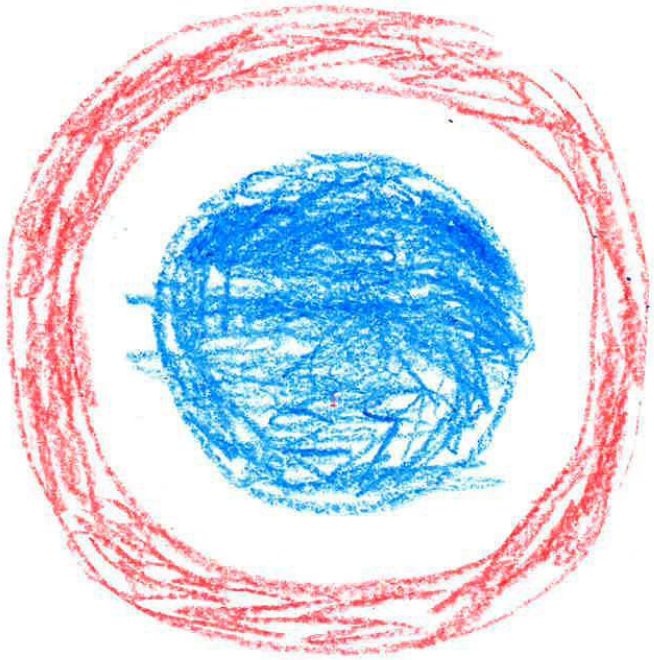
APPENDIX VII: THE EARTH[1]

[The author is saddened to report that the digital file holding this artwork did not make our trans-Atlantic journey. However, please refer to the artwork on the following page and imagine the blue marble in this middle represents this piece.]

This excellent drawing represents the theoretical framework of "ecological economics." The blue represents the Earth, the biosphere and all of its inter-connected systems, which are, naturally, beholden to the second law of thermodynamics. Although "ecological economists" refer to this as a "whole-systems" approach; as you will see on the next page, they "forgot" two systems. This framework is represented in Axioms I-III.[2]

1 Artwork courtesy of William Matthew Funk © 2008.

2 See APPENDIX I.



This excellent drawing represents the theoretical framework of *The Funk-Zweikampf Solution*.
Note that, in addition to the axioms represented in the previous drawing (in blue),
this framework also recognizes two additional, fundamental assumptions:
(1) *political uncertainty* (white), and (2) *planetary uncertainty* (red).
As you can see, this is the "bigger picture," so to speak.
This framework is represented in Axioms I-VI.[1]

1 See APPENDIX I.

APPENDIX VIII: FIELD NOTES FROM MUSTIQUE

For the past several months, prior to engaging in the correspondence below, I reviewed a half-dozen relevant books, several two dozen papers, and a documentary film which all related to the Caribbean, St. Vincent & the Grenadines, and Mustique. On the final page of Goldsmith 1973, (which I will gladly forward upon request), one entry in particular on this final page of references caught my eye:

LLEWELYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, **1970.** *Mustique: proposals for a development study.* Unpubl. Report

Although I suspected that this unpublished report might serve my research well, of course I would never know unless I were able to obtain a copy of the report. Also, naturally, since I was not certain that I would in fact procure this report and, moreover, was uncertain what else I might be able to discover, I tried to cast several wide nets, as I endeavour to hold close the Novalis inscription in Popper's *The Logic of Scientific Discovery: "Hypotheses are nets: only he who casts will catch."*

With that said, here it is:

> *From:* Matt Funk [mailto:matt@covehead.org]
> *Sent:* Wednesday, March 19, 2008 12:05 PM
> *To:* rmahon@caribsurf.com
> *Subject:* Mustique
>
> Greetings from the Institute of Island Studies, Robin!
>
> I've been studying your work for the past several months, and, as I'm
> headed to Barbados on Saturday, and then heading over to Mustique on
> Monday, I hope that you may have some time to meet.
>
> Over the past year I've developed an Economic Theory of Value based
> upon relative Insularity - and although most of those efforts have
> been directed toward Iceland, when I discovered the curious case of
> Mustique several months ago, I realized it served as a far more
> descriptive model for my solution than any island I've encountered to
> date. I've attached an Abstract and the slides from a presentation I
> gave last week (no doubt you'll recognize some insights from your
> works!).
>
> While on Mustique next week, I intend to develop a study which I may
> begin, but plan to conduct in earnest when I return in November.
> Generally speaking, I'm looking to assess the relative successes and
> failures (my preliminary research, as you will see from my two
> attachments, anticipates I may discover more successes than failures)
> as they relate to the adherence to the development suggestions set

> forth in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970.
> *Mustique: proposals for a development study*, unpublished/. To date,
> however, I have not been able to obtain a copy of this original
> report. (Of course I would be very glad to hear if you knew where I
> might find one I would also be grateful to know who commissioned this
> report). Thus my research endeavours will most likely be based upon
> the details from Goldsmith's 1973 /The ecologist's role in development
> for tourism: a case study in the Caribbean/ (which, I'm sure you may
> know, is a review of this 1970 report; if you haven't reviewed this,
> I'll forward it).
>
> Naturally, I would be very grateful for any general insights you may
> have to offer, and if you have time to get together on either island,
> that would be great. Depending upon which day may be available, we may
> have an extra room for you and a guest (my wife and I are guests on
> this trip, but I understand the home we're staying at is substantial;
> also, we're renting a house for a week in November and I would very
> gladly host a Mustique get-away then as well).
>
> In any case, we'll be on Barbados the 22nd-24th (arriving this
> Saturday), then on to Mustique for a week late on the 24th.
>
> Are there any library and/or bookstore (UWI? CERMES?) resources I
> should explore while on Barbados? I have not yet procured a good topo
> map nor a nautical chart - would I find these on Barbados as well?
> Also, if you have any relevant papers which are not archived on the
> CERMES site (I have read your excellent works posted there), I would
> also be grateful for those. Any other suggestions? Also, has anyone
> surveyed the turtle populations on Mustique? Are there any notable and
> relatively readily surveyed Mustique endemics?
>
> Finally, I will add that I hold your *Coastal resources and*
> *livelihoods in the Grenadine Islands: Facilitating Change in*
> *Self-organizing Systems* in utmost high-regard, and it has influenced
> my research significantly. If you think any of your co-authors on this
> piece (or anyone else for that matter) would find mutual benefit in
> exchanging ideas and drinking iced tea with me (on Barbados, Mustique,
> or elsewhere in the Grenadines), please feel free to forward my email
> and/or attachments.
>
> I hope to meet you next week!
>
> Sincerely...Matt Funk

Mahon, Robin wrote:

> Dear Matt,
>
> So nice to hear form someone with similar interests especially an
> interest in the Grenadines. I'll try to answer some of your questions
> below, but first to note that your visit is over Easter weekend and
> that both Good Friday and Easter Monday are holidays in Barbados.

> Everything will be closed, UWI included. It also happens that this
> weekend I have a family reunion here with folks form the UK,
> Australia, Jamaica and US converging. The week end is packed out. I
> would like to meet up with you but it will have to be November.
>
> Regarding the reports you mention, to be honest we have not paid
> Mustique much mind. They do not seem particularly interested in the
> rest of the Grenadines, although Peter Ernst has tried to engage them.
>
> I believe that Julie Horrocks has done some turtle nesting work there
> julia.horrocks@cavehill.uwi.edu
> <mailto:julia.horrocks@cavehill.uwi.edu> Also Father Mark De Silva
> mayreau@caribsurf.com <mailto:mayreau@caribsurf.com> has recently
> completed a very nice book on the biota of Mustique with input from
> Diane Wilson of Mustique dianne@vincysurf.com
> <mailto:dianne@vincysurf.com> .
>
> Re charts, the Imray-Iolaire nautical charts for yachters are among
> the best and are fairly readily available on St. Vincent and in Bequia.
>
> Best of luck with your visit and hopefully we can meet up in November.
>
> All the best
>
> Robin
>
> Robin Mahon
>
> Professor of Marine Affairs and Director
>
> Centre for Resource Management and Environmental Studies (CERMES)
>
> University of the West Indies, Cave Hill Campus
>
> Barbados
>
> Phone 246-417-4570, Fax 246-424-4204

-----Original Message-----
From: Matt Funk [mailto:matt@covehead.org]
Sent: Friday, March 21, 2008 10:55 PM
To: Mahon, Robin
Subject: Re: Mustique

Thanks for the great insight, Robin - and the contacts, I've made plans
to connect with Father Mark and hope to hear back from the other two.
I'm sorry I won't have the opportunity to meet you on this trip, I hope
we can connect in November....

Too bad to hear The Mustique Co. is not particularly interested,
especially considering it would even serve selfish interests:
The transboundary issues make the Caribbean - SVG in particular -
especially problematic. I actually find it rather odd that
they wouldn't be at the forefront of conservation efforts in SVG,

especially the near-neighbouring islands.

In any case, thanks again and enjoy your holiday with your family!
Happy Easter...Matt Funk

PS: You might find this Goldsmith paper of some interest.

-------- Original Message --------
Subject: RE: Mustique
Date: Sat, 22 Mar 2008 06:43:20 -0400
From: Robin Mahon <rmahon@caribsurf.com>
To: 'Matt Funk' <matt@covehead.org>

Thanks for the Paper Matt. And, I too was surprised at the lack of interest
even if only for selfish interests and to obtain some good press.

Robin Mahon
Professor of Marine Affairs and Director
Centre for Resource Management and Environmental Studies (CERMES)
University of the West Indies, Cave Hill Campus
Barbados
Phone 246-417-4570, Fax 246-424-4204

On Mar 18, 2008, at 3:53 AM, Matt Funk wrote:

Greetings from the Institute of Island Studies on Prince Edward Island!

Just wondering if you have completed your Bio-Inventory of Mustique?

Do you have a report and/or checklist available? What's the status of your study?

I'll be on Mustique on the 24th conducting a bit of research of my own - let me know if I may be of any assistance, as I will hope to conduct an informal, general ecological survey.

Thanks! Matt Funk

mayreau@caribsurf.com wrote:

Greetings to you too. I started out doing a "bio-inventory" but ended up doing a "Field Guide" with over 300 pages of photos and general information. When you arrive just ask for a copy of "*/A Natural History of Mustique/*". I would love to meet you and if possible be of some assistance to you. I live on the more southern Grenadine island of Mayreau but I still often 'run-away' to Mustique.

Regards,
Mark.

On Mar 19, 2008, at 3:18 AM, Matt Funk wrote:

> Excellent, they're already holding a copy for me! Wow, I only realized who you were after receiving your reply - I've been studying your work for the past several months!

Indeed, it would be really great to meet - I believe you may find that our common interests are heavily aligned! Over the past year I've developed an Economic Theory of Value based upon relative Insularity - and although most of those efforts have been directed toward Iceland, when I discovered the curious case of Mustique several months ago, I realized it served as a far more descriptive model for my solution than any island I've encountered to date. I've attached the Abstract for a current working paper, and the slides from a presentation I gave last week (no doubt you'll recognize some insights from your works!).

While on Mustique next week, I intend to develop a study which I may begin, but plan to conduct in earnest when I return in November. Generally speaking, I'm looking to assess the relative successes and failures (my preliminary research, as you will see from my two attachments, anticipates I may discover more successes than failures - but of course I realize how prone we are to error!) as they relate to the adherence to the development suggestions set forth in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970. *Mustique: proposals for a development study,* unpublished. To date, however, I have not been able to obtain a copy of this original report. (Of course I would be very glad to hear if you knew where I might find one! I would also like to know who commissioned this report. Tennant? The Mustique Co.? I would also very much like to know your opinions regarding the most influential and effective custodian/s of Mustique's ecology?). Thus my research endeavours will most likely be based upon the details from Goldsmith's 1973 *The ecologist's role in development for tourism: a case study in the Caribbean* (which, I'm sure you're well aware, is a review of this 1970 report; if you haven't reviewed this, I'll forward it).

Naturally, I would be very grateful for any general insights you may have to offer, and of course would love to have a personal introduction to Mustique (and/or the Tabogo Cays)! Depending upon which day may be available, we may have an extra room for you and a guest (my wife and I are guests on this trip, but I understand the home at which we're staying is spacious; also, we're renting a house for a week in November and I would very gladly host a Mustique get-away then as well).
In any case, we'll be on Barbados the 22nd-24th (arriving this Saturday), then on to Mustique for a week late on the 24th. Are there any library and/or bookstore (UWI? CERMES?) resources I should explore while on Barbados? I have not yet procured a good topo map nor a nautical chart - would I find these on Barbados as well? Also, if you have any relevant papers which are not archived on the CERMES site (I have read your relevant works posted there), I would also be grateful for those. Any other suggestions? Also, has anyone surveyed the turtle populations on Mustique? Are there any parrots or other notable endemics?

Thanks again for your reply, Mark, I hope to meet you next week!

Sincerely...Matt Funk
<Mustique Presentation March 08.pdf>
<Value of Insularity.pdf>

Dear Matt,

Wow!!! This is serious stuff - and so wonderful to see that Mustique has captured someone like you in its attempt to protect its natural environment and to help make its tourism sustainable. First of all, you must know that I am a mere amateur naturalist with no biological training or expertise whatsoever. Because of my very general knowledge of our Grenadine islands, I have got my name attached to some papers and documents, but I am only a good observer - not a scientist of any sorts.

I have never been able to locate that "LLEWYN-DAVIES" report and the only person that may be able to locate this is Mr. Brian Alexander of Mustique. The CERMES library at UWI, Barbados is your best bet for locating documents on our Grenadine area - they also have a published Grenadine bibliography at their office there and may also have some relevant maps. I do have a small library at my place on Mayreau that you would be most welcome to use anytime. While in Barbados, please try to locate Prof. Julia Horrocks at the UWI, as she is the most knowledgeable person on the marine turtles of our area. Please find attached a recent paper where I give some background on our present Grenadine conservation situation - it may be of some interest to you.

I will try my best to come to Mustique next week (about Tuesday or Wednesday) to meet with you. Please contact Ms. Dianne Wilson of the Mustique Environmental Committee or Mr Ty xxxx (cant remember his full name), one of the managers of the Mustique Company, when

you arrive there. These two people would be your most relevant resource persons there. Thanks for your offer of accommodation but I always have a place to stay whenever I come to Mustique.

By the way, let me warn you that you are arriving in the midst of our dry season and the vegetation will be quite dry - very different from when you next visit in November.

Regards,
Mark.

Mark de Silva flew to Mustique to meet with me. He joined our party for a picnic lunch under a palapa on windswept Pasture Bay: fruit, mixed salads, home-made pizza slices, and a fine assortment of refreshments and French wines set on linen, china, silver, and crystal, and served with cheer by four members of the house staff. We had several hours of great conversation; Fr. de Silva imparted very interesting anecdotes, filled in some gaps in my research, and seems thoroughly interested in my endeavour, paying me a far greater compliment than I deserve by exclaiming that "he has been waiting all of his life for someone to tell my story!" He then lead us on an excellent tour of the lagoon, and kindly gave me two copies of his excellent new book: *The Spiders of St. Vincent & the Grenadines* (and I in turn gave one copy to my cousin Ben).

----- Original Message -----
From: "Matt Funk" <matt@covehead.org>
To: <dianne@vincysurf.com>
Sent: Friday, March 21, 2008 10:48 PM
Subject: [Fwd: RE: Mustique]
> Hi Dianne!
>
> Both Father Mark and Robin Mahon suggested I might drop you a line to let
> you know I'm heading to Mustique in order to construct a research plan
> which I plan to conduct on a return trip after the rainy season in
> November. My research is rather unusual (and I've attached an abstract
> from a relevant working paper), but, in general, I'm interested in the
> relative health of all of the island's inhabitants - from the turtles to
> the people!
>
> I hope I'll have the opportunity to hear your thoughts on this matter!
>
> I'm a guest at Windwords next week (arriving from Barbados on Monday).
>
> Hope to meet you next week!
>
> Happy Easter!
>
> Matt Funk

Subject: Mustique
Date: Sat, 22 Mar 2008 09:10:25 -0400
From: Dianne Wilson <dianne@vincysurf.com>
Reply-To: Dianne Wilson <dianne@vincysurf.com>
To: Matt Funk <matt@covehead.org>
References: <47E4738F.1010303@covehead.org>

Matt;
I am sure you will enjoy Windwords tremendously. It is a beautiful property and Randall is a great host.

Further to your work, **I suggest that you contact the Mustique Company managing director Hon. Brian Alexander (whose father was the last British GG of Canada). It is best to contact Brian through Randall as he is a shareholder. You will want their cooperation, for sure.**
As you so rightly point out, Mustique is quite unique in that it is an island developed and managed privately, but governed under the laws of St Vincent. The island is very private, and does is not comfortable with scrutiny, so you may find they are not enthusiastic. The island is a sanctuary for flora, fauna and celebrity.

I am sure we will see each other at some point during your upcoming visit. Do let me know what the Mustique Company says, as without their openness, you will not have access to the data you need, and don't be surprised if they say no, you need to understand how Mustique has gained this success as a community where anonymity is a vital part of its success.

Best regards,
Dianne Wilson

Subject: Sustainable Economic Development
From: "Matt Funk" <mfunk@upei.ca>
Date: Mon, 10 Mar 2008 12:01:49 -0300
To: brian@mustique.vc

Greetings from the Institute of Island Studies. For the year I have been utilizing islands to model various problems and solutions relating to the significant problem of sustainable economic development, and, although much of my research has focused on the many positive attributes of Iceland, over the past several months Mustique has emerged as my primary model of the solution to this global problem. In the course of my research, I have developed an economic Theory of Value based on relative insularity which I believe you would find quite interesting. And, regarding Mustique in particular, I have reached a conclusion that (1) stringent land-use policy based upon a sound and thorough ecological development plan, and (2) your management of Mustique have been largely responsible for this sustainable development and pursuant success. I believe Mr Neumann (and, of course Mr Tenant's initial privatization of the island) may certainly be credited as well, but I would be very interested in hearing your thoughts on these and several other points. I will be coming to Mustique on the 24th (for one week) to conduct some field research, and if you have any time available I would be very grateful to discuss your island endeavours, struggles, and extraordinary accomplishments. I plan to spend most of the week taking stock of the island in regards to the original ecological development report Goldsmith (1973) outlined in "The Ecologist's Role in Development for Tourism: a Case Study in the Caribbean." If possible, I would also be very grateful to review a copy of LLEWELYN-DAVIES, WEEKS, FORESTIER-WALKER, BOR (1970) "Mustique: proposals for a development study," and/or any other documentation you believe might serve my research purposes well. I will be in Barbados for two days prior to my arrival on Mustique; if you are aware of any special library collections there, please advise. **Also, I am giving a seminar at The University of Prince Edward Island tomorrow entitled *On the Problem of Islandness: Lessons from Mustique*, and I am submitting a proposal to give another seminar at the Åland International Institute of Comparative Island Studies entitled *On the Problem of Connectivity: Branding Insularity - lessons from Mustique*.** Naturally, if you should have any interest, I would be happy to share any of my research and/or seminars with you and/or your board members. I look very forward to visiting Mustique later this month!

Sincerely...Matt Funk

> -----Original Message-----
> From: Matt Funk [mailto:matt@covehead.org]
> Sent: 18 March 2008 22:47
> To: brian@mustique.vc

> Subject: [Fwd: RE: Mustique Presentation…]
>
> Greetings Brian….Not sure if you received my email last week, so I
> wanted to follow up in hopes that we might be able to visit.
>
> I also thought perhaps you may be more inclined to visit with me if I
> were able to paint a better picture of my research endeavour.
>
> I've attached a pdf copy of a presentation of my research on Mustique
> (which I delivered here on PEI two weeks ago, and to which my cousin, Ben Funk, refers below).
>
> It seems likely that you have had an extraordinarily positive impact
> upon the development of Mustique, and I would like the opportunity to
> document your contribution in my research.
>
> Also, I have been waiting to hear back from your rental/sales department
> regarding the availability of Fort Shandy for this November. I would
> also be very keen to learn if the property is for sale. Otherwise, I
> would also be interested in any property which demonstrates rental
> cash-flow independence (if, that is, such a property should exist).
>
> If you and/or others would be interested in hearing my presentation
> while I am on the island, I would be happy to do so.
>
> I'll call your office Thursday to see if you have the time or interest
> in meeting with me next week.
>
> Sincerely…Matt Funk

> -------- Original Message --------
> Subject: RE: Mustique Presentation…
> Date: Tue, 18 Mar 2008 11:26:25 -0000
> From: Ben Funk <bfunk@liongatecapital.com>
> To: Matt Funk <matt@covehead.org>
> References: <47DF9A3B.2000309@covehead.org>
>
> Love it…cant wait to show it to Randall…
>
> Ben Funk
> Partner
> Liongate Capital Management
> Liongate House
> 23 Great Pulteney Street
> London W1F 9NH
> United Kingdom
> T: +44 (0)20 7534 3640
> F: +44 (0)20 7534 3641
> M: +44 (0)7973 525 911

Brian Alexander wrote:

> Matt,
> No, I did not get your first email--hence my not replying to you.

> Thank you for sending a copy of your pdf presentation which I have read with interest.

> It is not clear from this email when you are going to be on the island and
> where you will be staying. I assume that next week is the dates you will be
> here. I would be happy for us to meet and, yes, please call the office
> tomorrow Thursday and speak to Cordelia who is my PA (I am in St Vincent
> all day tomorrow)and she can arrange a day and time and as you can see, I am
> copying her with this. I must point out that next week is my busiest week of
> committee and planning and Board meetings with the Directors and so we will
> have to work around those times.
> I have spoken to the villa rental department about Fort Shandy and they will
> get back to you about its availability in Nov. It is not for sale.
> When we meet I can show you the short list of properties for sale and
> discuss with you their rental prospects
> Regards
> Brian Alexander

-----Original Message-----
From: Matt Funk [mailto:matt@covehead.org]
Sent: 21 March 2008 22:41
To: Brian Alexander
Subject: Re: [Fwd: RE: Mustique Presentation...]

Thank you for your reply and offer to get together with me, Brian. We leave for Barbados tomorrow, then on to Mustique on Monday. My cousin Ben and his wife, Zarina have graciously invited us to spend the week with them at Windwords. If you have time to come over for lunch, that would be great, otherwise perhaps we could meet somewhere for a bite or drink? In any case, I realize I'm catching you in the middle of your busy season, and I'd appreciate any time you might have available.

I'm sorry you didn't receive my previous email; I'll sketch an outline of my rather unusual research interest:

I'm conducting research at the Institute of Island Studies here on Prince Edward Island, and over the past year I've developed an Economic Theory of Value based upon relative Insularity - and although most of my efforts have been directed toward Iceland, when my cousin Ben brought Mustique to my attention several months ago, I realized it served as a far more descriptive model for my solution to *The Problem of Sustainable Economic Development* (which I endeavour to demonstrate is actually no different than *The Problem of Global Warming*, i.e. irrational resource consumption). You kindly reviewed the presentation slides I forwarded (and I imagine - out of context and without the corresponding dialogue - at best they may merely rather hazily outline my efforts). I've attached the Abstract for a current working paper which may also shed some light on my research.

While on Mustique, I hope to distil a general assessment and develop a

study which I may begin, but would like to conduct in earnest when I return in November. Generally speaking, I'm looking to assess the rather extra-ordinary, asymmetrical success Mustique has achieved through privatization, initial carrying-capacity assessments, strict land-use policies, a community of individual with relatively like-minded values, and prudent management (which is, of course, where I believe your efforts factor heavily in the equation) as they all relate to the adherence of the development plans outlined in LLEWYN-DAVIES, WEEKS, FORESTIEK-WALKER & BOR, 1970, *Mustique: proposals for a development study*. To date, I have not had the fortune of reviewing this report. If you are aware of a copy that I may be able to review, I would be extraordinarily grateful.

Thus my research objectives have been centred upon the only source of the early planning stage that I am aware of: Goldsmith's 1973 *The ecologist's role in development for tourism: a case study in the Caribbean*. (which, I'm sure you're well aware, is a review of the LLEWYN-DAVIES report; if by chance you're not familiar with this study, I'll attach it to this email as well.

Naturally, I would be also be very grateful for any general insights, direction, archives, or opinions you may have to offer.

Also, I should note that I've discovered that my central thesis seems rather controversial in some circles (for I have discovered that some individuals appear uncomfortable considering the possibility that individuals with relatively extraordinary means may offer a solution to global ecological degradation (and thus, in the long run, global poverty, as well). But I have also discovered that, for other individuals, Mustique helps simplify a powerful solution to what is perhaps one of the single greatest problems facing human civilization.

Thanks again Brian, I look forward to meeting and speaking with you next week.

Happy Easter...Matt Funk-------- Original Message --------

Subject:RE: [Fwd: RE: Mustique Presentation...]
Date: Sat, 22 Mar 2008 11:17:27 -0400
From: Brian Alexander <brian@mustique.vc>
To:'Matt Funk' <matt@covehead.org>

Thanks for sending me the Abstract and the Goldsmith report which I had read, but many years ago.

I have the Llewlin-Davies report and can give you a photocopy of it when you are here.

I think the best is for you to call the office on Tuesday and then we can make an arrangement to meet. We will be in here from 8 am.

Yours truly, Brian Alexander

I met with the Hon. Brian Alexander at the Mustique Co. Office, and we engaged in an excellent two-hour conversation about the developmental history of Mustique, and Mr Alexander offered his insights regarding my research, which he had kindly, thoroughly reviewed. His secretary went off to photocopy the *original* development plan by hand, and returned with my copy just as we were wrapping up our conversation! Mr Alexander also gave me a parting gift: A fine copy of Billinghurst's1804 Mustique map (cited in *The Mustique Development Plan* and Goldsmith 1973)! The Mustique Co. has a framed print of the same map on the wall just outside of Mr Alexander's office. Quite fortunately, I made it back to PEI with the plan and the map in perfect condition (the plan was never beyond arm's-reach during my entire trip home!).

I have detailed this brief snapshot of this discovery, intuitive hunch, and somewhat relentless pursuit within the context of my life-long pursuit of knowledge, and I might also add that, despite a recent contention that I was very "lucky" to procure this report, *I contend that what many refer to as luck is in reality the intersection of preparation and opportunity*.

Thus, below I offer a snapshot of the treasured I discovered on my first expedition to the admirable island Mustique, the first two pages of the 128 page, original, unpublished, 1970 *Mustique Development Plan*, which beautifully illustrates the essence of the entire report, and, most significantly, perhaps the single greatest planned execution of sustainable economic development. If you should have interest in reviewing this remarkable plan, you are all welcome to Stanhope, Prince Edward Island, for a guest-room for 3 nights (!), an Atlantic Lobster dinner, refreshments, a comfortable chair, and a good light under which to review the report, as I will respect the trust in which The Mustique Co. has generously endowed me with my present custodianship of their unpublished, private report.

In December 1970 the Mustique Company, sole owners of the Eastern Caribbean Island of Mustique, appointed the firm of Llewelyn-Davies Weeks Forestier-Walker & Bor to prepare a 20-year Development Plan for the island by May 1971. It was stressed that the study should concentrate on establishing the feasibility of low density high-income residential tourist development with small hotels both for the international and the local market. Proposals for immediate action were also required.

Within these wide terms of reference we have attempted to produce a Plan that is both a document showing existing and proposed use of land, and an instrument that embodies social, economic and ecological policies.

Despite the small size of the island a study of this kind involves consideration of most of the interacting components of a much larger system and similar or perhaps greater problems in making projections for future development.

We have felt therefore that the Plan should afford as much freedom as possible for the Mustique Company to respond to future opportunities, while at the same time providing policies that are firm and clear enough to guide development and to offer assurances to those investing.

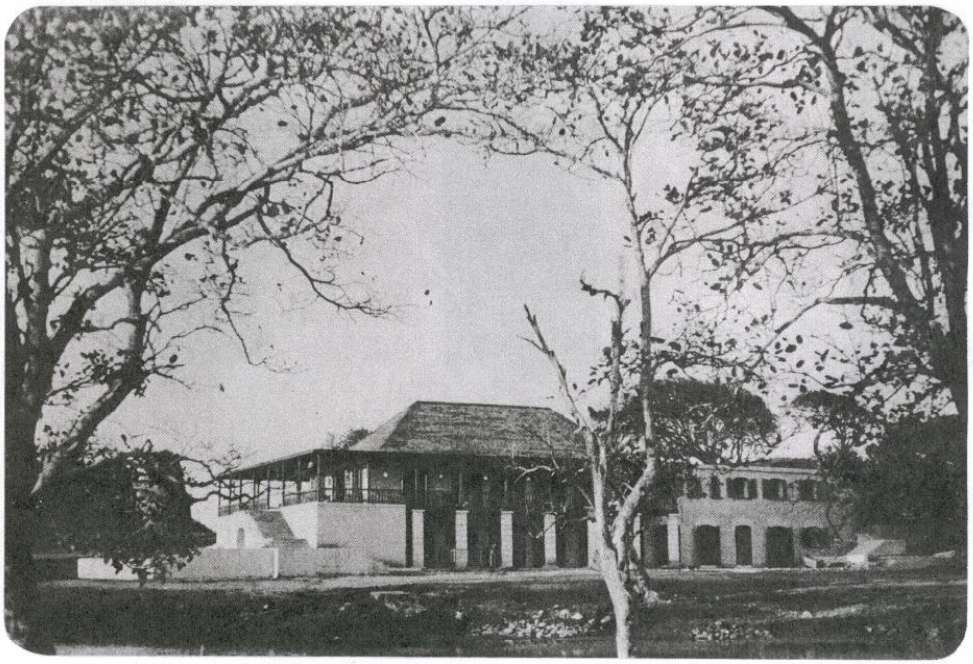


FIGURE 1: MUSTIQUE 1970 : THE COTTON HOUSE HOTEL

The development of Mustique involves the relationship of 3 groups of people: the Vincentians, the Visitors and the Mustique Company. The plan will need to assure potential investors that the proposals offer them the facilities they need within a context of reasonable long-term environmental and socio-economic stability.

This study has therefore attempted to identify the ecological and socio-economic constraints to development on the island and to make proposals that will offer a framework for maximising return on investment taking into account those constraints.

The goals of the plan have therefore been seen as:

1 To identify that sector of the potential regional market that will complement rather than compete with development elsewhere in the St Vincent Grenadines and provide suitable residential, recreational and service facilities on Mustique.

2 To minimise disturbance to the ecology of the island by achieving the most suitable relationships between proposed uses and the natural resources, and ensuring that the capacity of the island is not exceeded.

3 To maximise returns on capital invested by the Mustique Company within the constraints, ensuring that at each stage investments can be seen to be related to specific returns.

4 To adopt generally a policy of gradualism so that the effects of development can be carefully monitored; and in the short-term, to optimise the use of already existing and committed infrastructure.

5 To maximise the benefits accruing to the people of St Vincent from the development of Mustique.

ABBREVIATIONS & DEFINITIONS

Axiom

(a) "Fundamental Ideas"... are the sources of necessary truths (sometimes called "Axioms").[1]
(b) One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps to justify and clarify the other.[2]

Byr **Billion Years**

Biogeography

(a) Biogeography is the study of the distribution and patterns of distribution of plants, animals and other organisms across the globe, on land, in the sea and in the air 3
BIOGEOGRAPIHS the study of the facts and the patterns of species distribution. It's the science concerned with where animals are, where plants are, and where they are not. On the island of Madagascar, for instance, there once lived an ostrichlike creature that stood ten feet tall, weighed half a ton, it thumped across the landscape on a pair of elephantine legs. Yes, it was a bird. One thousand pounds of bone, flesh, feathers. This 1s no hypothetical monster, no implausible fantasy of Herodotus or Marco Polo. h a ramshackle museum in Antananarivo, I've seen its skeleton; I've seen its two-gallon egg, Palaeontologists know it as *Aepyomzs maximus*. The species summed until Europeans reached Madagascar m the sixteenth century and began hunting it, harrying it, transforming the ecosystem a was part of, scrambling those bounteous eggs. A millennium ago, *Aepyomzs maxzmus* existed only on that single island; now it exists nowhere. To say so is the business of biogeography. As practiced by thoughtful scientists, biogeography does more than ask *Which species?* and *To Where?* It also asks Why? and, what is sometimes even more crucial, Why *not?*[4]

Consilience

(a) Of the two major methods for inferring history from single configurations, consilience calls upon a greater range of evidence. This word, coined by William Whewell in 1840, means "jumping together." By this term, Whewell referred to proof by coordination of so many otherwise unrelated consequences under a single causal explanation that no other organization of data seems conceivable. In a sense, consilience defines the larger method underlying all Darwin's inference from historical records In a more specific context, I use consilience... for Darwin's principal tactic of bringing so many different points of evidence to bear on a single subject, that history wins assent as an explanation by overwhelming confirmation and unique coordination.[5]

Cultural Evolution

It has been claimed that a meaningful theory of cultural evolution is not possible because human beliefs and behaviors do not follow predictable patterns. However, theoretical models of cultural transmission and observations of the development of societies suggest that patterns in cultural evolution do occur.... We show that natural selection... slows the evolution of functional structures, whereas symbolic designs differentiate more rapidly. This finding indicates that cultural change, like genetic evolution, can follow theoretically derived patterns.[6]

Ecology

In 1870, the German biologist Earnst Haeckel (1834-1919) first coined the term 'ecology' and defined it as 'the total relations of the animal both to its inorganic and organic environment'. In some ways that encapsulated what ecology is today; the study of the interactions between organisms and their environment.[7]

---

1 Whewell 1837, reprinted in Butts 1968, p 5.
2 Nash 1953, p 129.
3 Spellerberg & Sawyer 1999, p xi.
4 Quammen 1996, p 2.
5 Gould 2002, p 104.
6 Rogers & Ehrlich 2008, p 3416.
7 Spellerman & Sawyer 1999, p 14.

Equilibrium

(a) The notion of an equilibrium point… yields a generalization of the concept of the solution of a two-person…game. It turns out that the set of equilibrium points of a two-person…game is simply the set of all pairs of opposing "good strategies."[1]

(b) A Nash equilibrium is defined as a strategy combination with the property that every player's strategy is a *best reply* to the other players' strategies. This of course is true also for Nash equilibria in *mixed* strategies. But in the latter case, besides his mixed *equilibrium strategy,* each player will also have infinitely many *alternative* strategies that are his *best replies* to the other players' strategies. This will make such equilibria potentially unstable.[2]

Evolutionary Game Theory

(a) Evolutionary theorizing has a long tradition in economics. Only recently has this approach been brought into the framework of noncooperative game theory. Evolutionary game theory studies the robustness of strategic behavior with respect to evolutionary forces in the context of games played many times in large populations of boundedly rational agents. This new strand in economic theory has… opened up doors to other social sciences.[3]

(b) Nowadays it almost seems to be obvious that the correct application of Darwinism to problems of social interaction among animals requires the use of non-cooperative game theory, but when this idea was first conceived it was a revolutionary great insight.[4]

ESS

Evolutionary Stable Strategy

Maynard Smith and Price (1973) introduced the concept of an evolutionarily stable strategy (ESS). Initially they were not aware of the relationship between the concept of an ESS and that of a Nash equilibrium. Rational game theory looked at mixed strategies as produced by conscious randomization. Nash's interpretation of a mixed equilibrium as a mass action phenomenon was buried in his unpublished dissertation and not found in textbooks on game theory. In biology the mass action interpretation is very natural and guided the work on evolutionary stability already from its beginning. In their original paper, Maynard Smith and Price (1973) restricted their attention to two person games in normal form. They defined an ESS as a strategy prescribed by a symmetric equilibrium point.[5]

Funk-Zweikampf Solution

Our strategic solution is derived through the axiomatic application of our unified theory of value of the biological and social sciences,[6] generated through the discovery that *Value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$.

I_R is formulated with the following variables: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year & % km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), and the following four qualitative inputs: Sovereign Status, Constitutional Balance, Cultural Homogeneity, and Military Power*. We calibrate our formulae by adjusting relative input weighting in accordance a positive, linear biogeographical correlation between I_R and the average human life expectancy for the corresponding politico-biogeographic area.

Game Theory

(a) It is conventional to call these situations "games" when they are being studied from an abstract mathematical viewpoint. Here the original situation is reduced to a mathematical description, or model. In the abstract "game" formulation only the minimum quantity of information necessary for the solution is retained. What the actual alternative courses of action are among which the individuals must choose is not regarded as essential information. These alternatives are treated as abstract objects without special qualities and are called "strategies." Only the attitudes (like or dislike) of the two individuals towards the ultimate results of the use of the various possible opposing pairs of strategies are

1 Nash 1950, p 286.
2 Harsanyi 1994, p 167.
3 Weibull 2002, abstract.
4 Selten 1994, p 168.
5 Selten 1994, p 168.
6 See APPENDIX I

considered (Nash 1953, 128).

(b) A game is non-cooperative if it is impossible for the players to communicate or collaborate in any way (Ibid, pp 128-129).

(c) Game theory is a theory of *strategic interaction*. That is to say, it is a theory of *rational behavior* in social situations in which each player has to choose his moves on the basis of what he thinks the other players' *countermoves* are likely to be.

After preliminary work by a number of other distinguished mathematicians and economists, game theory as a systematic theory started with von Neumann and Morgenstern's book, *Theory of Games and Economic Behavior,* published in 1944. One source of their theory was reflection on *games of strategy* such as chess and poker. But it was meant to help us in defining rational behavior also in *real-life* economic, political, and other social situations [all italics Harsanyi's 1994, p 136].

GEMS **Globalized Economic Military Superpowers**

Presently, the United States of America represents the only true player in this arena, but our definition includes all five signatory members of the UK-USA agreement (UK, USA, Canada, Australia, and New Zealand), often referred to as AUSCANZUKUS, and six other nations which have developed, detonated, and presently maintain nuclear weapons (Russia, France, China, India, Pakistan, and North Korea). As noted below (RIS), however, GEMS status is not absolute.

Guns Vrs. Organic

Guns versus Organic Butter model is our contemporary reformulation of the classic, antiquated production possibility frontier analogy, which models the national defence/civilian goods dilemma. Our model emphasized that, when RIS pursue rational development strategies, the dominant strategy is "Organic Butter" rather than simply "Butter." Organic butter is an agricultural and fisheries development strategies for sustaining and fostering (1) a pristine environment, (2) organic agricultural, (3) agriculture and fisheries independence, and (3) a sustainable and pure water table.

Hyperbolic Discounting

It is well known from the literature that hyperbolically discounting agents tend to postpone actions into the future from an ex ante point of view, as declining discount rates imply a change of the relative weight of benefits and losses. It is also well known that naive agents tend to further procrastinate actions from an ex post point of view, as they are not aware of the time-inconsistency problem and that this outcome may be inefficient (e.g., Ackerlof 1991, O'Donoghue and Rabin 1999). Yet, the interesting result derived from the exposition so far is that, no matter whether agents are sophisticated or naive, they will never invest in environmental protection if agent 1 does not invest (Winker 2006, p 13).

I_n/ i_n **Island**

The foundation to our game theoretical approach to comparative island studies rests on the principles of set theory, and our primary island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All biogeographical regions on Earth are distinguishable to various degrees of relative insularity, and thus, *all* regions on Earth – islands, continents, and oceans alike – make up the sub-set: $\{i_1, i_2, i_3, \ldots i_n\}$. Thus, the islands which make up the Earth are a subset Earth Island: $\{i_1, i_2, i_3, \ldots i_n\}$ $\{I_1\}$. These sub-sets may be configured and analyzed by utilizing a wide-variety of biogeographical and political parameters.

Learning

Learning from history does not come naturally to us humans.... It is a platitude that children learn only from their own mistakes; they will cease to touch a burning stove only when they are themselves burned; no possible warning by other s can lea to developing the smallest form of cautiousness. Adults, too, suffer from such a condition. This point has been examined by behavioural economics pioneers Daniel Kahneman and Amos Tvesrsky.... In some respects we do not learn from our own history. Several branches of research have been examining our inability to learn from our own reactions to past events: For example, people fail to learn that their emotional reactions to past experiences (positive or negative) were short-lived—yet they continuously retain the bias of thinking that the purchase of an object will bring long-lasting , possibly permanent happiness or that a setback will cause severe and prolonged distress (when in the past similar setbacks did not affect them for very long and the joy of the purchase was short-lived.[1]

Myr **Million Years**

1 Taleb 2001.

Myths

Human events spring from passions, which generate systems of attendant *myths*. A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason.[1]

Politician

(a) The successful politician owes his power to the fact that he moves within the accepted framework of thought, that he thinks and talks conventionally. It would be almost a contradiction in terms for a politician to be a leader in the field of ideas. His task in a democracy is to find out what the opinions held by the largest number are, not to give currency to new opinions which may become the majority view in some distant future.[2]

(b) Politicians do not find any attractions in a view which does not lend itself to party declamation, and ordinary mortals prefer views which attribute misfortune to the machinations of their enemies. Consequently people fight for and against quite irrelevant measures, while the few who have a rational opinion are not listened to because they do not minister to any one's passions.[3]

PEI Prince Edward Island

Prisoner's Dilemma

(a) Al Tucker was on leave at Stanford in the Spring of 1950 and, because of the shortage of offices, he was housed in the Psychology Department. One day a psychologist knocked on his door and asked what he was doing. Tucker replied: "I'm working on game theory.", and the psychologist asked if he would give a seminar on his work. For that seminar, Al Tucker invented the Prisoner's Dilemma as an example of game theory.[4]

(b) The Prisoner's Dilemma… is a game where two players have the option to cooperate or to defect. If both cooperate they receive the reward, *R*. If both defect they receive the punishment, *P*. If one cooperates and the other defects, then the cooperator receives the sucker's payoff, S, while the defector receives the9 temptation, *T*. The Prisoner's Dilemma is defined by the ranking $T>R>P>S$.

Would you cooperate or defect? Assuming the other person will cooperate it is better to defect, because $T>R$. Assuming the other person will defect it is better to defect, because $P>S$. *Hence, no matter what the other person will do it is best to defect. If both players analyze the game in this rational way then they will end up defecting. The dilemma is that they both could have received a higher payoff if they had chosen to cooperate. But cooperation is irrational.*[5]

(c) This ''collective-risk social dilemma'' exists in various social scenarios, the globally most challenging one being…climate change.[6]

Problem of Global Warming

Contrary to popular opinion, "*The Problem of Global Warming*," is *not* ecological distress due to the superheating of the Earth—because this is clearly not the problem—it is merely a single symptom of far more significant, inter-related problems, which stem from the *Problem of Induction.* In short, this problem is synonymous with *The Problem of Sustainable Economic Development*.7

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1 Italics mine, Russell 1928, pp 6-7.

2 Hayek 1982.

3 Russell 1928, p3.

4 Kuhn 1994, p 161. For A.W. Tucker's version, see APPENDIX IV: THE PRISONER'S DILEMMA.

5 Italics mine, May & McLean, 2007, p 8. Also see APPENDIX I, Cressman 1996, Hauert 2006, Weibull & Salomonsson 2006

6 Milinski et. al. 2008, p 2291.

7 Funk 2007a.

Problem of Induction[1]

We submit *The Problem of Induction* may represent the most deeply entrenched and least understood problem on Earth, and it seems not much more about this problem may be usefully imparted without opening another four hundred page pandora's box; We regret the complexities surrounding this problem are too expansive to address in what is already a very long letter,[2] but the problem was first recognized by Hume (see Solution Part 1, below), and the solution was developed by Popper (see Part II). We've included numerous examples, which may help illuminate the pervasive nature of this problem in various contexts, especially in regards to Dasgupta's dubious claim to be a contributor in "these are early days in the *quantitative* study of sustainable development;"[3] because, since the time of Hume[4] and Cournot,[5] it has been self-evident that hope for a *quantitative* study of sustainable development is impossible without the aid of a time machine.

[Solution Part I:] Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience*.[6]

[Solution Part II:] According to a widely accepted view... the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences....

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity' [Reichenbach, Erkenntnis 1, 1930, p. 186]. At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads...to an infinite regress.[7]

(exempli gratia: a) It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume...saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this*.[8]

(exempli gratia: b) *The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today*. But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory.

The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. *Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge*.[9]

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1 Also see Cournot 1838, Reichenbach 1930, 1966, Reichenbach et. al. 1971, Russell 1903, 1908, 1913, 1919, 1948,Ludwig et. al. 1993, and Wittgenstein 1969. Most works by Popper address this problem from various angles and within variable contexts.

2 Popper's 513 page treatise (1959) offers the best introduction.

3 2005, italics mine.

4 1739

5 1838

6 Italics mine, Hume 1739, Book I, Vol I, p 137.

7 Popper 1959, pp 31-35.

8 Italics mine, Popper 1994, p 36.

9 All italics mine, Popper 1994, p 37.

(exempli gratia: c) Hume has permanently influenced the development of the best of philosophers who came after him. *Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing.*[1]

(exempli gratia: d) There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility we must ready ourselves for.[2]

(exempli gratia: e) The assumption that economists can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers.[3]

(exempli gratia: f) There is a problem in inference well-known as the problem of induction. It is a problem that has been haunting science for a long time, but hard science has not been as harmed by it as the social sciences, particularly economics, even more the branch of financial economics.[4]

(exempli gratia: g) Reared on Merton's and Scholes teachings of efficient markets, the professors actually believed that prices would go and go directly where the models said they should. The professors' conceit was to think that models could forecast limits of behavior. In fact, the models could tell them what was reasonable or what was predicable based on the past.[5]

(exempli gratia: h) Recall that I have waged a war against the charlatanism of some prominent financial economists for a long time. The points are as follows. One Harry Markowitz received something called the Nobel Memorial Prize in Economics…

What is his achievement? Creating an elaborate method of computing *future* uncertainty… An immediate result of Dr. Markowitz's theory was the near collapse of the financial system in the summer of 1998… by Long Term Capital Management ('LTCM'), a Greenwich, Connecticut, fund that had for principals two of Dr Markowitz's colleagues, 'Nobels' as well"…

Somehow they thought they could scientifically 'measure' their risks. They made absolutely no allowance in the LTCM episode for the possibility of their not understanding markets and their methods being wrong."[6]

(exempli gratia: i) Kant, in his Critique of Pure Reason, asserted under the influence of Hume that pure speculation or reason, whenever it ventures into a field in which it cannot possibly be checked by experience, is liable to get involved in contradictions or 'anti-anomies' and to produce what he unambiguously described as 'mere fancies' ; 'nonsense' ; 'illusions' ; 'a sterile dogmatism' ; and 'a superficial pretension to the knowledge of everything.'[7]

(exempli gratia: i) The indomitable force of nature was a fashionable nineteenth-century belief. The age was marked by tremendous optimism about science. The lesson gleaned from Charles Darwin, especially as interpreted by the tremendously influential British scientific philosopher Thomas Henry Huxley, was that nature was a marvellous and determined force that held the inevitable solutions to all of life's problems. Huxley was appointed to three British fishing commissions. He played a major role in an 1862 commission, which was to examine a complaint of driftnet herring fishermen, who said that longliners were responsible for their diminishing catches. The fishermen had asked for legislation restricting longlining. But Huxley's commission declared such complaints to be unscientific and prejudicial to more "productive modes of industry." The commission also established the tradition in government of ignoring the observations of fishermen. It reported that "fishermen, as a class, are exceedingly unobservant of anything about fish which is not absolutely forced upon them by their daily avocations."

At the 1883 International Fisheries Exhibition in London, which was attended by most of the great fishing nations of the world, Huxley delivered an address explaining why overfishing was an unscientific and erroneous fear: "Any tendency to over-fishing will meet with its natural check in the diminution of the supply,… this check will always come into operation long before anything like permanent exhaustion has occurred."…

For the next 100 years, Huxley's influence would be reflected in Canadian government policy. An 1885 report by L.Z. Joncas in the Canadian Ministry of Agriculture stated:

"The question here arises: Would not the Canadian fisheries soon be exhausted if they were worked on much

1 Italics mine, Einstein 1956 p 21-22.
2 Botton 2000, p 90.
3 Hayek 1991, p 9.
4 Taleb 2004, p 117.
5 Lowenstein 2000, p 234.
6 Taleb 2001, pp 241-242.
7 Popper, 1945, vII, p38.

larger scale and would it be wise to sink a larger amount of capital in their improvement?

...As to those fishes which, like cod, mackerel, herring, etc. are the most important of our sea fishes, which form the largest quota of our fish exports and are generally called commercial fishes—with going so far as to pretend that protection would be useless to them—I say it is impossible, not merely to exhaust them, but even noticeably to lessen their number... *For the last three hundred years fishing has gone on in the Gulf of St. Lawrence and along the coast of our Maritime Provinces, and although enormous quantities of fish have been caught, there are no indications of exhaustion* ."[1]

Only a decade after reassuring the Canadians and the world that the waters around Great Britain "show no sign of exhaustion," such a thing being scientifically impossible, the British discovered that the cod stocks in the North Sea had been depleted.[2]

(exempli gratia: j) We shall never attain scientific consensus concerning the systems that are being exploited. There have been a number of spectacular failures to exploit resources sustainably, but to date there is no agreement about the causes of these failures....

The great difficulty in achieving consensus concerning past events and a fortiori in prediction of future events is that controlled and replicated experiments are impossible to perform in large-scale systems. Therefore there is ample scope for differing interpretations. There are great obstacles to any sort of experimental approach to management because experiments involve reduction in yield (at least for the short term) without any guarantee of increased yields in the future. Even in the case of Pacific salmon stocks that have been extensively monitored for many years, one cannot assert with any confidence that present levels of exploitation are anywhere near optimal because the requisite experiments would involve short-term losses for the industry....

Scientific certainty and consensus in itself would not prevent overexploitation and destruction of resources. Many practices continue even in cases where there is abundant scientific evidence that they are ultimately destructive. An outstanding example is the use of irrigation in arid lands. Approximately 3000 years ago in Sumer, the once highly productive wheat crop had to be replaced by barley because barley was more salt-resistant. The salty soil was the result of irrigation. E. W. Hilgard pointed out in 1899 that the consequences of planned irrigation in California would be similar. His warnings were not heeded. Thus 3,000 years of experience and a good scientific understanding of the phenomena, their causes, and the appropriate prophylactic measures are not sufficient to prevent the misuse and consequent destruction of resources....

Once we free ourselves from the illusion that science or technology (if lavishly funded) can provide a solution to resource or conservation problems, appropriate action becomes possible. Effective policies are possible under conditions of uncertainty, but they must take uncertainty into account.[3]

(exempli gratia: k) 'In cases of uncertainty, economic reasoning will be of little value' (Lucas, 1981, P 224).... In the case of uncertainty no such probability distribution is possible and in consequence, to quote two of economics most eminent practitioners 'no theory can be formulated in this case' (Arrow, 1951 p. 417) and again 'In cases of uncertainty, economic reasoning will be of little value' (Lucas, 1981, P 224). But human beings do construct theories all the time in conditions of pure uncertainty-and indeed act on them and sometimes die for them.... Therefore the central questions that confront economists in cognitive science are not only how human beings learn and meld beliefs and preferences to reach decisions and hence the choices that underlie economic theory but also how and why do they develop theories in the face of pure uncertainty.[4]

1 Italics mine, Kurlansky, 1997, pp 121-123.

2 Ibid, p 144.

3 Ludwig et. al. 1993.

4 North, no date, p 2.

Problem Solving

Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.

An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements.

We can see that life–even at the level of the unicellular organism–brings something completely new into the world, something that did not previously exist: problems and active attempts to solve them; assessments, values: trial and error.

It may be supposed that, under the influence of Darwin's natural selection, it is the most active problem solvers, the seekers and the finders, the discoverers of new worlds and new forms of live, that undergo the greatest development.

Each organism also strives to stabilize its internal conditions of life and to maintain it's individuality – an activity whose results biologists call 'homoeostasis'. Yet this too is an internal agitation, an internal activity: an activity that attempts to restrict the internal agitation, a feedback mechanism, a correction of errors. The homoeostasis must be incomplete. It must restrict itself. Were it completely successful, it would mean the death of the organism, or, at the very least, the temporary cessation of all its vital functions. Activity, agitation, search are essential for life, for perpetual restlessness, perpetual imperfection; for perpetual seeking, hoping, evaluation, finding, discovering, improving, for learning and for the creation of values; but also for perpetual error…

Darwinism teaches that organisms become adapted to the environment through natural selection. And it teaches that they are passive throughout this process. But it seems to me far more important to stress that the organisms find, invent and reorganize new environments in the course of their search for a better world…

All organisms are fully occupied with problem-solving. *Their first problem is survival.* But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.

According to this optimistic interpretation, it is through natural selection and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche.

This pressure from within results in a choice of niches; that is, in forms of behavior that may be regarded as a choice of lifestyles and of surrounding. This must be taken to include choice of friends, symbiosis, and above all, perhaps most importantly… the choice of a mate… [1]

R&D **Research & Development**

RIS **Relatively Insular States**

This category includes sovereign island nations, sub-national island jurisdictions, insular provinces (i.e. Newfoundland & Labrador), states (i.e. Hawaii), municipalities (i.e. Vancouver Island), and relatively insular jurisdictions (i.e. The Alpine Convention region) Given relative insularity (see Axiom VII), we divide geopolitical regions into (1) RIS and (2) GEMS, but in reality, naturally, the true relative insularity of each region lies along a sliding scale with a true GEMS at one end (the United States) and a true RIS, such as the big island of Hawaii at the other.

Social Norms

The existence of social norms is one of the big unsolved problems in social cognitive science. Although no other concept is invoked more frequently in the social sciences, we still know little about how social norms are formed, the forces determining their content, and the cognitive and emotional requirements that enable species to establish and enforce social norms….

Human societies represent a spectacular outlier with respect to all other animal species because they are based on large-scale cooperation among genetically unrelated individuals. In most animal societies, cooperation is either orders of magnitude less developed compared with humans, or it is based on substantial genetic relatedness. [2]

1 All italics mine, Popper 1992.

2 Fehr & Fischbacher 2004, p 1.

Strategic Equilibrium

What do I mean by "strategic equilibrium"? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior*. Sharing that Prize were John Harsanyi, for formulating and developing the concept of *Bayesian* equilibrium, i.e., strategic equilibrium in games of incomplete information; and Reinhard Selten, for formulating and developing the concept of *perfect* equilibrium, a refinement of Nash's concept, on which we will say more below. Along with the concepts of *correlated* equilibrium (Aumann 1974, 1987), and *strong* equilibrium (Aumann 1959), both of which were cited in the 2005 Prize announcement, the above three fundamental concepts constitute the theoretical cornerstones of noncooperative game theory [all italics Aumann's 2005, p 352].

Struggle for Life

(a) Nothing is easier than to admit in words the truth of the universal S*truggle for Life*, or more difficult--at least I have found it so--than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.[1]

(b) Our objective here is not to come up with a ponderous definition of war, but rather to grasp its essence: *Zweikampf*:[2] *The Struggle for Life*. War is actually nothing but a series of *Struggles for Life*. It may be most helpful to think of the innumerable struggles that make up war as a single unit, to imagine two wrestlers locked in a hold, each struggling to impose his will, to attack, to defend against counter-attack, to render his opponent incapable or further resistance, and, both generally and ultimately, to survive the *Struggle for Life*.[3]

Theory of Value

(a) As a man's judgement about value, so, in the last resort, must his judgement about economics. Value is the essence of things in economics. Its laws are to political economy what the law of gravity is to mechanics. Every great system of political economy up till now has formulated its own peculiar view on value as the ultimate foundation in theory of its applications to practical life, and no new effort at reform can have laid an adequate foundation for these applications if it cannot support them on a new and more perfect theory of value.4

(b) As early as Aristotle we find an attempt to discover a measure of the use value of goods and to represent use value as the foundation of exchange value. In the *Ethica Nicomachea* (v. 5. 1133a, 26–1133b, 10) he says that "*there must be something that can be the measure of all goods*. . . . This measure is, in reality, nothing other than need, which compares all goods. For if men desire nothing or if they desire all goods in the same way, there would be no trade in goods.5

(c) In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its

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1 Darwin 1859, p 62.

2 The essence of war is a violent struggle between two hostile, independent, and irreconcilable wills, each trying to impose itself on the other. War is fundamentally an interactive social process. Clausewitz called it a *Zweikampf* [*The Struggle for Life*]...and suggested the image of a pair of wrestlers locked in a hold, each exerting force and counterforce to try to throw the other. War is thus a process of continuous mutual adaptation, of give and take, move and countermove (Gray 1997).

3 Clauswitz 1832, p 1. The author would like to thank Simone Stahel-Webster for her assistance with this English translation; naturally, any errors or omissions may be attributed singularly to the author.

4 Wieser 1893, p xxx.

5 Italics mine, Menger 1871.

essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories.[1]

1 Stigler 1982, p 61.

On the Problem of the Island of Earth: Introducing a Universal Theory of Value in an Open Letter to The President of the United States

Funk, Matt
The University of Prince Edward Island

04. July 2008

On the Problem of the Island of Earth:

Introducing a Universal Theory of Value*[1] *in an Open Letter to

The President of the United States

There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness helping to make the situation truly non-cooperative.

(John Nash, NON-COOPERATIVE GAMES, 1950)

For Stephen Hawking[2] *&Richard Dawkins*[3]

4 July 2008
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1 (a) As a man's judgement about value, so, in the last resort, must his judgement about economics. Value is the essence of things in economics. Its laws are to political economy what the law of gravity is to mechanics. Every great system of political economy up till now has formulated its own peculiar view on value as the ultimate foundation in theory of its applications to practical life, and no new effort at reform can have laid an adequate foundation for these applications if it cannot support them on a new and more perfect theory of value (Wieser 1893, p xxx).

(b) In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories (Stigler 1982, p 61).

2 If we are the only intelligent beings in the galaxy we should make sure we survive and continue. But we are entering an increasingly dangerous period of our history. Our population and our use of the finite resources of planet earth are growing exponentially along with our technical ability to change the environment for good or ill.... It will be difficult enough to avoid disaster in the next hundred years, let alone the next thousand or million. Our only chance of long-term survival is not to remain inward looking on planet Earth but to spread out into space.... If we want to continue beyond the next hundred years, our future is in space (Hawking 2008).

3 I want to persuade the reader, not just that the Darwinian world-view happens to be true, but that it is the only known theory that could, in principle, solve the mystery of our existence....

For reasons that are not entiely clear to me, Darwinism seems more in need of advocacy than similarly established truths in other brances of science. Many of us have no graps of quantum theory, or Einstein's theories of special and general relativity, but this does not in itself lead us to *oppose* these theories! Darwinism, unlike 'Einsteinism', seems to be regarded as fair game for critics with any degree of ignorance. I suppose one trouble with Darwinism, is that, as Jacques Monod perceptively remarked, everybody *thinks* he understands it. It is, indeed, a remarkably simple theory; childishly so, one would have thought, in comparison with almost all of physics and mathematics. In essence, it amounts to simply the idea that non-random reproduction, where there are hereditary variation, has consequences that are far-reaching if there is time for them to be cumulative. But we have good grounds for believing that this simplicity is deceptive. Never forget that, simple as the theory may seem, nobody thought of it until Darwin and Wallace in the mid nineteenth century, nearly 200 years after Newton's *Principia*, and more than 2,000 years after Eratosthenes measured the Earth. How could such a simple idea go so long undiscovered by thinkers of the calibre of Newton, Galileo, Descartes, Leibnitz, Hume and Aristotle? Why did it have to wait for two Victorian naturalists? What was *wrong* with philosophers and mathematicians that they overlooked it? And how can such a powerful idea go still largely unabsorbed into popular consciousness?

It is almost as if the human brain were specifically designed to misunderstand Darwinism, and to find it hard to believe. [all italics Dawkins', 1986, p xiv-xv].

TABLE OF CONTENTS

TOUCHSTONE[1]

Nothing is easier than to admit in words the truth of the universal S*truggle for Life*,[2] or more difficult—at least I have found it so—than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.

—Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life,* 1859

1 Every man carries about him a touchstone… to distinguish… truth from appearances [Locke 1706, as cited in Popper 1963, p 3].

2 (a) Our objective here is not to come up with a ponderous definition of war, but rather to capture its essence: *Zweikampf, The Struggle for Life.* War is actually nothing but a series of struggles. It may be most helpful to think of the countless struggles that make up war as a single unit, to imagine two wrestlers locked in a hold, each *struggling* to impose his will, to attack, to defend against counter-attack, to render his opponent incapable of further resistance, and, both generally and ultimately, to survive the S*truggle for Life* [General Carl von Clauswitz, *Vom Kriege,* 1832. The author would like to thank Simone Stahel-Webster for her assistance with this English translation; naturally, any errors or omissions may be attributed singularly to the author.].

(b) When we reflect on this struggle, we may console ourselves with the full belief that death is generally prompt, and that the vigorous, the healthy, and the happy survive and multiply [Darwin 1859, p 37, as cited in Gould 2002, p 137].

PORTRAIT OF THOMAS JEFFERSON[1]

1 (a) 1788 portrait by John Trumbull (Depicts Jefferson at age 33). Oil on wood. Image: The Thomas Jefferson Foundation.
(b) We…, the Representatives of the united States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be Free and Independent States…; and that as Free and Independent States, …have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor (Jefferson 1776).
(c) HAPPINESS IS generally considered an ultimate goal of life; virtually everybody wants to be happy. The United States Declaration of Independence of 1776 takes it as a self-evident truth that the "pursuit of happiness" is an "unalienable right, comparable to life and liberty. It follows that economics is - or should be - about individual happiness; in particular, how do economic growth, unemployment and inflation, and institutional factors such as governance affect individual well-being? (Frey & Stutzer 2002 p 402).

Matthew William Funk – 7 Fairway Drive – Stanhope – Prince Edward Island – Canada -

The Honorable George W. Bush
President of The United States of America
The White House

4 July 2008

Dear Mr President:

On 2 August 1939, Albert Einstein wrote the first of four letters[1] to President Roosevelt because he realized that the rational solution to a global dilemma was not the optimal solution[2] – yet he realized it was clearly the best solution to a difficult problem which threatened our nation and the future prospect of human life on Earth. I have written this letter because I have discovered a solution to an even more complex and far greater threat to both our nation and the future of the human race.

First, Sir, I will offer an illuminating anecdote and briefly relate how this solution came about. Sir Karl Popper was a young boy, the chaotic and tumultuous aftermath of World War I drew he and many others, of course, into the teachings of Marxist theory, which at the time, were being widely popularized and taught as "scientific socialism." But Popper grew suspicious, and began to wonder if "socialism" could in fact even be considered "scientific." As Popper recollected:

> I had accepted a dangerous creed uncritically, dogmatically. The reaction made me… a sceptic….
>
> By the time I was seventeen I had become an anti-Marxist. I realized the dogmatic character of the creed, and its incredible intellectual arrogance. It was a terrible thing to arrogate to oneself a kind of knowledge which made it a duty to risk the lives of other people for an uncritically accepted dogma, or for a dream which might turn out not to be realizable. It was particularly bad for an intellectual, for one who could read and think. It was awfully depressing to have fallen into such a trap.
>
> Once I had looked at it critically, the gaps and loopholes and inconsistencies in the Marxist theory became obvious….

1 See Einstein 1939.

2 Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE. We call these *choices between lesser evils*. We know that whatever we choose, something important will be sacrificed. Whatever we do, someone will get hurt. Worst of all we HAVE to choose. We cannot wait for better information or advice or some new set of circumstances. We have to decide NOW, and we can be sure that there will be a price to pay. If we do not pay it ourselves, someone else will.

These are the kinds of choices we face when dealing with terrorist threats. If we do too little, we will get attacked again. If we do too much, we will harm innocent people. In making these choices, we never have enough information. Some sources exaggerate the threat; others minimize it. Nothing we are told is reliable and nothing we do is ever likely to strike the right balance (Ignatieff 2004, Preface).

> It took me some years of study before I felt with any confidence that I had grasped the heart of the Marxian argument.... Even then I had no intention of publishing my criticism of Marx, for anti-Marxism in Austria was a worse thing than Marxism... Of course I talked about it to my friends. But it was not till sixteen years later, in 1935, that I began to write about Marxism with the intention of publishing what I wrote. As a consequence, two books emerged between 1935 and 1943 – *The Poverty of Historicism* and *The Open Society and Its Enemies*....
>
> Later, in my *Logik der Forschung*, I dealt with this problem very fully (p 43).

Logic der Forschung (*The Logic of Scientific Discovery*), Popper's magnum opus, gave us at long last a method for discerning between scientific and pseudo-science: During his 1974 *Sveriges Riksbank Prize Lecture, The Pretense of Knowledge,* F.A. von Hayek suggested that

> If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass.

Although I, too, had accepted a dangerous creed uncritically and dogmatically, my path of discovery followed many curious parallels to Popper's search for a better world (and certainly leveraged his methodological insights), one significant difference between the two paths is that Popper ended up discovering his intuition was correct, but I, on the other hand, discovered that my intuition was incorrect. And my great fear, Sir, is based in part of the effective popularization (by figures such as former vice-president Al Gore, Richard Branson, and media figures ranging from Leonardo de Caprio to Oprah Winfrey) and uncritical acceptance of an equally dangerous creed regarding *The Problem of Global Warming*.

By the late 1990's, I had been surfing the California coast – from the Ventura County line to San Diego – for more than a decade, and to state that I was alarmed by the rapidly deteriorating coastal ecosystem would be a significant understatement. I was primarily concerned with *The Problem of Global Warming* (the Kyoto Protocol Dilemma in particular) and, furthermore, it seemed that, in general, our politico-economic development strategy were sub-optimal at best. So I set sail in search of the theoretical politico-economic mechanisms which generated this misguided resource allocation: I began the study of economics because I could not understand *why* neoclassical economics had not long-since been rejected, why it was taking so long for "ecological economics" to make ground in University economics

departments; however, after struggling for some years with the philosophical foundations of economics, I discovered that Robert Aumann was quite right when he suggested that "economics teaches us that things are not always as they appear."[1]

In his 2001 *Sveriges Riksbank Prize* autobiography, Joeseph Stiglitz offered:

> Growing up in Gary Indiana gave me, I think, a distinct advantage over many of my classmates who had grown up in affluent suburbs. They could read articles that argued that in competitive equilibrium, there could not be discrimination, so long as there are some non-discriminatory individuals or firms, since it would pay any such firm to hire the lower wage discriminated-against individuals, and take them seriously. I *knew* that discrimination existed, even though there were many individuals who were not prejudiced. To me, the *theorem* simply proved that one or more of the assumptions that went into the theory was wrong; my task, as a theorist, was to figure out which assumptions were the critical ones;[2]

and,

> although I grew up in a small farm-town in the vast sea of the great American cornbelt, 41 miles due south of Gary on U.S. Highway 41, my Indiana was not nearly as instructional as Stiglitz's Indiana. But I have come to believe that islands, especially small islands with big problems (and small islands which model equally substantial solutions), may offer even more distinct advantages and more profound economic insights than those offered in Gary, Indiana.[3] I have also come to the conclusion that there are very distinct advantages of exploring islands – including their problems and solutions – as an "outsider…"[4]
>
> Islands are lighthouses[5]—beacons far brighter, far more representative, and far more descriptive than mathematical models.[6]
>
> Furthermore, these small islands offer insights which stand in stark contradistinction and diametrical opposition

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1 Ibid, p 351.

2 Italics Stiglitz's 2001.

3 Funk 2008a

4 *It is often outsiders who see a problem first.* This may be because an inventor is rightly keen to have his invention applied, and may therefore overlook its possibly undesirable consequences. Thus, certain chemical inventions proved very successful against mosquitoes and other insects, but with the undesirable result that songbirds died of starvation. The American naturalist Rachel Carson reported all this in her excellent book *Silent Spring* (Popper 1999, p 101).

5 Islands are synecdoches: their understanding facilitates a 'coming to grips' with a more complex whole. They also act as advance indicators or extreme reproductions of what is future elsewhere. Crucial, new insights into evolutionary theory, and the realization of so much species differentiation on islands in modern zoogeography, are primarily due to the unwitting and haphazard stumbling of what, at first sight, may have appeared to be inconsequential, island-based, island-specific fieldwork. This includes such investigations as the study of Darwin's finches on the Galapagos Islands (Darwin 1859…) or Alfred Wallace's study of birds-of-paradise on the Aru Islands (Wallace, 1880)… The forays of Bronislaw Malinowski amongst the Trobriand… Islanders of Papua New Guinea (1922), Margaret Mead to Samoa… (1928; 1934) and Raymond Firth to Tikopia (1936) (Baldacchino 2007b, p 9).

6 (a) Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds (Maxwell 1873, p 400).

(b) Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up (Hayek 1945, pp 519-530).

to most of those discovered by Professor Stiglitz. In short, over the past decade I have struggled to develop a useful method for the analysis of complex systems (the complex system of life on earth in particular), analysis often referred to as *nonlinear dynamics*; and although some advances may be emerging in chaos theory, *The Problem of Induction* limits *all* mathematical methods to formulating solutions to the most pressing problem threatening the nonlinear dynamics of life on Earth. But I have discovered that islands offer models for complex systems analysis of life on earth far more accurate, reliable, and descriptive than mathematical models,[1] and thus my use of mathematics is more often than not from the *opposite direction*.[2]

And after spending the past decade struggling with *The Problem of Sustainable Economic Development*, not only did I discover my intuition was incorrect, I managed to derived a solution to this rather complex problem in the process. In order to highlight the neutrality of my approach, I should also disclose, Sir, that, on one hand, I am ashamed that, at 39 years old, I have not once exercised my right as a U.S. citizen to vote; however, on the other hand, I will also note that I am steeped in a tradition[3] which does not take such decisions lightly, and, moreover, I now realize that by electing not to vote was the most rational (though admittedly less than optimal) decision, since, in hindsight, it seems I would have mistakenly voted against my personal interests, national interests, and even, as I see so clearly now, global interests (of which more to follow).

Last month I delivered the first of three papers at the Åland International Institute of Comparative Island Studies

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1 (a) Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up (Hayek 1945, pp 519-530).

2 Mathematics is a study which, when we start from its most familiar portions, may be pursued in either of two opposite directions. The more familiar direction is constructive, towards gradually increasing complexity : from integers to fractions, real numbers, complex numbers ; from addition and multiplication to differentiation and integration, and on to higher mathematics. The other direction, which is less familiar, proceeds, by analysing, to greater and greater abstractness and logical simplicity ; instead of asking what can be defined and deduced from what is assumed to begin with, we ask instead what more general ideas and principles can be found, in terms of which what was our starting-point can be defined or deduced (Russell 1919, pp1-2).

3 A story is told of Pyrrho, the founder of Pyrrhonism (which was the old name for scepticism). He maintained that we never know enough to be sure that one course of action is wiser than another. In his youth, when he was taking his constitutional one afternoon, he saw his teacher in philosophy (from whom he had imbibed his principles) with his head stuck in a ditch, unable to get out. After contemplating his for some time, he walked on, maintaining that there was no sufficient ground for thinking he would do any good by pulling the old man out. Others, less sceptical, effected a rescue, and blamed Pyrrho for his heartlessness. But his teacher, true to his principles, praised him for consistency (Russell 1928, pp 1-2).

(AICIS),[1] and although *On the Problem of Sustainable Economic Development: The Funk-Zweikampf Solution to this Prisoner's Dilemma*[2] offers detailed methodological and contextual descriptions, it is chock-full of data cascades, passionate tricks of the advocate's trade,[3] and most desiderata would not warrant your attention, but the abstract offers a concentrated point of departure which will frame our solution, introduce key terms, begin to highlight implications, risks, and opportunities within my objective of offering you a working knowledge of my solution in less than a dozen pages:

> This paper offers a solution to *The Problem of Sustainable Economic Development* and a universal theory of value. We introduce axioms, and note they falsify the central thesis of *ecological economics* and solve a problem which has defied theorists since the time of Aristotle.[4] We introduce our methods, the genesis and evolution of our theory, field notes from Mustique, Iceland, and Prince Edward Island, and set the stage for a more thorough discourse, of which this paper represents the first of three segments. We demonstrate that *value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$, then model economic development by dividing the world into geo-political islands[5]: P_1: *Relatively Insular States* (RIS),[6] and P_2: *Global Economic Military Superpowers* (GEMS).[7] Our axioms offer two dominant development strategies: S_1: *Maximum Economic Development,* and S_2: *Maximum Ecological Preservation*. Furthermore, we discover pure GEMS (i.e. low I_R) and pure RIS (i.e. high I_R) rational economic development strategies are antithetical, yet also discover these naturally opposing strategies represent the most tenable, rational solution-set possible: in light of inescapable human and planetary uncertainties, we discover the optimal RIS strategy = S_2 and GEMS = S_1. We note our solution represents the Prisoner's Dilemma. We also note, that, ceteris paribus, based upon revealed 20th and 21st century preferences, RIS strategy has been sub-optimal/irrational (S_1). GEMS strategy (S_1), however, has been and remains rational and optimal. Strategic Equilibrium/ESS[8] is attained when players pursue respective rational, opposing development strategies. Equilibrium, however, offers windfalls: surplus value is created (RIS-driven *ecological* protection, and GEMS-driven *planetary* protection). In essence, this non-cooperative, strategic equilibrium paves the way for rational, mutually beneficial, cooperative behaviour, and yields higher ecological and planetary insularities, and thus

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1 AICIS… is an Åland based, international and *independent*, research institute which explores the economic and institutional aspects of insular entities - mainly from a comparative point of view. It operates, on a network basis, in close cooperation with other island institutes and academic institutions, as well as with a variety of economic and policy milieus, all over the world. AICIS.… is an independent foundation, set up by a number of leading Ålandic companies: Åland Mutual, Alandia Corporations, Bank of Åland, and Åland Investment Ltd. [italics mine AICIS 2008].

2 See Funk 2008a. This complete discourse is published on the AICIS website: Naturally, I would gladly send an updated draft of this paper (v 2.0, 1 July 2008) upon request.

3 Explaining is a difficult art. You can explain something so that your reader understands the words; and you can explain something so that the reader feels in in the marrow of his bones. To do the latter, it sometimes it isn't enough to lay the evidence before the reader in a dispassionate way. You have to become an advocate and use the tricks of the advocate's trade (Dawkins 1985, p xiv).

4 As early as Aristotle we find an attempt to discover a measure of the use value of goods and to represent use value as the foundation of exchange value. In the *Ethica Nicomachea* (v. 5. 1133a, 26–1133b, 10) he says that "*there must be something that can be the measure of all goods* [Italics mine, Menger 1871].

5 Our game theoretical approach rests upon a foundation insular evolutionary biology and set theory: our master island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All bio-geo-politico regions on Earth are distinguishable by various degrees of relative insularity, and thus, *all* regions on Earth – islands, continents, and oceans alike – make up the sub-set: $\{i_1, i_2, i_{3,\ldots}i_n\}$. In other words: $\{i_1, i_2, i_{3,\ldots}i_n\} \subseteq \{I_1\}$.

6 See ABBREVIATIONS & DEFINITIONS: *Relatively Insular State*

7 See ABBREVIATIONS & DEFINITIONS: *Global Economic Military Superpower*

8 See ABBREVIATIONS & DEFINITIONS: *Strategic Equilibrium, & Evolutionary Stable Strategy*

surplus economic and biologic value: RIS cooperate, form coalitions, and struggle for greater *ecological insularity* (ecological preservation); GEMS fight for economic development and *planetary insularity* (global defence, extraterrestrial exploration, and extra-planetary threat mitigation, such as the development of a SHIELD,[1] Gravity Tractor, or Asteroid Tugboat,[2] and, ultimately, the means to inhabit another planet). Surplus value is maximized through strategic transparency: *If* all players recognize the value of respective, opposing, and antithetical, rational strategies, *then* all players negotiate more rationally, efficiently, and peacefully. We refer to our solution based upon two opposing, rational strategies as *The Funk-Zweikampf Solution*. Moreover, we demonstrate our solution is as powerful at local and individual levels as it is at the national level, including its use as a tool for strategic decision-making under uncertainty and variable insularity. Furthermore, our *Theory of Value* illuminates an entrenched, systemic, strategic RIS error which reflects the misguided application of economic principles and a fundamental constitutional flaw[3] which promotes *The Tragedy of the Commons.*[4] We consider the effects of relative insularity, the principles of rational pure RIS development strategy, and cite Åland, Iceland, and Japan as ideal island models for RIS/GEMS mixed-strategies. Our theory also suggests that it is no coincidence that the island which best models optimal pure RIS economic development strategy (S_2) is the extraordinarily independent, autonomous, privately-controlled island of Mustique. We note this simplified model does not represent the only RIS mechanism for our solution, however, as all RIS and GEMS may optimize with this counter-intuitive solution. Furthermore, our *Theory of Value* promotes self-organization, constitutional amendment, self-sufficiency, independence, and thus places stones along the illusive path to our tenable solution to *The Problem of Sustainable Development*.[5]

Presently, I will only expand upon and demonstrate the relevance of one statement from this abstract. Recall that I had asserted that

> Surplus value is maximized through strategic transparency: If all players recognize the value of respective, opposing, and antithetical, rational strategies, then all players negotiate more rationally, efficiently, and peacefully. We refer to our solution based upon two opposing, rational strategies as *The Funk-Zweikampf Solution*.

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1 The greatest natural threat to the long-term survivability of mankind is an asteroid or comet impact with the Earth. SHIELD is an architectural concept for a comprehensive Earth defense system designed to discover, catalog, calculate orbits of near-Earth Object, and to deflect potential impactors (Gold 2001, abstract).

2 See ABBREVIATIONS & DEFINITIONS: *Asteroid Tugboat* & *Gravity Tractor*

3 Is there a greater tragedy imaginable than that, in our endeavour consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving? (Hayek 1944, p4).

4 (a) It should be clear by now that the idea of the commons did not suddenly arise out of nothing in the year 1968. Passing references to the problem occur as far back as Aristotle, and Lloyd certainly saw it clearly in 1833. H. Scott Gordon's work in 1954 saw the beginning of a new concern with the problems presented by this politico-economic system. Yet the fact remains that a widespread recognition of these problems did not develop until after 1968. Why the delay? Two reasons are apparent. First, a favorable climate of opinion was needed for remarks about the commons to be noticed. This was created in the 1960's by the rapid growth of the environmental movement, which alerted people to the consequences of distributional systems. Second, it was necessary that the properties of the commons be stated in no uncertain terms if people were to consider the matter seriously. It was necessary that the human tragedy of adhering to a commons-type distribution be emphasized. A good, solid fortissimo minor chord had to be sounded. Before 1968 most of the sounds were either mere grace notes or extended passages played pianissimo. The down-playing was for good reason, of course: the clear message of the commons threatened cherished beliefs and practices. Abandoning any traditional practice requires a political upset (though revolution may be too strong a word) (Hardin 1977, p 1).

(b) I will also note that there was another important, insightful, pre-1968 work which clearly details this problem on the public lands of great American West: Stewart 1925. Also see ABBREVIATIONS & DEFINITIONS: *Tragedy of the Commons*

5 Funk 2008a

Please allow me to offer an example. On Monday, April 16, 2007, at 3:56 post-meridian, Reuters reported:

> WASHINGTON (Reuters) - The Environmental Protection Agency said on Monday U.S. greenhouse gas emissions linked to global warming increased 16 percent over a 15-year period.
>
> President George W. Bush pulled the United States out of the subsequent Kyoto global warming treaty, arguing the accord's limit on annual emissions would hurt the U.S. economy.

Despite former vice-president Al Gore's insistence that this statement is not true, I understand as well as you do that it is. However, the passage I have highlighted above illustrates a powerful political tool offered by Funk-Zweikampf solution: If an economic theory of value based upon relative insularity were well-understood, relatively insular states, including those low-lying island nations feeling most threatened by the effects of global warming, might be more inclined to understand if we were to say: "We realize that the consequences of global warming are significant, but we must understand that they merely represents *one* of more than a dozen *even more threatening* global risks, and our ability to offer *all* inhabitants of the earth protection from this myriad of global risks depends largely upon an unhindered U.S. economy. And if members of these relatively insular states wish to pursue dominant, rational, selfish economic development strategies, we will likewise understand their reluctance to engage with in the trade when they state "We realize that your economy functions more effectively when all nations, including ours, engage in unrestricted, free-trade with the United States. This, however, does not represent a good, long-term value proposition for us, and you will in fact, in the long term, appreciate our objectives of independence, self-sufficiency, and the maximum preservation of our ecology. With this illustrative point and the abstract in mind, let's move directly to our solution: the Seven Axioms[1] map (1) the lower limit of what *must* be known,[2] (2) the upper limit of what *may* be known, and thus (3), as Nash noted,[3]

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1 These Axioms rest upon (1) the fundamental physical laws of science, and (2) the syllogistic core of natural selection: (i) *Fluid Mechanics* (Archimedes' Principle), (ii) *Force, Mass, and Inertia* (Kepler's Three Laws of Planetary Motion, Newton's Three Laws of Motion, Newton's Law of Universal Gravitation), (iii) *Heat, Energy, and Temperature* (Newton's Law of Cooling, Boyle's Law, Law of Conservation of Energy, Joule's First and Second Law, The Four Laws of Thermodynamics), (iv) *Quantum Mechanics* (Heisenberg's Uncertainty Principle), and (v) *Superfecundity*, *Variation*, *Heredity*, and *Natural Selection* (Darwin's Laws of Natural Selection).

2 Before we can try to remold society intelligently, we must understand its functioning; we must realize that, even when we believe that we understand it, we may be mistaken. What we must learn to understand is that human civilization has a life of its own, that all our efforts to improve things must operate within a working whole which we cannot entirely control, and the operation of whose forces we can hope merely to facilitate and assist so far as we can understand them (Hayek 1960, pp 69-70).

3 One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps to justify and clarify the other (Nash 1953, p 129).

helps determine and clarify our unique solution:

AXIOM I **The Ground Zero Premise**[1]

The Problem of the Struggle for Life

(i) Survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a survival enterprise. It follows that survival is the… "problem" for human societies as well; it is a prerequisite for any other, more exalted objectives. Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely.…Our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern governments… [is] either directly or indirectly related to the meeting of our basic survival needs.[2]

AXIOM II **The R-3 Premise**[3]

The Problem of the Limited Resources

Global natural Resource consumption is approximately three times (3x) the earthly replenishing rate. Though this problem may be soluble on local, municipal, regional, and even on national levels, in light of *The Tragedy of the Commons,* it is insoluble at the global level.

AXIOM III **The Ecological Uncertainty Premise**

Axiom II poses a threat to Axiom I.

AXIOM IV **The Political Uncertainty Premise**

The Problem of Warfighting:[4]

(i) (1) the system is anarchic, (2) all great powers have some offensive military capability, (3) **states can never be certain about other states' intentions**, (4) states seek to survive, and (5) great powers are rational actors or strategic calculators.[5]

(ii) Extinction follows chiefly from the competition of tribe with tribe, and race with race. Various checks are always in action, …which serve to keep down the numbers of each… tribe, such as… famines,… wars, accidents, sickness,… infanticide, and, perhaps, lessened fertility from less nutritious food, and many hardships. If from any cause any one of these checks is lessened, even in a slight degree, the tribe thus favoured will tend to increase; and when one of two adjoining tribes becomes more numerous and powerful than the other, the contest is soon settled by war.[6]

A nuclear exchange involving full superpower arsenals, including resultant nuclear winter…, could result in 2 bn person deaths (30% of world population). Pro rata, this is equivalent to an all-biota loss of 547 bn tonnes biomass. The cumulative risk during 40 years of Cold War of this occurring was seen by some as much as 50 per cent. In the next century, a realignment leading to a new standoff as dangerous as the Cold War cannot be ruled out.[7]

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1 Also see annotation 1under Popper 1992; also see TOUCHSTONE; also see Dawkins 1985,

2 Corning 2000, abstract.

3 Resource Replenishing Rate.

4 In one of the greatest speeches of all time – his second inaugural – Abraham Lincoln said: "Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came." It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. *If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem* (Italics mine, Aumann 2005, p 351).

5 Bold and underlined emphasis mine, Mearsheimer, p 112, 2006c.

6 Darwin 1888, p 912.

7 Leggett 2006.

AXIOM V **The Planetary Uncertainty Premise**

The Problem of Semi-closed Planetary Systems (such as the Earth)

(i) The range of potential types of global risk, as well as their apparent imminence, is significantly increasing. Illustrating this increase, Rees [1] concluded starkly that, if we do nothing, humanity has a 50 per cent chance of becoming extinct within the next century.

(ii) In light of Axiom I, even *if* we are able to mitigate Axiom IV, and even if we are able so survive the next century, given the gravity of the critical problems outlined in this Axiom, an alternative inhabitable planet must be discovered, and immigration must occur within an unknown and unknowable time-frame, ostensibly as soon as tomorrow, but no later 50,000 years from present.[1] Although I will not delve into details for many risk factors below, Mark Leggett's *An Indicative Costed Plan for the Mitigation of Global Risks* details and ranks his assessment of the 15 risk factors most likely to bring about human extinction; although some details are offered to illustrate the relative magnitude, for brevity's sake (and a minor difference of opinion on a few minor points), not all are detailed nor even listed (though I have added a few), but please read with the assumption that any and all known significant risks are theoretically included: this axiom's purpose is not to provide an exhaustive list of risk factors, but to illustrate the nature of the dilemma *The Problem of Sustainable Economic Development* inherently presents. However, it is of interest and relevant to this letter to note that Leggett ranks *The Problem of Global Warming* 8th out of 15. Risks are roughly listed in order of importance:

(1) *The Problem of Scientific Experiments Altering the Fabric of the Universe and/or the Ecology of Earth*[2]

(2) *The Problem of Meteorites:*

(a) The Earth has a long and violent history of collisions with extraterrestrial bodies such as asteroids and comet nuclei. Several of these impacts have been large enough to produce major environmental changes, causing mass extinctions and severe alterations to weather patterns and geography. There is no reason to suppose that the likelihood of such collisions will be any less in the future and the spread of human settlement, civilisation, and particularly urbanisation, makes it much more likely that a future impact, even relatively small, could result in the massive loss of human life and property. Despite the fact that the technology exists to predict and to some extent prevent such events, there is currently no co-

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1 Stephen Hawking called for a massive investment in establishing colonies on the Moon and Mars in a lecture in honour of NASA's 50th anniversary. He argued that the world should devote about 10 times as much as NASA's current budget – or 0.25% of the world's financial resources – to space.

The renowned University of Cambridge physicist has previously spoken in favour of colonising space as an insurance policy against the possibility of humanity being wiped out by catastrophes... He argues that humanity should eventually expand to other solar systems....

"Robotic missions are much cheaper and may provide more scientific information, but they don't catch the public imagination in the same way, and they don't spread the human race into space, which I'm arguing should be our long-term strategy," Hawking said. "If the human race is to continue for another million years, we will have to boldly go where no one has gone before."

"We cannot envision visiting them with current technology, but we should make interstellar travel a long-term aim," he said. "By long term, I mean over the next 200 to 500 years...."

"Even if we were to increase the international [space exploration] budget 20 times to make a serious effort to go into space, it would only be a small fraction of world GDP," he said. GDP, or Gross Domestic Product, is a measure of a country's economic activity.

Hawking argued that the world can afford 0.25% of its collective GDP to devote to space colonisation. "Isn't our future worth a quarter of a percent?" he asked.

The physicist also speculated on the reasons that SETI (Search for Extra-Terrestrial Intelligence) projects have not yet detected any alien civilisations.

He offered three possibilities: that life of any kind is very rare in the universe; that simple life forms are common, but intelligent life rare; or that intelligent life tends to quickly destroy itself.

"Personally, I favour the second possibility – that primitive life is relatively common, but that intelligent life is very rare," he said.

"Some would say it has yet to occur on Earth" (Hawkins & Shiga 2008).

2 See Greenleaf & Kremen 2006 ; Leggett 2006.

ordinated international response to this threat.[1]

(b) It is widely believed that meteorites originate in the asteroid belt, but the precise dynamical mechanism whereby material is transported to Earth has eluded discovery. The observational data for the ordinary chondrites, the most common meteorites, impose severe constraints on any proposed mechanism. The ordinary chondrites are not strongly shocked, their cosmic ray exposure ages are typically <20 Myr, their radiants are concentrated near the antapex of Earth's motion and they show a pronounced 'afternoon excess' (for every meteorite which falls in the morning two fall in the afternoon). Wetherill concluded that these data could only be explained by an "unobserved source" of material... His subsequent, more sophisticated investigations have not changed this basic conclusion. Recently I have shown that there is a large chaotic zone in the phase space near the 3/1 mean motion commensurability with Jupiter and that the chaotic trajectories within this zone have particularly large variations in orbital eccentricity. Since asteroidal debris is quite easily injected into this chaotic zone, it could provide Wetherill's 'unobserved source' if chaotic trajectories which begin at asteroidal eccentricities (e<0.2) reach such large eccentricities that Earth's orbit is crossed (e>0.57)... At least some of these chaotic trajectories do have the properties required to transport meteoritic material from the asteroid belt to Earth. Combined with the Monte Carlo calculations which show that the resulting meteorites are consistent with all the observational constraints, *the case for this chaotic route to Earth is fairly strong* [italics mine].[2]

(3) *The Problem of Biovorous Nanoreplicators*

(4) *The Problem of Supermassive Star Collapse*

(5) *The Problem of Super-Eruptions*:

(a) In the past 2 Myr, there have been, on average, two super-eruptions every hundred millennia, the last of which shattered the crust of New Zealand's north island 26,500 years ago. To date, no mechanisms have been discovered for predicting these events; thus an eruption of this magnitude (VE8)[3] is possible within this decade and likely within 50,000 years. Post-eruption human survival is unlikely; even smaller eruptions (VE4, VE5, VE6) present extraordinary challenges.

(b) The Laki eruption, and other similar large lava eruptions in Iceland (e.g., Eldgja, AD 934...) and the Canary Islands (Lanzarote, AD 1731...), was accompanied by widespread dry fogs... and unusual climatic cooling in the northern hemisphere... Using the ice core record, it can be seen that large Icelandic fissure basalt eruptions (≥10 km^3) occur perhaps about once per millennium (e.g., AD934 and AD1783)... Estimates of H^2SO^4 aerosols produced by Laki range from 77–190 Mt based on erupted volume of magma, to 100–280 Mt based on acid fallout over Greenland (Stothers 1996). From estimates of atmospheric opacity in the dry fog of 1783 over Europe, Stothers (1996) suggested an aerosol mass of ~150 Mt. The resulting "haze famine" in Iceland, related to crop failures and livestock death from volcanic pollution (from SO^2, F, Cl, etc.), led to the death of 25% of the Icelandic population. The AD 934 Eldgja eruption may have had a similar serious effect on early Icelandic colonization (Stothers 1998). Historic eruptions were quite small, however, compared to some volcanic events in the geologic record of the past million years that may truly be called "supereruptions." The largest recorded explosive eruptions (VEI =8 and ≥1012 m3 of bulk deposits) were large caldera-forming eruptions that produced large-volume pyroclastic flow deposits (ignimbrites) and widespread ashfall... Some of the largest events occurred in continental hotspot areas where extensional tectonics and thick continental crust lead to large-volume magma chambers of silicic composition... The greatest explosive eruption in the past few hundred thousand years was the Toba (Sumatra) event of ~73,500 years ago... This event produced at

1 Tate 2006, abstract.

2 Wisdom 1985, abstract.

3 Self 1982

least 2,800 km^3 of magma (pyroclastic flow deposits, pumice fall, and ash) and is estimated to have created from 1,000 to 10,000 Mt of stratospheric dust and sulfuric acid aerosols... Extrapolation of the data of Pyle et al. (1996) to VEI 8 eruptions gives about 1000 Mt of SO^2 release, which would be converted to aerosols in the stratosphere. The Toba aerosols apparently persisted for up to 6 years in the upper atmosphere... Based on scaling up from smaller eruptions and computer models, stratospheric aerosol loading of ~1000 Mt is predicted to have caused a "volcanic winter," with a global cooling of 3to5°C for several years, and regional coolings up to 15°C... Such a cooling is estimated to have drastically affected tropical and temperate vegetation and ecosystems... All above-ground tropical vegetation would have been killed by sudden hard freezes, and a 50% die-off of temperate forests is predicted from hard freezes during the growing season... This probable climatic and ecologic disaster may have impacted humans. Evidence from human genetic studies have been interpreted as indicating a severe human population bottleneck—a near extinction—with reductions to a total population as small as a few thousand at a time just prior to ~60,000 years ago... This is roughly the same interval as the great Toba eruption, and a cause and effect relationship with Toba has been proposed... and is supported by the predicted severe ecological effects of the eruption.

(6) *The Problem of Global Warming*

(7) *The Problem of Ice Ages* (both natural and anthropogenic)

(8) *The Problem of Chaotic Behaviour:*

There are several physical situations in the solar system where chaotic behavior plays an important role. Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behavior also seems to be an essential ingredient in the explanation of certain non-uniformities in the distribution of asteroids. The long-term motion of Pluto is suspiciously complicated.[1]

(9) *The Problem of Solar Flux:*

There has been life on Earth for at least 3,500 Myr but the assumption that a comparable future lies ahead may not be justified. Main sequence stars appear to increase their burning rate as they age. Thus the Sun, if a typical star, can be predicted to have increased its output by 30% since the Earth's origin 4,500 Myr ago. The maintenance of an equable climate since life began probably required some means of planetary thermo-stasis. The Gaia hypothesis proposed by Lovelock and Margulis included an unspecified biological means for climate control. Walker... suggests an abiological automatic thermostasis in which the atmospheric abundance of CO2, a greenhouse gas, adjusts to resist the warming tendency of the increased solar flux. It is clear that whatever the mechanism, atmospheric CO2 is now close to its lower limit of partial pressure, so the biosphere may soon, in geological terms, be exposed without protection to the predicted progressive increase of solar luminosity.[2]

(10) *The Problem of Ohmic Decay:*

The mechanism by which the Earth and other planets maintain their magnetic fields against ohmic decay is among the longest standing problems in planetary science. Although it is widely acknowledged that these fields are maintained by dynamo action, the mechanism by which the dynamo operates is in large part not understood. Numerical simulations of the dynamo process in the Earth's core have produced magnetic fields that resemble the Earth's field, but it is unclear whether these models accurately represent the extremely low values of viscosity believed to be appropriate to the core.[3]

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1 Wisdom 1987, abstract.

2 All italics mine, Lovelock & Whitfield 1982, abstract.

3 Kuang & Bloxham 1997, abstract.

AXIOM VI The Deductive Premise

The Problem of Induction[1]

This may represent the most deeply entrenched, least understood (and/or acknowledged),[2] relatively simple problem on Earth, and thus perhaps the crux of his axiomatic solution. Therefore, we offer a clarification within the following Axiom and within the closing remarks which follow our axiomatic derivation of our solution. For now, however, consider the following propositoin: *Will the sun rise tomorrow?* Those whom have mistakenly adopted inductive methods would conclude that, based upon 5,292.5 billion affirmative inferences (365 days X 14.5 Byr), yes, we may conclude with certainty (and validity) that the sun will rise tomorrow. However, as we have just demonstrated in both axioms IV and V, there are many *black swans* which would falsify our inductive logic. As Professor Popper noted, *no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white*.

AXIOM VII The Insularity Premise

The Problem of Value

The search for an economic theory of value may have begun with Aristotle. For the next half-century, however, very little progress was made, and the evolutionary stable strategy tabled in 1776 by Smith[3] was fully adopted by the classical school and generally accepted for nearly a century. The German school grew critical, however, and this Germanic scepticism gave birth to the Austrian School and their quest for a new *Theory of Value*, which began with a very independent professor of political economy at the University of Vienna, the Austrian School's founding father, Carl Menger (1840–1921). In his 1871 *Grundsätze der Volkswirtschaftslehre* (*Principles of Economics*), Menger outlines his groundbreaking theory.[4]

Perhaps the most convoluted, self-refuting theory may have been tabled by Walras in 1886.[5] Walras, however, was certainly not alone in his approach. Indeed, all known (to this fairly well-read author, that is) attempted solutions since Menger have, essentially, followed Wieser's method,[6] and, despite the extraordinary efforts from Aristotle to Smith to Menger to Weiser, economics has remained without a theory of value. Note, however, the development of our theory has *not* followed the methodological approach consistent with previous attempts. Based upon our understanding that insularity is the key to

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1 See ABBREVIATIONS & DEFINITIONS: *The Problem of Induction*.

2 It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this* [Italics mine, Popper 1994, p 36].

3 (a) Gould 2002.
(b) It has been said that one finds in Adam Smith nearly all the explanations of value which have ever been attempted. What is certain is that, in his explanation, Adam Smith has put together two views that contradict each other (Wieser 1893, p xxvii).

4 (a) It is in Austria, in the lineal succession to Menger, that the development of the new value theory is to be sought (Wieser 1893, p xxxiv).
(b) In Chapter III, Menger (1871) presents his groundbreaking *Theory of Value;* the essence, clarity, and promethean insight of this chapter may best sampled in Section E: *The value of the services of land, capital, and labour, in particular.*

5 That of Walras, though admirable of its kind, suffers, to my mind, from the preponderance of the mathematical element. The laws which govern amounts of the value undoubtedly allow of a mathematical expression ; nay, the more complicated of these can be expressed exactly only by means of mathematics ; and here certainly mathematics has a great task to fulfil. But in the value theory we have to do with something more than the expression of the laws of amounts. The obscure conception of value is to be made clear ; *all its manifold forms are to be described* [italics mine] ; the service of value in economic life is to be analysed ; the connection of value with so many other economic phenomena is to be shown (Wieser 1893, p xxxiii).

6 The economist who undertakes to explain value has to explain the procedure of those who value. He describes in plain language the meaning of transactions carried on, times without number, by all of us. He does, on a large scale and with a difficult subject, the same thing as one who accurately describes some trade or some mechanical operation, which every one can do, but which it is not easy, without the assistance of concrete instances, to present and follow up in all its complexity of conditions (1893, p 5).

evolutionary fitness (including, for example, *economic* evolutionary fitness) and thus life on earth,[1] our theory of value is constructed by demonstrating that *value* (V) is a *derivative function* of relative insularity; we are able to quantify value far more accurately *and* far more easily by quantifying it *indirectly*.[2] Aside from the originality of value based upon insular qualities, the *derivative nature* of this theory is what lends this insight elegance, simplicity, and power: $V=f'(I_R)$! The utter simplicity and descriptive power of this theory, what sets it apart from every known previous attempt, is this is the first which expressly does *not* attempt to "describe all manifold forms," and "the myriad connections of economic phenomena;" rather, this theory describes the *environment*[3] in which economic value is created (from which it is *derived)!* In other words, the relative insularity of a biogeographic region itself is *not* what makes it valuable, the value is *derived* as a direct by-product of this insularity. For example, backing out to the most macro-view, a quick look at the *relative insularity* of the Earth reveals that the earth is *more valuable, relatively* speaking, than the other planets in our solar system due to the value of the relatively high level of atmospheric insularity which enables the Earth to produce both biologic *and* economic value: *Life!*

Moreover, although our quest had commenced as a search for an *economic* theory of value, in the end, our solution produced a *universal* (economic and biologic) *Theory of Value*, which presents a solution to what arguably represents the most fundamental problem in any so-called "field" of science, since relative insularity is as valuable to whales, dragonflies, and unicellular organisms as it is to man. Although this solution was inadvertent, it is a logical outcome, since it is well understood that a useful, truthful economic theory of value requires a biogeographical and political foundation which acknowledged *The Problem of Induction*, including both political and extraterrestrial uncertainties. Our theory was constructed by simply observing nauture, by simply observing the universal revealed preference for relative insularity, and thus, moreover, discovering that *value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$. Our axioms also reveal that, contrary to the central thesis of so-called "ecological economics," the Earth is not in fact a closed-system, but rather merely *semi-closed* and thus only relatively insular. Comprehending these biological and panetary realities is the cornerstone to the comprehension of our unified theory. Greater clarity may be derived with the following game theoretical application: Applying our *Theory of Value* within requisite biogeographical & political contex of the necessirily non-coopertive game (in which all the world is a stage; note the great Nash insight pasted across the cover-page) reveals divergent, optimizing rational strategies for *continental* (GEMS) and *insular* (RIS) economic development. Our theory reveals pure GEMS and RIS strategies are antithetical, yet discover, in light of *The Problem of Induction,* these naturally opposing strategies represent the most tenable, rational solution possible. How is it possible that two players may arrive at two *different*, antithetical optimal strategies when utilizing the same theory of value? Although there is ultimately only one sphere of insularity, it must be defended on two *inherently uncertain* levels: (1) insularity pertaining to the biosphere (i.e. Ecology: Axioms I-III, the "whole world" according to the principles of "ecological

1 Carlquist 1974, p 1.

2 I_R is formulated with: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year & % km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), Sovereign Status, Constitutional Balance, Cultural Homogeneity, and Military Power*. We calibrate our formulae by adjusting relative input weighting in accordance a positive, linear biogeographical correlation between I_R and the average human life expectancy for the corresponding politico-biogeographic area.

3 One of the great discoveries of game theory came in the early seventies, when the biologists John Maynard Smith and George Price realized that strategic equilibrium in games and population equilibrium in the living world are defined by the same equations. Evolution be it genetic or memetic – leads to strategic equilibrium (Aumann 2005, p 352).

economics"), and (2) insularity pertaining to the semi-closed nature of the biosphere, including planetary and extra-planetary forces and uncertainties (i.e. meteorites, volcanoes, chaotic gravitational forces, supernovas, etc.: Axiom V), and geopolitical uncertainty (i.e. War: Axiom IV). Generally speaking, pure RIS strategy protects relative insularity on the first level, while GEMS pure strategy protects relative insularity on the second level. Moreover, our theory of value is as applicable and powerful at the local and individual levels as it is at the national/global level, including its use as a powerful analytical tool applicable to common problems, such as: (1) where to live (addressing both biogeographical and geopolitical insularity), (2) what to eat, (3) how to vote, (4) where to vacation, (5) what type of vehicle to drive, (6) what types of investments to make, (7) what water to drink, and, most generally, (8) understanding how relative insularity frames strategic decision-making under uncertainty.

I realize this concentrated outline is perhaps yet rather abstract, but I trust the implications and the utility may be immediately recognizably; if they are not as readily clear as I hope they may be, I detailed some of the most significant implications in a recent, necessarily[1] pointed letter which I believe the first few pages may offer clarification:

Sir Partha Dasgupta, Fellow, St. John's College
University of Cambridge, Faculty of Economics
Sidgwick Avenue
Cambridge, England

1 May 2008

RE: A Solution to *The Problem of Sustainable Economic Development*

Dear Sir:

I am writing to inform you that you have made a great mistake.

Your error came to my attention while reviewing *Nature in Economics*.[2] I emphasize the greatness of this mistake because, upon a broad review of your considerable works,[3] I have discovered that this fundamental error is entrenched in your most fundamental assumptions, and in short, I conjecture you have committed this error for four (possibly five) primary reasons : (1) you do not understand *The Problem of Induction*, (2) you do not understand that economics is a *derivative science* (and *derivative*, in this

1 What Mises taught us in his writings, in his lectures, in his seminars, and in perhaps everything he said, was that economics—yes, and I mean sound economics, Austrian economics—is primordially, crucially important. Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics.

This is a lesson, which is located almost entirely outside economics proper. But all Mises' work depended ultimately upon this tenet. Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not identified by science as worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability calmly to ignore the sneers of, and the isolation imposed by, academic contemporaries, was his conviction that the survival of mankind depends on the development and dissemination of Austrian economics.

Austrian economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race (Kirzner 2006).

2 2007.

3 See SELECTED BIBLIOGRAPHY: Dasgupta.

sense, is not a reference to the well-known financial WMD's,[1] but rather to Bertrand Russell's *Theory of Economic Power*),[2] and moreover (3) you have failed to comprehend, essentially, *the whole economy of nature;*[3] (4) you do not understand that subject matters do not exist,[4] and (5) another possible reason, I suspect, may be related to your personal religious beliefs, but since I do not know you personally, I will leave this point for your consideration…[5]

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1 The derivatives genie is now well out of the bottle, and these instruments will almost certainly multiply in variety and number until some event makes their toxicity clear. Knowledge of how dangerous they are has already permeated the electricity and gas businesses, in which the eruption of major troubles caused the use of derivatives to diminish dramatically. Elsewhere, however, the derivatives business continues to expand unchecked. Central banks and governments have so far found no effective way to control, or even monitor, the risks posed by these contracts.

Charlie and I believe Berkshire should be a fortress of financial strength – for the sake of our owners, creditors, policyholders and employees. We try to be alert to any sort of megacatastrophe risk, and that posture may make us unduly apprehensive about the burgeoning quantities of long-term derivatives contracts and the massive amount of uncollateralized receivables that are growing alongside. In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal [Buffett 2003, p 15. Also see Jon Danielsson's (2000) *The Emperor has no Clothes: Limits to Risk modeling*].

2 (a) *Economic power, unlike military power, is not primary, but derivative.* Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but *when large issues are involved it depends upon war or the threat of war*. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it [all italics mine, 1928, p 95].

(b) *The very nature of economics is rooted in nationalism….It would never have been developed except in the hope of throwing light upon questions of policy, but policy means nothing unless there is authority to carry it out, and authorities are national* [italics mine Robinson 1962, p 117].

(c) Power Projection: The ability of a nation to apply all or some of its elements of national power - political, economic, informational, or military - to rapidly and effectively deploy and sustain forces in and from multiple dispersed locations to respond to crises, to contribute to deterrence, and to enhance regional stability (The United States Department of Defense 2001).

3 See ABBREVIATIONS & DEFINITIONS: *The Struggle for Life*.

4 As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them*. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(1) There is no method of discovering a scientific theory.

(2) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.

(3) There is no method of ascertaining whether a hypothesis is 'probable', or probably true [Popper 1956, pp 5-6].

5 (a) The word God is for me nothing more than the expression and product of human weaknesses, the Bible a collection of honourable, but still primitive legends which are nevertheless pretty childish. No interpretation no matter how subtle can (for me) change this. These subtilised interpretations are highly manifold according to their nature and have almost nothing to do with the original text. For me the Jewish religion like all other religions is an incarnation of the most childish superstitions. And the Jewish people to whom I gladly belong and with whose mentality I have a deep affinity have no different quality for me than all other people. As far as my experience goes, they are also no better than other human groups, although they are protected from the worst cancers by a lack of power. Otherwise I cannot see anything 'chosen' about them.

In general I find it painful that you claim a privileged position and try to defend it by two walls of pride, an external one as a man and an

I have not written this letter to be cruel; it is not my intent to ridicule you. In fact, as I have stated, I do suspect you may be a great man. But, following in the footsteps of Popper, Russell, Pyrrho,[1] and Socrates, I have accepted an obligation to stand my post, remain ever on the lookout, and never hesitate to table criticism. Indeed, our survival may depend upon it.[2]

Did you notice the brief outline of my "UNIFIED THEORY OF THE BIOLOGICAL AND SOCIAL SCIENCES & SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT" I clipped to the top of this letter? If you considered the axioms carefully, perhaps your great mistake has already occurred to you. I did endeavour, afterall, to make this lesson as simple as possible for you to understand. If it hasn't occurred to you yet, note that your assumptions, the framework upon which all of your works have been based for at least the past two decades, are contained within axioms I through III. Although I am not a gambling man, I believe you will discover your mistakes may be directly related to the fact that you have failed to comprehend inherent uncertainties associated with axioms IV through VII (of which, more to follow). I've noted errors are nothing to be ashamed of; this error is especially free of disgrace, since *all* of your fellow practitioners of your so-called "ecological economics" (as well as many other economists, naturally) have committed, and continue to commit the exact same error. Yes, I believe you will discover that this discourse is not simply a refutation of your *Nature in Economics*, but ultimately a falsification of the theoretical framework and central thesis of "ecological economics"....

Over the past forty years... many of those most able to navigate the perilous seas[3] of economics, mistakenly assert that neoclassical economic theory fails to pass the test of the second law of thermodynamics,[4] then proceed

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internal one as a Jew. As a man you claim, so to speak, a dispensation from causality otherwise accepted, as a Jew the privilege of monotheism. But a limited causality is no longer a causality at all, as our wonderful Spinoza recognized with all incision, probably as the first one. And the animistic interpretations of the religions of nature are in principle not annulled by monopolisation. With such walls we can only attain a certain self-deception, but our moral efforts are not furthered by them. On the contrary (Einstein 1954).

(b) I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument, as we should thus be compelled to believe in the existence of many cruel and malignant spirits, only a little more powerful than man; for the belief in them is far more general than in a beneficent Deity. The idea of a universal and beneficent Creator does not seem to arise in the mind of man, until he has been elevated by long-continued culture (Darwin 1883, p 1242).

(c) Beware of the man whose god is in the skies (Shaw 1903, ln 83).

(d) Also see Hitchens 2007 ; Weale 2007 ; Dawkins 2006 ; Darwin 1883 ; Russell 1931 ; Hume 1777a, 1777b, & 1779.

1 Sceptic: A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity... holds that there are no adequate grounds for certainty as to the truth of any proposition... Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet... to look out (OED 1997).

2 If our civilization is to survive, we must break with the habit of deference to great men. Great men may make great mistakes... Their influence, too rarely challenged, continues to mislead those on whose defense civilization depends, and to divide them. The responsibility for this tragic and possibly fatal division becomes ours if we hesitate to be outspoken in our criticism of what admittedly is a part of our intellectual heritage. By our reluctance to criticize some of it, we may help to destroy all of it (Popper 1945, inscription).

3 There are 'perilous seas' in the world of thought, which can only be sailed by those who are willing to face their own physical powerlessness. And above all, there is liberation from the tyranny of Fear, which blots out the light of day and keeps men grovelling and cruel. No man is liberated from fear who dare not see his place in the world as it is; no man can achieve the greatness of which he is capable until he has allowed himself to see his own littleness (Russell 1928, pp 22).

4 Economic theory has always maintained that economic value is "generated" solely within the economy where it is fully distributed among the factors of production before being "consumed". According to this theory, the economy is an isolated system that does not need flows to pass across its boundaries in support of its steady state ("general equilibrium"). From a thermodynamic point of view this idea is unacceptable. According to thermodynamic theory, any open system, which allows flows of matter and energy to cross its boundaries, is capable of maintaining itself in steady state only because it "transport" value from its environment to restore the value that has been "consumed" within the system and dissipated. Drawing on the analogy with thermodynamics, this paper replaces the traditional systemic analog of the economy, which is the closed "circular flow" process, with the steady flow process. According to this analog, any efficient economy is an open system both physically and economically requiring a "flow" of economic value to maintain its steady state. In other words, an economically isolated system has to be inefficient and is bound to misallocate and overuse environmental resources. Whether the economy behaves as an economically isolated (inefficient) or open (efficient) system is an empirical question. However, if real economies are economically open and

to report that, based upon this "revolutionary new perspective", we are now positioned to "reshape economic theory and policy".[1] The problems which appear to consistently elude you all is [that] you have failed to recognize the mission-critical nature of Axioms IV-VII.

Take, for example, a recent reformulation of ecological economics' central thesis from one of your so-called "field's" founding fathers, Herman E. (*ECONOMICS IN A FULL WORLD*, *Scientific American*, September 2005, Vol. 293, Issue 3):

> But the facts are plain and *uncontestable*: the biosphere is finite, nongrowing, *closed* (except for the constant input of solar energy), and constrained by the laws of thermodynamics. Any subsystem, such as the economy, must at some point cease growing and adapt itself to a dynamic equilibrium, something like a steady state.

But are the *facts plain* and *uncontestable?* Is the biosphere *finite* and *closed*? No, two strikes, wrong on both counts. Daly has failed, as you have failed, to grasp that greatest truth of all truths.[2] Go back and look at those axioms again. Pay attention to Axioms IV and (especially) Axiom V. Think about it: it's *not* a closed system, is it? The facts are not *plain* and *uncontestable*, are they? I suspect by now you may feel a bit nauseated, perhaps like an obedient sheep who has blindly followed a drunken shepherd over a cliff, in that very brief interval between terminal velocity and the rocks just below. Perhaps by now you are beginning to understand that this letter is not a joke. Please try not to take it personally (in fact, perhaps you may want to imagine that the letter has been written to Daly,[3] Nicholas Georgescu-Roegen, William Kapp,[4] Karl Polanyi,[5] E.F. Schumacher,[6] Røpke,[7] Splash,[8] Norgaard,[9] Daily,[10] McCauley,[11] Farley,[12] Hawken,[13] Constanza,[14] Olson,[1] Gowdy instead), for this

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efficient, and environmental resources are abused due to the economy's unrestrained material growth, parts of traditional economic theory, especially those related to benefit evaluation, will have to be modified. Policy recommendations will be affected in any case because internalization, the panacea of resource misallocations, cannot be more than a temporary solution. Instead of opening the economy, internalization encloses the harmed resource and saves it by abusing excessively other environmental resources (Amir 1994, abstract).

1 The policy recommendations of most economists are driven by a view of economic reality embodied in Walrasian general equilibrium theory. Ironically, the Walrasian system has been all but abandoned by leading economic theorists. It has been demonstrated to be theoretically untenable, its basic assumptions about human decision making have been empirically falsified, and it consistently makes poor predictions of economic behaviour. *The current revolution in welfare economics offers opportunities on two related fronts for an evolutionary perspective on human behaviour to reshape economic theory and policy*.... Expanding the role of economic analysis beyond stylized market behaviour to focus on well-being (real utility) has far-reaching consequences for microeconomic policy... Abandoning the Walrasian model also means rethinking the microfoundations approach to the economic analysis of sustainability. This opens the door for economists to engage with the growing body of research on the evolution of whole societies (Gowdy 2006, abstract).

2 The Socratic maxim that the recognition of our ignorance is the beginning of wisdom has profound significance for our understanding of society.... This fundamental fact of man's unavoidable ignorance of much on which the working of civilization rests has received little attention. Philosophers and students of society have generally glossed it over and treated this ignorance as a minor imperfection which could be more or less disregarded.... Perhaps it is only natural that the scientists tend to stress what we do know; but in the social field, where what we do not know is often so much more important, the effect of this tendency may be very misleading (Hayek 1960, pp 22-23).

3 DALY is a professor in the School of Public Policy at the University of Maryland. From 1988 to 1994 he was senior economist in the environment department of the Work Bank, where he helped to formulate policy guidelines related to sustainable development. He is a co-founder and associate editor of the journal Ecological Economics and has written several books (Daly 2005). Also see Daly 1971.

4 1950.

5 1944.

6 1973.

7 2004 ; 2005.

8 1999 ; 2007.

9 1994 ; Nogaard & Bode 1998.

10 1997.

11 2006.

12 Daly & Farley 2004.

13 1994 ; Hawken, Lovins et. Al 2000.

14 et al 1997.

critique is as applicable to their positions–and countless others–as it is to yours)....

And since it seems that you may not possess sufficient problem solving skills for "whole-systems" studies, I will make this critical point regarding the false and sandy foundation of "ecological economics" as simple as possible, with two simple figures which compare and contrast the theoretical framework of "ecological economics" with the theoretical framework of *The Funk-Zweikampf Solution*. My five year old son, William, drew them for you, and you will find them in APPENDIX I: THE EARTH.

At the end of m letter to AICIS (mentioned on page 1 of this letter), I noted that, "if this long letter accomplishes nothing else, I hope it has at least irrefutably demonstrated that *we are all islanders, and all inextricably intertwined and inextricably engaged in a non-cooperative game*;" this remark ties into the insightful passage from John Nash's Ph.D. dissertation on the cover-page of this letter, and I believe it may be fair to infer that Albert Einstein was aware of the nature of the implicit, sub-optimal – yet rational – gambit presented be all Prisoners' Dilemmas: in the complex problem of global economic development, as I have illustrated in our Axioms, the "prisoners" we are unable to communicate with are the unknown and unknowable future, including (1) the future agenda and military capabilities of foreign nations and terrorist organizations, and (2) unknown planetary uncertainties, such human scientific experiments gone awry, super-novas, chaotic orbits, VEI-8 eruptions, and rogue Asteroids. I will also note that a few of critics have pointed out that, later in life, Einstein expressed regret over writing his letters to Roosevelt, but one of the greatest lessons in economics is that revealed-preferences (the choices people make and actions they ultimately take) are far more reliable and useful than stated preferences (the choices people *say* they *would* make, *would like* to make, or *should have* made). Yes, Einstein stated that he made a mistake, but of course his mistake may have been in stating that he had made a mistake!

Although Professor Dasgupta, Mr Gore ,and the growing population of "ecological economics" have rightfully acknowledged that we must fight to protect the relative insularity of our ecology, they have failed to grasp that we must *also* fight to protect the relative insularity of our planet from even greater threats, *and that makes me nervous*.[2] When an Academy Award and a Nobel Prize are awarded to an individual who is able to popularize evolutionary unstable solutions

---

1 Et al 1996.

2 What is becoming a scarce resource is any sense of the significance of this welter of information. We are losing the sense of what matters, of the habits of mind that can be traced to a loss of context; abstract ideas are not easily conveyed absent a recognizable embodiment, and the subtext, that which is not said, may be missing (Hayek et al. 1991, p 13).

to problems he does not understand, and, moreover, when a critical mass of highly influential people – such as David Suzuki– are mobilized in this – though perhaps well-intended – but ultimately misguided effort to change behaviours and alter perceptions of reality, it neither bodes well for the future of the United States nor the inhabitants of Earth. For if these individuals did grasp the true nature of the problem, they would understand that the ultimate solution they ostensibly seek – to save our planet – may actually require *greater* consumer consumption, *greater* greenhouse gas emissions, etc: As you are no doubt well aware, although this point seems to pass by many without much consideration, GPS, radar, and other communications systems which they enjoy in their cars, which guide oil tankers, aircraft, and fishermen alike back safely to home port, are almost entirely the fruits of the U.S. and allied forces military R&D. How soon so many of us forget that, on 12 April 1961, Yuri Alekseyevich Gagarin blasted into outerspace in, quite literally, a coldwar era ICBM: consumer spending (and thus greenhouse emissions) is rocket fuel for the military and NASA R&D upon which the future of our civilization depends. But this sentiment does not appear to be on the rise, in fact, I fear it is waning. As Thomas Schelling noted in his 2005 *Sveriges Riksbank Prize Lecture,*

> In 1960 the British novelist C. P. Snow said on the front page of the New York Times that unless the nuclear powers drastically reduced their nuclear armaments thermonuclear warfare within the decade was a "mathematical certainty",[1]

and it seems, despite all of our progress, we may be – yet again – enduring this sort of intellectual epidemic which first spread through the United States late 19th century,[2] but we were fortunate to transition through this problematic period, if I may speculate, with logical investigations out of the Chicago School and other forward thinking American institutions such as Princeton, Yale, Stanford, MIT, NYU, RAND, The Rockefeller Foundation, and The Institute of Advanced Study,[3] and it is my hope that these and other institutions will help us transition through this period again.

---

1 p 365.

2 We seem to be passing through what may be called an exceptional development of the heart without a corresponding development of the head. Through all classes of people there seems to have run a contagious epidemic of sentiment which has arisen from a really high and noble moral purpose. Persons of sensibility, refinement and intelligence have been touched as never before by a strong desire to do for the classes below them. So find and so lofty has unquestionably been the purpose behind this movement, that it seems ungracious, if not unjust, to hint at a possible improvement in it; and yet the ascertainment of the causes of things and the susequent remedying of evils can be advanced only by the most rigorous, logical, and scientific investigation. Lofty as the well meaning purpose of many persons may be, still, if founded only on a sentimental basis, it may be as dangerous as error (Laughlin 1892, p 2).

3 Of course I'm limiting my survey to the United States: the extraordinary contributions out of the Scottish Enlightenment, the Austrian

In closing, Mr President, I will offer that I followed your presentation of the Medal of Freedom Awards three weeks ago with great interest, especially your words in honour of General Peter Pace;[1] in fact, I have been invariably drawn to these great Awards since 1991, the year your father presented the a Medal of Freedom to F.A. von Hayek.[2] If I it not too much to ask, I would be grateful if you are able to share these words of thanks with your father, since, despite their accolades and achievements, as other writers have rightly noted, the teachings of Hayek and his close friend and fellow Austrian, Sir Karl Popper have not received due attention, and I doubt I will ever be able to adequately express my debt to their contributions - but I will attempt to do so in this brief valediction: [3]

> *If I have seen farther, it is by standing on the shoulders of giants*, wrote Isaac Newton in a letter to Robert Hooke in 1676. Although Newton was referring to his discoveries in optics rather than his more important work on gravity and the laws of motion, it is an apt comment on how science, and indeed the whole of civilization, is a series of incremental advances, each building on what went on before…
>
> But… our understanding doesn't advance just by slow and steady building on previous work. Sometimes as with Copernicus and Einstein, we have to make the intellectual leap to a new world picture. Maybe Newton should have said, "*I used the shoulders of giants as a springboard*."[4]

And in may feeble attempt to express my gratitude to these great defenders of freedom, I will relate that, on 11

School, the University of Zurich, Humboldt University of Berlin, Cambridge, Oxford, The London School of Economics, Mount Perlin Society, and the highly rationalized problem solving skills which developed through centuries of relatively homogoneous Norse and Japanese cultural evolution were certainly, at the very least, all equal or greater, each in their own right.

1 On his final day in uniform, General Pace took a quiet journey to the Vietnam Veterans' Memorial. He searched the names engraved in the sleek granite, and then found a spot where he placed his four stars that had adorned his uniform. Along with those stars he attached notes addressed to the men who died under his first command some four decades ago. The notes said: "These are yours -- not mine. With love and respect, your platoon leader, Pete Pace." General Pace ended his military career the same way that he began it -- with love for his country and devotion to his fellow Marines.

For his selfless service to his country, and for always putting the interests of our men and women in uniform first, I am proud to award the Presidential Medal of Freedom to General Pete Pace (Bush 2008).

2 We honor Professor Friedrich von Hayek for a lifetime of looking beyond the horizon. At a time when many saw socialism as ordained by history, he foresaw freedom's triumph. Over 40 years ago, Professor von Hayek wrote that ``the road to serfdom'' was not the road to the future or to the political and economic freedom of man. A Nobel laureate, he is widely credited as one of the most influential economic writers of our century. Professor von Hayek is revered by the free people of Central and Eastern Europe as a true visionary, and recognized worldwide as a revolutionary in intellectual and political thought. How magnificent it must be for him to witness his ideas validated before the eyes of the world. We salute him.

The people of the United States are indeed indebted… You have touched us. You have enriched us. You have shaped our Nation's destiny. And you've also shown us the strength and joy of a simple but powerful idea: the idea of freedom (Bush 1991).

3 My present design… is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own…. This tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all. It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgements of our friends are to be suspected when given in our favour (Descartes 1637, pp 1-2).

4 Hawking 2002 ix.

June 2008, just a few minutes past one o'clock in the afternoon, I stood before the small group of searchers remaining in the afternoon of the final day of the AICIS conference and said,

> Hello, my name is Matt Funk, I am thirty-nine years old, and I have only solved one significant problem in my entire life. But I am in fact pleased with this result, as the problem that I have solved has remained an open problem in economics for over 2,300 years.[1]

First of all, this introductory remark was intended to emphasize the importance of the discovery over the importance of the discoverer,[2] for I'm well aware of how difficult these lessons are to learn and, even when grasped, how easily they are lost.[3]

Moreover, on a practical level, for example, there are more deaths per 10,000 drivers here on Prince Edward Island than in any other province in Canada, and I think about this statistic every time my beautiful Canadian wife walks heads off for the Queen Elizabeth Hospital, where she has worked as a registered nurse for the past five years. I also consider this statistic every time I get into the car: I think of my wife, my five year old son, and I also consider the completed and nearly completed solutions I've been working on over the past decade, buy have yet to publish. How unfortunate it would be if they all vanished in a blink of an eye? It was with a similar thought[4] that I sent the following email a few hours prior to boarding my flight from Stockholm last month:

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1 Funk 2008b.

2 All the great… scientists were intellectually modest; and Newton speaks for them all when he says: 'I do not know what I may appear to the world, but to myself I seem to have been only a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.'"

Moreover, all the great scientists realized that every solution to a scientific problem raises many new and unsolved problems. Our knowledge of our ignorance, becomes increasingly conscious, detailed and precise, the more we learn about the world. Scientific research is the best method we have for obtaining information about ourselves and about our ignorance. It leads us to the important insight that there may be great differences between us with regard to minor details of what wed may perhaps know, yet we are all equal in our infinite ignorance (Popper 1992, p 40).

3 It is the fact that in [economics] no knowledge can be regarded as established once and for all, and that, in fact, knowledge once gained and spread is often, not disproved, but simply lost and forgotten…. The reason why in our field knowledge can be so lost is, of course, that is never established by experiment, but can be acquired only by following a rather difficult process of reasoning…. The result is that in economics you can never establish a truth once and for all but have always to convince every generation anew (Hayek, Bartley, & Kresege 1991, p 38).

4 [The wise] will start each day with the thought… Fortune gives us nothing which we can really own. Nothing, whether public or private, is stable; the destinies of men, no less than those of cities, are in a whirl. Whatever structure has been reared by a long sequence of years, at the cost of great toil and through the great kindness of the gods, is scattered and dispersed in a single day. No, he who has said 'a day' has granted too long a postponement to swift misfortune; an hour, an instant of time, suffices for the overthrow of empires. How often have cities in Asia, how often in Achaia, been laid low by a single shock of earthquake? How many towns in Syria, how many in Macedonia, have been swallowed up? How often has this kind of devastation laid Cyprus in ruins? We live in the middle of things which have all been destined to die. Mortal have you been born, to mortals have you given birth. Reckon on everything, expect everything (Botton 2000, p 91).

-------- Original Message --------

Subject: Re: Greetings from Stockholm!
Date: Tue, 17 Jun 2008 01:11:16 +0000
From:matt@funkisland.org
To: Godfrey Baldacchino <gbaldacchino@upei.ca>

Here's a copy of my final draft - if Fortuna she twist her hand and thwart my efforts to reach the shores of North America again, please do you best to write an introduction, find a publisher, and send proceeds to my son! (Have I mentioned the importance of the theoretical implications this paper presents?!?)
Cheers! Matt

But this is not even the type of loss I fear most. The loss I fear most is the lost of not being discovered, or, rather, not being *accepted*, in the first place. And there are fairly good reasons for this fear.

Throughout history, there have been, essentially two types of economists: those who become rich and famous and those whom parish in poverty and obscurity, and, unfortunately, I am of the latter type.

Why is this so?

Because, as Einstein noted, "Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing."[1] Those economists whom recognize and acknowledge Hume's clear message[2] regularly meet poverty and obscurity, while those whom cater to man's crushing desire for certainty reap fortune and fame.

The Problem of Induction, as we have noted, was first recognized by Hume,[3] and Cournot[4] was the first economist to developed probability theory to the point where he recognized that it was not applicable to economics. Cournot died blind and penniless, while his contemporary, William Stanley Jevons, an economist of nearly no ability, gained fortune and fame for assuring speculators of a connection between sunspots and commodity prices.[5] And although a tenable solution was finally tabled by Popper (both Popper and Hayek, I will note were two great exceptions to the rule above,

1 Italics mine, Einstein 1956 p 21-22.

2 Ever since the beginning of modern science, the best minds have recognized that 'the range of acknowledged ignorance will grow with the advance of science.' Unfortunately, the popular effect of this scientific advance has been a belief, seemingly shared by many scientists, that the range of our ignorance is steadily diminishing and that we can therefore aim at more comprehensive and deliberate control of all human activities. It is for this reason that those intoxicated by the advance of knowledge so often become the enemies of freedom (Hayek1945).

3 1739

4 1838

5 See Funk 2007.

though they certainly did not find the fortunes of two economists I will shortly note),[1] probability theory and inductive methods remain in the core curriculum of nearly every economics department and continues to provide false foundations for Nobel Laureates, hedge fund managers, and central bankers alike. As Lowenstein keenly observed in *When Genius Failed: The Rise and Fall of Long-Term Capital Management*, his story of two Nobel Laureates, both firm believers and sellers of certainty whom gained fortune, fame, and nearly brought the U.S. and global financial markets to a crashing halt, the "belief that tomorrow's risks can be inferred by from yesterday's prices and volatilities prevails at virtually every investment bank and trading desk."[2]

In any case, Mr President, it is out of this fear of being lost or not being discovered at all that I have written this letter to you, as I hope that by placing it in your hands it may be more readily preserved.

And if I have indeed been able to see a bit farther, if you, my fellow Americans, and any other fellow inhabitants of Earth should find my discovery of a any meaningful *value*, if I have not mistaken and pyrite and plexi-glass for diamonds and gold,[3] then not only will I have done so *without* using the shoulders of these two Austrian intellectual giants as springboards,[4] for I will have done so without yet climbing within sight of their shoulders.

Moreover, despite the fact that these men were often not well-received by the open arms of America, I have

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1 1959

2 2000, p 235

3 My present design… is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own.... This tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all. It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgements of our friends are to be suspected when given in our favour (Descartes 1637, pp 1-2).

4 Most economists enter this market in ney ideas, let me emphasize, in order to obtain ideas and methods for the applications they are making of economics to the thousand problems with which they are occupied: these economists are not the suppliers of new ideas but only demanders. Their problem is comparable to that of' the automobile buyer: to find a reliable vehicle. Indeed, they usually end up by buying a used, and therefore tested, idea.

Those economists who seek to engage in research on the new ideas of the science - to refute or confirm or develop or displace them - are in a sense both buyers and sellers of new ideas. They seek to develop new ideas and persuade the science to accept them, but they also are following clues and promises and explorations in the current or preceding ideas of' the science. It is very costly to enter this market: it takes a good deal of time and thought to explore a new idea far enough to discover its promise or its lack of promise. The history of economics, and I assume of every science, is strewn with costly errors: of ideas, so to speak, that wouldn't run far or carry many passengers (Stigler 1982, pp 529-530).

sufficient reason to believe they admired our nation, our independence,[1] and the safe anchorage we provided for independent thinkers and intellectual rebels[2] such as they:

> In 1949 I received an invitation to give the William James Lectures at Harvard. This led to my first visit to America, and it made a tremendous difference to my life….
>
> I liked America from the first, perhaps because I had been somewhat prejudiced against it. There was in 1950 a feeling of freedom, of personal independence, which did not exist in Europe and which, I thought, was even stronger than in New Zealand, the freest country I knew….
>
> The greatest and most lasting impact of our visit was made by Einstein. I had been invited to Princeton, and read in a seminar a paper on "Indeterminism in Quantum Physics and in Classical Physics", an outline from a much longer paper. In the discussion Einstein said a few words of agreement, and Bohr spoke at length (going on until we were the only two left)… The fact that Einstein and Bohr came to my lecture I regard as the greatest compliment I have ever received.
>
> I learned to my surprise that Einstein thought my suggestions concerning simplicity (in *Logic der Forschung*) had been universally accepted, so that everybody now knew that the simpler theory was preferable because of its greater power of excluding possible states of affairs; that is, its better testability….
>
> It is difficult to convey the impression made by Einstein's personality. Perhaps it may be described by saying that one felt immediately at home with him, his good sense, his wisdom, and his almost childlike simplicity. *It says something for our world, and for America, that so unworldly a man not only survived, but was appreciated and so greatly honoured* [Italics mine, Popper 1992, pp 146 – 152].

And finally, Mr President, if I may offer a personal note: I realize you have been faced with difficult strategic

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1 On July 4, 1776, our Nation's Founders declared "That these United Colonies are, and of Right, ought to be free and Independent States." This declaration marked a great milestone in the history of human freedom. On the 230th anniversary of the signing of the Declaration of Independence, we pay tribute to the courage and dedication of those who created this country, and we celebrate the values of liberty and equality that make our country strong.

The patriots of the Revolutionary War acted on the beliefs that "all men are created equal" and "that they are endowed by their Creator with certain unalienable Rights." By advancing these ideals, generations of Americans have unleashed the hope of freedom for people in every corner of the world.

As we celebrate our independence, Americans can take pride in our history and look to the future with confidence. We offer our gratitude to all the American patriots, past and present, who have sought to advance freedom and lay the foundations of peace. Because of their sacrifice, this country remains a beacon of hope for all who dream of liberty and a shining example to the world of what a free people can achieve. May God continue to bless the United States of America.

NOW, THEREFORE, I, GEORGE W. BUSH, President of the United States of America, by virtue of the authority vested in me by the Constitution and laws of the United States, do hereby proclaim July 4, 2006, as Independence Day. I call upon the people of the United States to observe with all due ceremony our Independence Day as a time to honor our Founders and their legacy of freedom and remember with thankfulness the sacrifice of our men and women in uniform.

IN WITNESS WHEREOF, I have hereunto set my hand this twenty-six day of June, in the year of our Lord two thousand six (Bush 2006).

2 Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels…. And, as recent research into Einstein's personal papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity…. *Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job* [italics mine]. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern…. *Other scientists had come close to his insight, but they were too confined by the dogmas of the day* [italics mine]. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics since Newton. "Imagination is more important than knowledge," Einstein later said. Indeed, if we are ever going to unravel the further mysteries of dark matter, come up with a unified theory, or discover the true nature of energy, we should carve that proclamation above all of our blackboards (Isaacson, 2007, pp 35-36).

decisions over the past eight years, and I want to let you know that, after thinking about these and other strategic, theoretical, and practical implications while completing the formulation of the theory of value based upon relative insularity which I have enclosed herewith, I called my father in Chicago last month to tell him about my exciting discovery, and at the end of this conversation, I told him something he had never heard me say before: I told him I was proud to be an American.

"You should be," my father said without hesitation, "it's a great country."

Sincerely,

(Matt Funk)

APPENDIX I: THE EARTH[1]

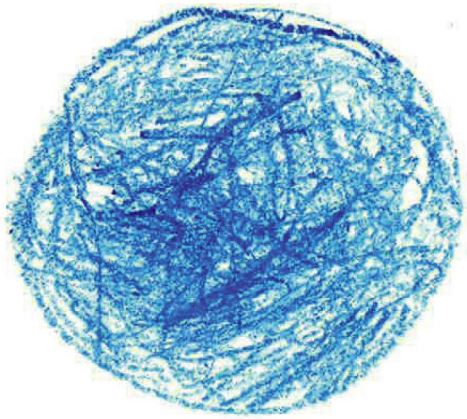

Figure 1

This excellent drawing represents the theoretical framework of "ecological economics." The blue represents the Earth, the biosphere and all of its inter-connected systems, which are, naturally, beholden to the second law of thermodynamics. Although "ecological economists" refer to this as a "whole-systems" approach; as you will see in Fig. 2, they "forgot" two systems. This framework is represented in Axioms I-III.[2]

1 Funk 2008a. Artwork courtesy of William Matthew Funk © 2008.

2 See APPENDIX I.

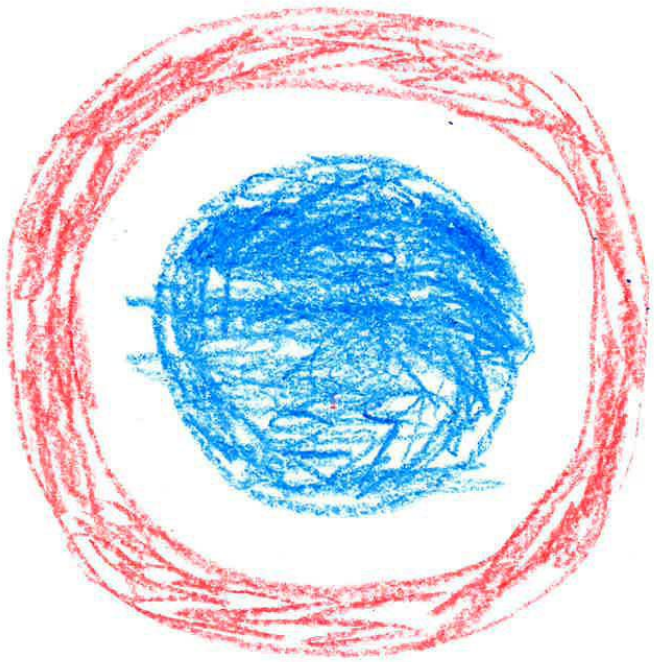

Figure 2

This excellent drawing represents the theoretical framework of *The Funk-Zweikampf Solution*.
Note that, in addition to the axioms represented in the previous drawing (in blue),
this framework also recognizes two additional, fundamental assumptions:
(1) *political uncertainty* (white), and (2) *planetary uncertainty* (red).
As you can see, this is the "bigger picture," so to speak.
This framework is represented in Axioms I-VI.[1]

1 See APPENDIX I.

Asteroid Tugboat

An Asteroid Tugboat… is a fully controlled asteroid deflection concept using a robotic spacecraft powered by a high efficiency, electric propulsion system (ion or plasma) which docks with and attaches to the asteroid, conducts preliminary operations, and then thrusts continuously parallel to the asteroid velocity vector until the desired velocity change is achieved. Based on early warning, provided by ground tracking and orbit prediction, it would be deployed a decade or more prior to a potential impact.[1]

Axiom

"Fundamental Ideas"… are the sources of necessary truths (sometimes called "Axioms").[2]

Byr **Billion Years**

ESS **Evolutionary Stable Strategy**

Maynard Smith and Price (1973) introduced the concept of an evolutionarily stable strategy (ESS). Initially they were not aware of the relationship between the concept of an ESS and that of a Nash equilibrium. Rational game theory looked at mixed strategies as produced by conscious randomization. Nash's interpretation of a mixed equilibrium as a mass action phenomenon was buried in his unpublished dissertation and not found in textbooks on game theory. In biology the mass action interpretation is very natural and guided the work on evolutionary stability already from its beginning.… They defined an ESS as a strategy prescribed by a symmetric equilibrium point.[3]

Funk-Zweikampf Solution

Our strategic solution is derived through the axiomatic application of our unified theory of value of the biological and social sciences,[4] generated through the discovery that *Value* (V) is a derivative function of *relative insularity* (I_R): $V = f'(I_R)$.

I_R is formulated with the following variables: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year & % km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), and the following four qualitative inputs: Sovereign Status, Constitutional Balance, Cultural Homogeneity, and Military Power*. We calibrate our formulae by adjusting relative input weighting in accordance a positive, linear biogeographical correlation between I_R and the average human life expectancy for the corresponding politico-biogeographic area.[5]

GEMS **Globalized Economic Military Superpowers**

Presently, the USA represents the only true player in this arena, but our definition includes all five signatory members of the UK-USA agreement (UK, USA, Canada, Australia, and New Zealand), often referred to as AUSCANZUKUS, and six other nations which have developed, detonated, and presently maintain nuclear weapons (Russia, France, China, India, Pakistan, and North Korea).

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1 Schweickart et. al., 2003, abstract.

2 Whewell 1837, reprinted in Butts 1968, p 5.

3 Selten 1994, p 168

4 See APPENDIX I

5 Funk 2008a

Prisoner's Dilemma

(a) Al Tucker was on leave at Stanford in the Spring of 1950 and, because of the shortage of offices, he was housed in the Psychology Department. One day a psychologist knocked on his door and asked what he was doing. Tucker replied: "I'm working on game theory.", and the psychologist asked if he would give a seminar on his work. For that seminar, Al Tucker invented the Prisoner's Dilemma as an example of game theory.[1]

(b) The Prisoner's Dilemma… is a game where two players have the option to cooperate or to defect. If both cooperate they receive the reward, *R*. If both defect they receive the punishment, *P*. If one cooperates and the other defects, then the cooperator receives the sucker's payoff, S, while the defector receives the9 temptation, *T*. The Prisoner's Dilemma is defined by the ranking $T>R>P>S$.

Would you cooperate or defect? Assuming the other person will cooperate it is better to defect, because $T>R$. Assuming the other person will defect it is better to defect, because $P>S$. *Hence, no matter what the other person will do it is best to defect. If both players analyze the game in this rational way then they will end up defecting. The dilemma is that they both could have received a higher payoff if they had chosen to cooperate. But cooperation is irrational.*[2]

(c) This "collective-risk social dilemma" exists in various social scenarios, the globally most challenging one being…climate change.[3]

Problem of Induction[4]

[Problem:] Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience*.[5]

[Solution:] According to a widely accepted view… the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences….

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity' [Reichenbach, Erkenntnis 1, 1930, p. 186]. At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later

1 Kuhn 1994, p 161. For A.W. Tucker's version, see APPENDIX IV: THE PRISONER'S DILEMMA.

2 Italics mine, May & McLean, 2007, p 8. Also see APPENDIX I, Cressman 1996, Hauert 2006, Weibull & Salomonsson 2006

3 Milinski et. al. 2008, p 2291.

4 Also see Cournot 1838, Reichenbach 1930, 1966, Reichenbach et. al. 1971, Russell 1903, 1908, 1913, 1919, 1948,Ludwig et. al. 1993, and Wittgenstein 1969. Most works by Popper address this problem from various angles and within variable contexts.

5 Italics mine, Hume 1739, Book I, Vol I, p 137.

reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads…to an infinite regress.[1]

(exempli gratia: a) There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility we must ready ourselves for.[2]

(exempli gratia: b) The assumption that economists can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers.[3]

(exempli gratia: c) There is a problem in inference well-known as the problem of induction. It is a problem that has been haunting science for a long time, but hard science has not been as harmed by it as the social sciences, particularly economics, even more the branch of financial economics.[4]

(exempli gratia: d) Kant, in his Critique of Pure Reason, asserted under the influence of Hume that pure speculation or reason, whenever it ventures into a field in which it cannot possibly be checked by experience, is liable to get involved in contradictions or 'anti-anomies' and to produce what he unambiguously described as 'mere fancies' ; 'nonsense' ; 'illusions' ; 'a sterile dogmatism' ; and 'a superficial pretension to the knowledge of everything.'[5]

(exempli gratia: e) We shall never attain scientific consensus concerning the systems that are being exploited. There have been a number of spectacular failures to exploit resources sustainably, but to date there is no agreement about the causes of these failures….

The great difficulty in achieving consensus concerning past events and a fortiori in prediction of future events is that controlled and replicated experiments are impossible to perform in large-scale systems….

Once we free ourselves from the illusion that science or technology (if lavishly funded) can provide a solution to resource or conservation problems, appropriate action becomes possible.[6]

RIS **Relatively Insular States**

This category includes sovereign island nations, sub-national island jurisdictions, insular provinces (i.e. Newfoundland & Labrador), states (i.e. Hawaii), municipalities (i.e. Vancouver Island), and relatively insular jurisdictions (i.e. The Alpine Convention region) Given relative insularity (see Axiom VII), we divide geopolitical regions into (1) RIS and (2) GEMS, but in reality, naturally, the true relative insularity of each region lies along a sliding scale with a true GEMS at one end (the United States) and a true RIS, such as the big island of Hawaii at the other.[7]

Strategic Equilibrium

What do I mean by "strategic equilibrium"? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each

1 Popper 1959, pp 31-35.
2 Botton 2000, p 90.
3 Hayek 1991, p 9.
4 Taleb 2004, p 117.
5 Popper, 1945, vII, p38.
6 Ludwig et. al. 1993.
7 Funk 2008a

player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior*.[1]

Theory

Every scientific theory is a system of sentences…or ASSERTED STATEMENTS or, for short, simple STATEMENTS.[2]

Tragedy of the Commons

(a) William Forster Lloyd (1794-1852)… made a lasting if long unrecognized mark in economics… From 1832 to 1837 Lloyd held the Drummond chair of political economy at the University of Oxford. A collection of his lectures… were first published in 1833 in Oxford under the title *Two Lectures on the Checks to Population*…. The chief original contribution in Lloyd's discussion of population issues is his recognition and incisive analysis of the deleterious consequences that ensue "when the constitution of society is such that as to diffuse the effects of individual acts throughout the community at large, instead of appropriating them to the individuals, by whom they are respectively committed." Lloyd's discussion of this problem… [is] best known to modern readers through Garrett Hardin's influential 1968 article… *"The Tragedy of the Commons"*.[3]

(b) It is fair to say that most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy.[4] They think that farming the seas or developing new strains of wheat will solve the problem -- technologically. I try to show here that the solution they seek cannot be found. The population problem cannot be solved in a technical way, any more than can the problem of winning the game of tick-tack-toe (Hardin 1968).

(c) Scientific certainty and consensus in itself would not prevent overexploitation and destruction of resources. Many practices continue even in cases where there is abundant scientific evidence that they are ultimately destructive. An outstanding example is the use of irrigation in arid lands. Approximately 3000 years ago in Sumer, the once highly productive wheat crop had to be replaced by barley because barley was more salt-resistant. The salty soil was the result of irrigation. E. W. Hilgard pointed out in 1899 that the consequences of planned irrigation in California would be similar. His warnings were not heeded. Thus 3,000 years of experience and a good scientific understanding of the phenomena, their causes, and the appropriate prophylactic measures are not sufficient to prevent the misuse and consequent destruction of resources.[5]

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1 All italics Aumann's 2005, p 352.

2 Tarski 1941, p 3.

3 Population Council 1980, p 473

4 To keep downtown shoppers temperate in their use of parking space we introduce parking meters for short periods, and traffic fines for longer ones. We need not actually forbid a citizen to park as long as he wants to; we need merely make it increasingly expensive for him to do so. Not prohibition, but carefully biased options are what we offer him. A Madison Avenue man might call this persuasion; I prefer the greater candor of the word coercion.

Coercion is a dirty word to most liberals now, but it need not forever be so. As with the four-letter words, its dirtiness can be cleansed away by exposure to the light, by saying it over and over without apology or embarrassment. To many, the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats; but this is not a necessary part of its meaning. The only kind of coercion I recommend is mutual coercion, mutually agreed upon by the majority of the people affected.

To say that we mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it. Who enjoys taxes? We all grumble about them. But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless. We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons (Hardin 1968).

5 Ludwig et. al. 1993.

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Abstract: Fisheries are subject to a deep-rooted problem of economic inefficiency, often referred to as the fisheries problem. The fisheries problem derives fundamentally from inappropriate social institutions controlling the fishing activity, the foremost of which is the common property arrangement. Fisheries management consists of replacing these institutions with more appropriate ones. Which institutions are most appropriate depends on the social objectives of the fisheries. There are strong economic arguments for the view that there should be only a single objective, namely to maximize the present value of the flow of benefits from the fisheries. In reality, different interest groups often push for several, often conflicting, objectives. In that case a multi-objective programming approach may be appropriate. A set of institutions to manage fisheries is referred to as the fisheries management regime. The fisheries management regime consists of a (i) fisheries management system, (ii) fisheries enforcement system and (iii) fisheries judicial system. Each one of these has to be appropriately designed and implemented. The efficacy of the overall fisheries management regime cannot be greater than that of its weakest link. At the same time it is of the greatest importance to keep an eye on the cost of fisheries management. Global evidence suggests that the cost of fisheries management often constitutes a substantial fraction of the value of the harvest. The problem, thus, is to strike the right balance between the efficacy of the fisheries management regime and its cost of design, implementation and operation. The problem of fisheries management is by its nature multidisciplinary. It involves marine ecology and biology, mathematics, economics, game theory, political science and anthropology to name a few. The problem is, moreover, typically quite complex, requiring powerful modelling and calculation techniques. In many respects this is the kind of problem operations research techniques are designed to deal with.

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Baldacchino, G. (2007). Fixed links and the engagement of islandness: reviewing the impact of the Confederation Bridge. *The Canadian Geographer/Le Géographe Canadien, 51*(3), 323-336.
1.
The Confederation Bridge, linking Prince Edward Island (PEI) to New Brunswick (NB) across the Northumberland Strait… has probably been the most keenly debated and most traumatic event in the modern history of PEI, Canada's smallest province (Calhoun 1989; Weale 1991; Begley 1993; Shea 1993; Johnston 1995; Macdonald 1997) (p 329).
2.
In *A Geography of Islands*, Royle dedicates the first photo in his book to the 14-km Confederation Bridge, linking PEI (and its 140,000 citizens) to mainland New Brunswick since 1997 (Royle 2001, 13). To judge from the lead-up, many Islanders held high hopes from the completed structure. 'Our Island province is about to experience a transition to a new frontier of vigorous expansion and renewed community vitality,' PEI Premier Pat Binns predicted at the official opening. 'Our traditional sectors of agriculture and the fishery will be enhanced by a marked improvement in transportation infrastructure (Journal-Pioneer 1997).

The decision to bridge the gap (that is, the Northumberland Strait) was by no means universally popular, however (Royle 2001, 114; Begley 1993). Prominent islanders like Betty Howatt campaigned vigorously against the bridge—because she saw 'a loosening of the social fabric in the province' and claimed that 'people no longer have that sense of place that they once had' (The Guardian, PEI, 8 November 2003). In a January 1988 plebiscite, 40 percent of islanders voted against a fixed link. For many of these, a fixed attachment was a violation of a natural order of things; a forced and permanent alternation of an intimate and fundamental spatiality (e.g., Weale 1991, 82). A key perceived threat was to the impact that a bridge would have on the island's unique and distinct 'way of life.' The latter may escape definition, although Ansel Ferguson, an island fisherman, describes it as 'a little more friendliness, a little more community, a little less crime' (Calhoun 1989, 19). Critics argued that easy access to the island province would damage the tranquility, natural beauty and charm of island life. Islanders did not want the green fields and red soil to be tarnished by the hotdog stands and jukebox joints that would transform the place into another Coney Island (CBC 2002). A fixed connection would allow New Brunswick and Nova Scotia firms to truck their

products more efficiently to PEI, as well as encourage Islanders to go shopping in such places as Moncton or Halifax, undercutting the island's smaller producers and retail outlets. Fishers complained that any solid structure in the strait would affect fish stocks, shellfish beds and especially lobster (FEARO 1990, 13) (p 329).

3.

For an island that depends so much on its natural resources (sea, land) and their scapes and symbolism (through tourism) to support its economy, it is not surprising that much concern was raised on the environmental impact of the bridge, especially in the sensitive Northumberland Strait. There are now tell tale signs of 'ecological collapse' in that stretch of water (Gustafson 2006). Many are claiming that the bridge is to blame for a 'sick strait' (e.g., CBC 2006)....The Federal Environmental Assessment Review Office had concluded, in 1990, that '... in terms of the marine ecosystem of the Northumberland Strait, the risks associated with the proposed bridge concept are unacceptable' (FEARO 1990, 14) (pp 321-322).

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Baldacchino, G., Baldacchino, G., MacDonald, E., Baldacchino, G., & Spears, A. (2007). *Bridging islands : the impact of fixed links*. Charlottetown, P.E.I.: Acorn Press.

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1.

Even the official motto belies its aspirations. The motto of Prince Edward Island, Parva sub ingenti, "the small under the protection of the great," is an apt metaphor for Canada's smallest province. It is also a bitterly paradoxical expression of the Island's status as a "have not" province, largely dependent on others for its survival, first as a colony under British rule and then as a somewhat reluctant new province of Canada. As Prince Edward Island comes to the end of the 20th century, the goal of greater self-sufficiency and self-reliance remains as elusive as ever (p 175).

Baldacchino, G., Milne, D., Bartmann, B., Srebrnik, H. F., Paterson, R., Jolliffe, L., et al. (2000). *Lessons from the political economy of small islands : The resourcefulness of jurisdiction*. New York: St. Martin's Press.

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Beaulier, S., & Caplan, B. (2007). Behavioral Economics and Perverse Effects of the Welfare State. *Kyklos, 60*(4), 485-507.

1.

The perverse effects frequently attributed to the welfare state are easy to interpret from a behavioral perspective. If people overestimate the magnitude of immediate benefits relative to more distant ones, you can actually – on net – harm them by offering them additional immediate benefits. They already tend to under-invest. Making their present more livable with cash gifts only amplifies this tendency. Similarly, if individuals systematically overestimate their own abilities, you could easily harm a student by admitting him to a program for which he is under-qualified. Blinded by over-confidence, he would be likely to select the best school that accepted him, scarcely considering the possibility that he will be out of his league. Looking at the welfare state from a behavioral standpoint lays the groundwork for a stronger claim: Potential welfare recipients' deviations from neoclassical assumptions tend to be especially pronounced. If the average American falls short of the neoclassical ideal, the average recipient of government assistance does not even come close (p 487).

2.

To the best of our knowledge, this is the first paper to analyze the connection between behavioral economics and what Tyler Cowen calls the 'traditional conservative critique of the welfare state.' Most detractors of the welfare state have turned to neoclassical economics for intellectual support. Few promoters of behavioral economics have stopped to consider its implications for poverty policy.

Our paper aims to reverse both of these trends. Some of the most common complaints about the welfare state are, from a strict neoclassical perspective, senseless. But from the standpoint of behavioral economics, they are quite coherent. Moreover, even though behavioral economists have given policy towards the disadvantaged short shrift, this turns out to be a topic where behavioral findings are especially relevant. A variety of sources indicate that 'the poor deviate more.' If the average person violates neoclassical assumptions, the average welfare recipient violates them to a markedly greater degree....

Once you accept the idea that you can hurt people by giving them more choices, you cannot dismiss the idea that you can help them by taking some of their choices away. In practice, of course, the latter is much more costly and intrusive than the former (Glaeser 2006) (p 503).

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1.

WHEN on board H.M.S. Beagle, as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species — that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes (p 1).

2.

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. These laws, taken in the largest sense, being Growth with Reproduction; inheritance which is almost implied by reproduction; Variability from the indirect and direct action of the external conditions of life, and from use and disuse; a Ratio of Increase so high as to lead to a Struggle for Life, and as a consequence to Natural Selection, entailing Divergence of Character and the Extinction of less-improved forms. Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved (pp 489-490).

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The paradox has often been noted that the first edition of *The Origin of Species* makes a better case than the sixth. This is becuase Darwin felt obliged, in his later editions, to respond to contemporary criticisms of the fist edition, criticisms which now seem so dated that the replies to them merely get in the way, and inplaces even mislead (p xvi).

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The advent of wide spread internet publishing reduces the stifling impact of the refereeing process on the papers accepted and submitted to journals. Economics scholars are less bound to devote a large part of their time and effort on formalisms. They have more leeway to concentrate on matters of content. This greater freedom also improves the chances that the advice and suggestions proposed by economic methodologists are put into practice, provided they are of practical use for research. The dominance of orthodoxy is reduced. But at the same time the competition between papers is intensified, so that only methodological concerns held to be useful by practical economists have an impact on the profession (p 9).

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Abstract: Survival in academia depends on publications in refereed journals. Authors only get their papers accepted if they intellectually prostitute themselves by slavishly following the demands made by anonymous referees without property rights on the journals they advise. Intellectual prostitution is neither beneficial to suppliers nor consumers. But it is avoidable. The editor (with property rights on the journal) should make the basic decision of whether a paper is worth publishing or not. The referees only give suggestions on how to improve the paper. The author may disregard this advice. This reduces intellectual prostitution and produces more original publications.

Frey, B. S. (2007). Evaluierungen, Evaluierungen ... Evaluitis. *Perspektiven Der Wirtschaftspolitik, 8*(3) 207-220.
Abstract: In the sciences the outside evaluation of past performances of universities, faculties, departments, research groups and of individuals has become more and more frequent, nearly incessant. It could be said that the sciences are afflicted with Evaluitis, a creeping and widespread illness. Besides the obvious costs that arise for those being evaluated and for those doing the evaluation there are additional costs that weigh heavily but are usually disregarded: incentives are distorted systematically and ossification is promoted. Furthermore, the whole decision approach is wrongly conceived. For these reasons there are too many and too thorough evaluations. A useful alternative is an appropriate design of institutions guiding incentives and a careful selection of persons - who thereafter should be free to pursue their tasks.

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Abstract: Identification increases cooperation and fairness ("other-regarding" behaviour) in Prisoner's Dilemma and Dictator Games. While

identification explains all the difference in behaviour in nonstrategic interactions, face-to face communication further raises cooperation in strategic settings. This "cooperation-increasing" effect must be traded-off against the "equality-decreasing" effect of communication. Allowing for partial communication only—which prevails in large number settings—our experimental results indicate that discussion produces unequal distributions of outcomes to the disadvantage of those excluded from the interaction. Substituting identification for communication is relevant in democracy for all distributive questions and for public good type settings if equality is valued higher than a partial increase of "other-regardedness."

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- - - . (2007a). On the problem of hollywood economics: de vany's error—george lucas knows something. FIND Working paper.
Abstract: Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's '*Nobody knows anything*' theory and advance our replacement theory: *George Lucas knows something*.

- - - . (2007b). *On the problem of global warming: a brief history of a new & unpopular theory in an open letter to john gillis*. FIND working paper.
Abstract: Funk's (forthcoming) theory of *The Problem of Global Warming* forwards the hypothesis that 'global warming' is not in fact limited to ecological distress induced through the consumption of superheating fossil fuels—but that is merely *a single symptom* of far more significant problems, which stem from the *Problem of Induction*. This paper traces the history, evolution, and development of this new and unpopular theory.

- - - . (2007c). *On the problem of dependent people: natural resource valuation errors in atlantic canadian island jurisdictions*. FIND working paper.

- - - . (2006d). *Personal Correspondence.*
-----Original Message-----
From: Matt Funk <Mfunk@upei.ca>
To: Doherty, Peter
Sent: Sun Oct 28 20:44:21 2007
Subject: Thomas Kuhn & Karl Popper

Greetings Dr Doherty....I am researching a theory that the rejection of Karl Popper's logic and methods and general acceptance (in a popular sense) of Thomas Kuhn's logic and methods have been detrimental to science, especially social sciences such as economics.

Nearly a dozen Nobel Laureates have thanked Popper and acknowledged his great influence upon their work: most notably, of course, is F.A. von Hayek's Sveriges Riksbank Prize Lecture and, perhaps the most notable example in your field may be revealed in Eccles' Nobel biography.

I have only been able to discover one Nobel Laureate who acknowledged Kuhn's influence and, curiously, this noble individual (whom of course is you!) acknowledged both Popper and Kuhn: "I was influenced early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper and Thomas Kuhn."

So, naturally, I'm very curious to know if, after nearly a decade, the balance of this influence or your opinions regarding these two philosophers of science has changed?

I thank you very much for your time and consideration regarding this matter, as I am inclined to believe the long-term prospects of human survival may hang in the balance to the ultimate answer to this debate.

Any words of wisdom you are able to offer on this topic would be greatly appreciated.

Sincerely…Matt Funk

From:Doherty, Peter
To:Mfunk@upei.ca
Date:10/28/07 11:58 pm
Subject: Re: Thomas Kuhn & Karl Popper

A long time since I've read either. Popper's views re falsification of a null hypothesis seem correct to me. Much of the world's worst science is done by people who are determined to prove a point. Kuhn's idea of the paradigm shift is spot on.

Peter C. Doherty,
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- - - . (forthcoming). On the problem of global warming: a solution for william funk, albert gore and richard branson. 1156 pages.
Abstract: This exhaustive manuscript presents a solution to *The Problem of Global Warming*. Our discovery concludes that, contrary to popular opinion, "The Problem of Global Warming," is not ecological distress due to the superheating of the Earth, it is merely a single symptom of far more significant, inter-related problems, which are synonymous to *The Problem of Sustainable Economic Development*.

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Abstract: The greatest natural threat to the long-term survivability of mankind is an asteroid or comet impact with the Earth. SHIELD is an architectural concept for a comprehensive Earth defense system designed to discover, catalog, calculate orbits of near-Earth objects, and to deflect potential impactors. SHIELD consists of Sentries, Soldiers, and an Earth Control Center. Sentries are spacecraft designed to search and locate NEOs of all types. Sentries maximize the lead-time for a potential impact, which simplifies the task of the Soldiers to deflect the object. Sentry spacecraft determine the orbit of each object, and compare it with the onboard database of known NEOs. The results are kept in a distributed space-Earth database. Soldier spacecraft deflect or disperse the potential impactor. Several mitigation methods have been compared by their specific impulse. Each technique requires some development to be feasible. These techniques can be categorized into "rendezvous" in which the Soldier physically lands on the NEO and "intercept". The required number of Soldiers and their locations has been examined. SHIELD has clearly shown that an Earth-protection system is practical and that a full system could be built within a few years. Indeed, very capable Sentries can be launched today.

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Abstract: Ecologists are increasingly in demand to provide both background information to development and to conduct validatory studies prior to funding. This paper describes an advisory study conducted on the Caribbean island of Mustique prior to development for tourism. It is argued that the ecologist uses biological as well as physical indicators to assess suitability of different areas for development and to anticipate possible problems. In this study the primary environmental determinants and biological and human factors have been interpreted to identify the distribution and degree of seriousness of exposure, erosion potential and water yield and quality. The compatibility of physical and ecological factors with different categories of proposed development have been assessed, and maps of vegetation, soil and exposure transferred onto gridded overlays. The use of these overlays combined with a consideration of the compatibilities permitted the

degree of restraint to the various categories of development to be presented in map form. The problems that are likely to be encountered as a result of development are discussed, and finally it is suggested that the development be subjected to regular ecological monitoring.

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Abstract: Pollinators are required for producing 15–30% of the human food supply, and farmers rely on managed honey bees throughout the world to provide these services. Yet honey bees are not always the most efficient pollinators of all crops and are declining in various parts of the world. Crop pollination shortages are becoming increasingly common. We found that behavioral interactions between wild and honey bees increase the pollination efficiency of honey bees on hybrid sunflower up to 5-fold, effectively doubling honey bee pollination services on the average field. These indirect contributions caused by interspecific interactions between wild and honey bees were more than five times more important than the contributions wild bees make to sunflower pollination directly. Both proximity to natural habitat and crop planting practices were significantly correlated with pollination services provided directly and indirectly by wild bees. Our results suggest that conserving wild habitat at the landscape scale and altering selected farm management techniques could increase hybrid sunflower production. These findings also demonstrate the economic importance of interspecific interactions for ecosystem services and suggest that protecting wild bee populations can help buffer the human food supply from honey bee shortages.

Photo: A wild, native bee (*Svastra obliqua expurgata*) forages on a sunflower. Honey bees that interact with wild, native bees are up to five times more efficient in pollinating sunflowers. Protecting wild bees may help buffer the human food supply from reduced pollination resulting from honey bee shortages. Conservation measures for wild bees include maintaining and restoring natural habitats and adopting bee-friendly farming practices. Image courtesy of Sarah S. Greenleaf.

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Abstract: Economists and psychologists have been testing Nash equilibrium predictions of game theory models of human behavior. In many instances, humans do not conform to the predictions. These results are of great interest to biologists because they also raise questions about well-known ESS models of cooperation. Cooperation in certain one-shot, anonymous interactions, and a willingness to punish others at a net cost to oneself are some of the most intriguing deviations from standard theory. One proposed explanation for these results that is receiving increasing attention invokes the cultural group selection of 'other regarding' social norms. We critically review this explanation. We conclude that experimental results reveal limits in two implicit models of cognitive structure commonly employed by economists and evolutionary biologists.

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Abstract: Social dilemmas and the evolutionary conundrum of cooperation are traditionally studied through various kinds of game theoretical models such as the prisoner's dilemma, public goods games, snowdrift games or by-product mutualism. All of them exemplify

situations which are characterized by different degrees of conflicting interests between the individuals and the community. In groups of interacting individuals, cooperators produce a common good benefitting the entire group at some cost to themselves, whereas defectors attempt to exploit the resource by avoiding the costly contributions. Based on synergistic or discounted accumulation of cooperative benefits a unifying theoretical framework was recently introduced that encompasses all games that have traditionally been studied separately (Hauert, Michor, Nowak, Doebeli, 2005. Synergy and discounting of cooperation in social dilemmas. J. Theor. Biol., in press.). Within this framework we investigate the effects of spatial structure with limited local interactions on the evolutionary fate of cooperators and defectors. The quantitative effects of space turn out to be quite sensitive to the underlying microscopic update mechanisms but, more general, we demonstrate that in prisoner's dilemma type interactions spatial structure benefits cooperation—although the parameter range is quite limited—whereas in snowdrift type interactions spatial structure may be beneficial too, but often turns out to be detrimental to cooperation.

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The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate "given" resources if "given" is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge not given to anyone in its totality. This character of the fundamental problem has, I am afraid, been rather obscured than illuminated by many of the recent refinements of economic theory, particularly by many of the uses made of mathematics (pp 519-520).

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1.

It is the fact that in [economics] no knowledge can be regarded as established once and for all, and that, in fact, knowledge once gained and

spread is often, not disproved, but simply lost and forgotten.... The reason why in our field knowledge can be so lost is, of course, that is never established by experiment, but can be acquired only by following a rather difficult process of reasoning.... The result is that in economics you can never establish a truth once and for all but have always to convince every generation anew (p 38).

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Abstract: Varietal data from 27 crop species from five continents were drawn together to determine overall trends in crop varietal diversity on farm. Measurements of richness, evenness, and divergence showed that considerable crop genetic diversity continues to be maintained on farm, in the form of traditional crop varieties. Major staples had higher richness and evenness than nonstaples. Variety richness for clonal species was much higher than that of other breeding systems. A close linear relationship between traditional variety richness and evenness (both transformed), empirically derived from data spanning a wide range of crops and countries, was found both at household and community levels. Fitting a neutral "function" to traditional variety diversity relationships, comparable to a species abundance distribution of "neutral ecology," provided a benchmark to assess the standing diversity on farm. In some cases, high dominance occurred, with much of the variety richness held at low frequencies. This suggested that diversity may be maintained as an insurance to meet future environmental changes or social and economic needs. In other cases, a more even frequency distribution of varieties was found, possibly implying that farmers are selecting varieties to service a diversity of current needs and purposes. Divergence estimates, measured as the proportion of community evenness displayed among farmers, underscore the importance of a large number of small farms adopting distinctly diverse varietal strategies as a major force that maintains crop genetic diversity on farm.

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1.
In intellectual circles Popper was very much admired. But because The Open Society and Its Enemies was hostile to so much academic pretension it was treated less than respectfully by those in the various specialties upon whose turf it trod (p 6).
2.
In 1950, Popper went to Harvard to deliver the prestigious William James lectures. During his time in the States he appears to have given a talk at the University of Chicago, where Strauss taught. Strauss told Voegelin that the talk "was very bad," "the most washed-out, lifeless positivism" (Emberly and Cooper 1993: 67), and inquired of his opinion of Popper. Voegelin replied with a vicious letter. He reports having reluctantly read Popper because so many people insist his Open Society is a masterpiece. His judgment is that the book is "impudent, dilettantish crap. Every single sentence is a scandal . . ." (ibid.). Noting that Popper takes the concept of open society from Bergson, he comments that Bergson did not develop it "for the sole purpose that the coffeehouse scum might have some-thing to botch." Voegelin

believed that Bergson would have thought that "Popper's idea of the open society is ideological rubbish" (ibid.). Voegelin is only just getting started. He accuses Popper of "impertinent disregard for the achievements in this particular problem area [the history of political thought]" (Emberly and Cooper 1993: 68) and of being unable to reproduce accurately the ideas of Plato and Hegel. Popper is "a primitive ideological brawler." Voegelin then strings more epithets together, "a failed intellectual," "rascally impertinent, loutish; in terms of technical competence as a piece in the history of thought, it is dilettantish, and as a result is worthless" (Emberley and Cooper 1993: 67). The reader astonished at this undignified diatribe needs to remember that in the book in question Popper is vehement about the duty to think for oneself and not to defer to the authority of experts. Strauss and Voegelin agree on the opposite, and on the duty of the enlightened elite to defend standards. Strauss had said he was willing to keep Voegelin's remarks to himself. Voegelin concludes: "It would not be suitable to show this letter to the unqualified. Where it concerns its factual contents, I would see it as a violation of the vocational duty you identified, to support this scandal through silence" (Emberly and Cooper 1993: 69). Following this invitation, Strauss showed the letter to Kurt Riezler, "who was thereby encouraged to throw his not inconsiderable influence into the balance against Popper's probable appointment here [in the US]. You thereby helped to prevent a scandal." With hindsight one might think that the scandal is that someone who had dared to challenge the traditional Germanic learning, the worship of the great men, the enemies of science and Enlightenment, is not met out in the open with argument, but is disposed of behind the scenes, as quietly as possible, by the self-righteous use of power.

3.

In Germany and Austria Popper's vocabulary became standard in the attempt to build a philosophy for the democracies of those countries. Some German philosophers (but only some), and influential members of the intellectual and political class, took Popper's ideas for common currency, showering him with public honor and recognition. Translations into all the main European languages ensured a wide currency for the ideas. It might be only a slight exaggeration to say that Popper is a philosophical icon for the European Union's liberals. Equally important, though less obvious, was Popper's impact in totalitarian areas of Europe, From Spain and Portugal, through Eastern Europe to the USSR and to China, his works were spread in translation and samizdat publication as a fulcrum of intellectual resistance to the official ideology. After the fall of the Eastern European empire of the USSR in 1989, there was much need to build free and democratic institutions, and to reintroduce notions of freedom of thought, critical thinking, and intellectual inquiry in the former Soviet bloc countries. Popper was one of the few Western philosophers whose ideas were of sufficient scope amd depth to be applied to the task of linking free inquiry, free communication, freedom to enter and exit, with openness and freedom in politics. George Soros, the American billionaire of Hungarian origin who had encountered Popper's ideas during studies at the LSE, set up a network of philanthropic institutions in the region - aptly called "Open Society Foundations" - to put into practice Popper's ideas, by encouraging critical thinking in education, and by contributing to the development of an active, lively, civil society. In addition, Soros set up the Central European University (CEU) in Prague and then Budapest, to provide, among other things, an intellectual training ground for these ideas (p 8).

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The Structure of Scientific Revolutions by Thomas Kuhn was the most influential book on the nature of science in the second half of the 20th century – and arguably, the entire 20th century. Nevertheless, a reminder of the book's contents immediately makes this fact rather

surprising. *Structure* purports to provide a general account of scientific change in 200 non-technical, lightly referenced pages, in the manner of an extended encyclopaedia entry, as the book was in fact originally conceived (Fuller 2003, pp18-19).

For Kuhn, science is simply good at solving its self-defined problems, whose purely technical nature led him to dub them 'puzzles'. But far from demoting the physical sciences, Kuhn was actually trying – as a latter-day Plato might – to insulate them from responsibility for real world effects, entanglement in which has historically prevented the social and biological science from taking full control of their inquiries (Fuller 2003, p69).

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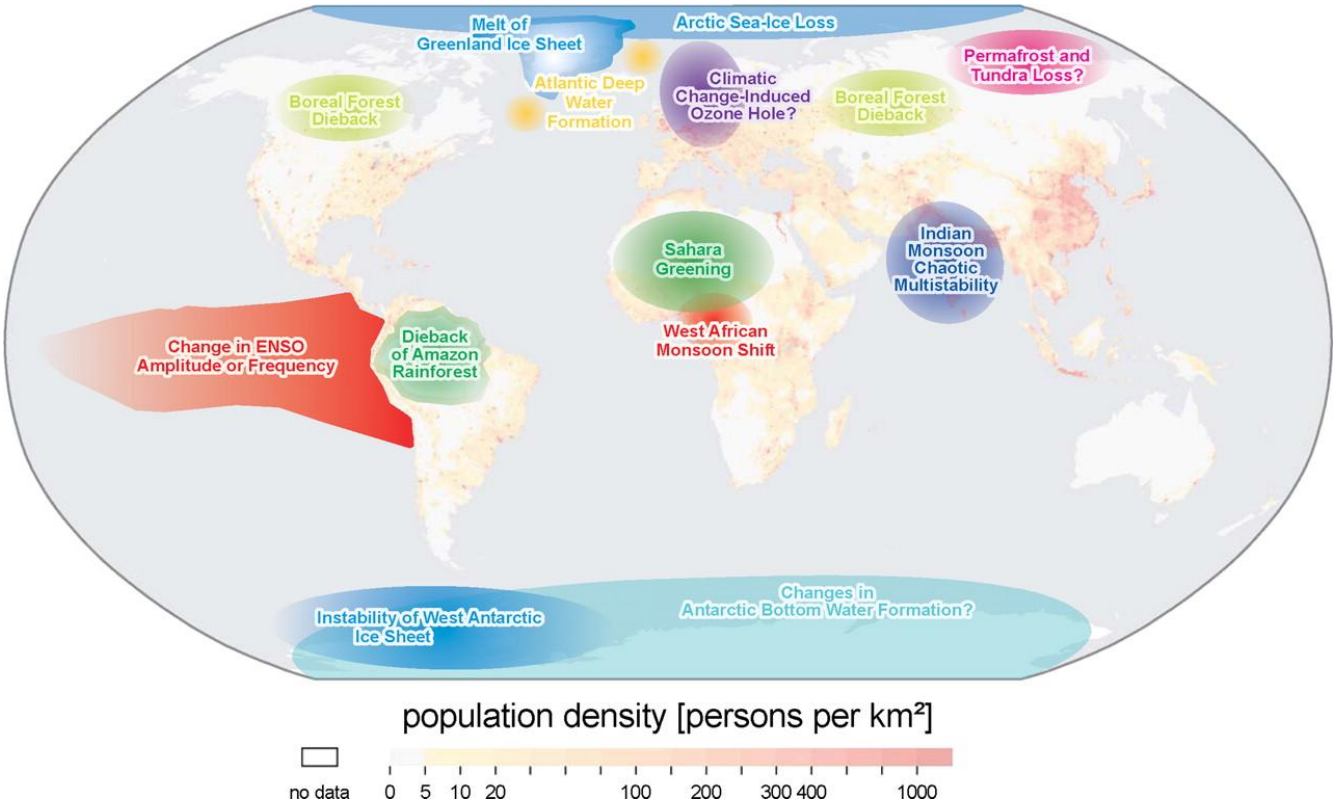

Map: potential policy-relevant tipping elements in the climate system, ...and overlain on global population density. Subsystems indicated could exhibit threshold-type behavior in response to anthropogenic climate forcing, where a small perturbation at a critical point qualitatively alters the future fate of the system. They could be triggered this century and would undergo a qualitative change within this millennium. We exclude from the map systems in which any threshold appears inaccessible this century (e.g., East Antarctic Ice Sheet) or the qualitative change would appear beyond this millennium (e.g., marine methane hydrates). Question marks indicate systems whose status as tipping elements is particularly uncertain.

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Abstract: Will a group of people reach a collective target through individual contributions when everyone suffers individually if the target is missed? This ''collective-risk social dilemma'' exists in various social scenarios, the globally most challenging one being the prevention of dangerous climate change. Reaching the collective target requires individual sacrifice, with benefits to all but no guarantee that others will also contribute. It even seems tempting to contribute less and save money to induce others to contribute more, hence the dilemma and the risk of failure. Here, we introduce the collective-risk social dilemma and simulate it in a controlled experiment: Will a group of people reach a fixed target sum through successive monetary contributions, when they know they will lose all their remaining money with a certain probability if they fail to reach the target sum? We find that, under high risk of simulated dangerous climate change, half of the groups succeed in reaching the target sum, whereas the others only marginally fail. When the risk of loss is only as high as the necessary average investment or even lower, the groups generally fail to reach the target sum. We conclude that one possible strategy to relieve the collective-risk dilemma in high-risk situations is to convince people that failure to invest enough is very likely to cause grave financial loss to the individual. Our analysis describes the social window humankind has to prevent dangerous climate change.

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Abstract: Although generally distinct from continental environments, and therefore of interest in their own right, island environments have been generally misunderstood, misinterpreted, and mismanaged. The main reason is that they have been interpreted for management purposes largely by continent-trained observers. An example of views towards island size is given. It is argued that the pejorative label 'small' should no longer be used to characterise islands. The ways in which island environments have been impacted by humans and their commensals is given. Questions of the sustainable development of island environments are also considered, including for whom these should be sustainable, how extraneous threats like sea-level rise are best incorporated into such plans, and what threats are posed to the rest of the world by mega-tsunami from certain island environments. Island environments are best managed by persons who understand their distinct character and who are committed to their future.

OED. (2007). *Insular. Oxford English Dictionary.*
[ad. L. *insular-is, f. insula* island: see
-AR[1]. Cf. F. *insulaire*.]
A. *adj.*
1. a. Of or pertaining to an island; inhabiting or situated on an island. 1611 COTGR., *Insulaire*, Insular, Iland-like; of, or belonging to, an Iland. 1669 GALE *Crt. Gentiles I. II. vi. 73 In ancient times..they called every Insular Prince by the name of Neptune. 1796 BURKE Regic. Peace i. Wks. VIII. 151 The names and other..signs of approximation, rather augmented than diminished our insular feuds. 1867 FREEMAN Norm. Conq. I. ii. 29 The insular Teutons showed themselves the most zealous of missionaries.*
b. Phys. Geog. Of climate: Of the moderate or temperate kind which prevails in situations surrounded and tempered by the sea. 1830 LYELL *Princ. Geol. I. 97 An alteration from what has been termed an 'insular' to an 'excessive' climate. 1880 HAUGHTON Phys. Geog. iii. 118 The term 'Insular Climate' has been always given to climates in which the annual range of temperature is small. 1885 R. H. SCOTT Elem. Meteorol. 344 Hence comes the subdivision of climates into insular or moderate, and continental or excessive. The west coasts of continents enjoy insular..climates.*
2. Of the nature of an island; composing or forming an island. 1662 STILLINGFL. Orig. Sacr. I. ii. §4 That the Tyre mentioned by Sanchoniathon was not the famous Insular Tyrus, but some other Tyre. 1830 LYELL Princ. Geol. I. 228 The alleged exposure of certain insular rocks in the Bothnian and other bays. 1879 D. M. WALLACE Australas. i. 1 A description of the great insular landAustralia.
3. a. transf. Detached or standing out by itself like an island; insulated.
b. *Bot.* 'Situated alone, applied to galls which occur singly on a leaf' (*Cent. Dict.* 1890).
c. *Path. insular sclerosis. 'Moxon's term for Sclerosis, disseminated'* (*Syd. Soc. Lex.* 1886).
d. *Anat.* (see quot. 1886). 1886 *Syd. Soc. Lex., Insular*, relating to an *Insula*, or to the Island of Reil. 1891 *Lancet 3 Oct. 780 We are inclined to think that the evidence of insular sclerosis is not quite convincing. 1897 Allbutt's Syst. Med. II. 932 In insular sclerosis the tremor is completely absent during rest.*
4. a. Pertaining to islanders; esp. having the characteristic traits of the inhabitants of an island (e.g. of Great Britain); cut off from intercourse with other nations, isolated; self-contained; narrow or prejudiced in feelings, ideas, or manners. 1775 JOHNSON *Journ. West. Isl., Coriatachan, The relief given to the mind in the penury of insular conversation by a new topick. 1829 LYTTON Disowned xxxv, Percy Bobus, with true insular breeding, took up the newspaper. 1847 JAMES J. Marston Hall ix, My English accent, and my insular notions, as he called them. 1849 MACAULAY Hist. Eng. ix. II. 427 They were a race insular in temper as well as in geographical position. 1856 MRS. BROWNING Aur. Leigh VI. 1 The English have a scornful insular way Of calling the French light. 1870 LOWELL Study Wind. 252 Without ceasing to be English, he has escaped from being insular. 1890 BOLDREWOOD Col. Reformer (1891) 136, I am not sufficiently insular to deny a foreign nobility all the graces and virtues that add lustre to our own.*
b. Palæogr. (See quots.) 1908 W. M. LINDSAY *Contractions in Early Latin Minuscule MSS. 1 The most fertile source of error..is the unfamiliarity of the writers with the contractions used in the Irish or pre-Carolingian script... The correct term is Insular, for English MSS. are included and Welsh too. 1913 F. W. HALL Compan. Classical Texts 167 Insular hands..i.e. Irish and Anglo-Saxon; a peculiar type of the half-uncial developed in the sixth century. 1960 G. A. GLAISTER Gloss. Bk. 195/1 Insular hand*, the name given to the Hiberno-Saxon script widely used in England until the Norman Conquest for non-Latin texts. Its origins may be traced to 6th-century Ireland. An example is the first London Charter, 1066, which may be

seen in the Guildhall Library. 1960 E. A. LOWE *Eng. Uncial 14 By Insular symptoms we mean features and practices peculiar to Anglo-Saxon (and Irish) scribes. 1971 T. A. M. BISHOP Eng. Caroline Minuscule p. xiii, The most extensive repertories of Insular abbreviations in Caroline minuscule are MSS. of probably Continental origin.*

B. n. An inhabitant of an island; an islander. 1744 BERKELEY *Siris §109 It is much to be lamented that our insulars..grow stupid or dote sooner than other people. 1845 in J. Pye Patron. Brit. Art v. 206 Generous insulars of our country. 1886 Longm. Mag. VII. 517 A nimbleness foreign to us phlegmatic, deliberate insulars.*

OED. (1997). *Skepticism, scepticism. Oxford English Dictionary.*

A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity…, one who holds that there are no adequate grounds for certainty as to the truth of any proposition… Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet… to look out.

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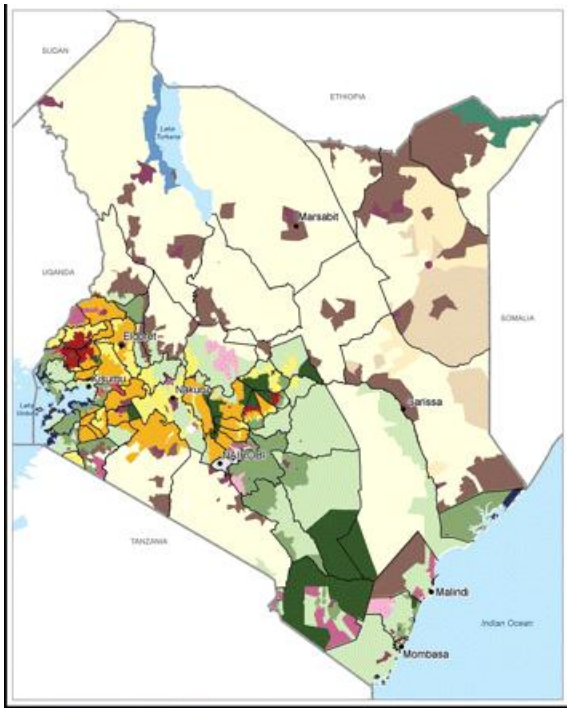

Map: Economic map of Kenya. Poverty is not uniform across the country but depends on a host of geographic factors such as soil type and elevation. Okwi *et al.* analyze the effect of Kenyan geography on income.

Ostrowski, T. (2006). Population equilibrium with support in evolutionary matrix games. *Linear Algebra and its Applications, 417*(1), 211-219.

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Plato. (*c.* 360 B.C.). *The Republic*. (J. Adam Trans.). (2nd ed.). Cambridge, UK: At the University Press.

1.

"Lies are necessary, Plato asserts, 'if your herd is to reach highest perfection' ; for this needs 'arrangements that must be kept secret from all butt the rulers, if we wish to keep the herd of guardians really free from disunion'. Furthermore, Plato "decrees that the rulers should

fabricate, for the purpose of mating the young auxiliaries, 'an ingenious system of balloting, so that the persons who have been disappointed .. may blame their bad luck, and not the rulers', who are, secretly, to engineer the ballot" (Popper 1945, Vol. II,, p 150).

2.

"Aristotle's thought is entirely dominated by Plato's. Somewhat grudgingly, he followed his great teacher as closely as his temperament permitted, not only in his general political outlook but practically everywhere. So he endorsed, and systematized, Plato's naturalistic theory of slavery : 'Some men are by nature free, and others slaves and for the later, slavery is fitting as well as just... A man who is by nature not his own, but another's, is by nature a slave... Hellenes do not like to call themselves slaves, but confine this term to barbarians... The slave is totally devoid of any faculty of reasoning', while free women have just a very little of it. (We owe to Aristotle's criticisms and denunciations most of our knowledge of the Athenian movement against slavery. By arguing against the fighters for freedom, he preserved some of their utterances.)" (Ibid p 3).

Polanyi, K. (1944) *The great transformation.* New York/Toronto: Rinehart & Company Inc.

Popper, K. R. (1999). *All life is problem solving* [Alles Leben ist Problemlosen.] . London ; New York: Routledge.

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- - - . (1944b). The Poverty of Historicism, II. A Criticism of Historicist Methods. *Economica, 11*(43), 119-137.

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1.

open societies, closed societies:

These terms were introduced by Karl Popper in his book *The Open Society and its Enemies* (1945), and further explored in *The Poverty of Historicism* (1957). Popper argued that both science and human history are essentially indeterminate and fluid. Applied to social theory, this produced Popper's lively and devastating attack on historicism. Theories such as those of Plato, Hegel, and Marx, which proposed the existence of laws of history and a knowable human destiny, were dismissed by Popper as scientifically insupportable and politically dangerous. He proposed that all such theories would lead to authoritarian and inhumane regimes, which he called closed societies because they were closed to the normal processes of change. Open societies by contrast were based on the activity, creativity, and innovation of many individuals, and would develop unpredictably through piecemeal social engineering. They are those societies in which social policies are monitored for unintended consequences, openly criticized, and altered in the light of such criticism. Such societies must be both liberal and democratic, in the sense that it must be possible to remove from office rulers who fail to respond to justified criticism.[1]

2.

For the Open Society (about 430 B.C.):

Although only a few may originate a policy, we are all able to judge it.
PERICLES OF ATHENS

Against the Open Society (*about 80 years later*):

The greatest principle of all is that nobody, whether male or female, should be without a leader. Nor should the mind of anybody be habituated to letting him do anything at all on his own initiative ; neither out of zeal, nor even playfully. But in war and in the midst of peace—to his leader he shall direct his eye and follow him faithfully. And even in the smallest matter he should stand under leadership. Fo example, he should get up, or move, or wash, or take his meals... only if he has been told to do so. In
a word, he should teach his soul, by long habit, never to dream of acting independently, and to become utterly incapable of it.
PLATO OF ATHENS
(Popper 1945, Vol. I, p 7)

3.

The development of thought since Aristotle could, I think, be summed up by saying that every discipline, as long as it used the Aristotelian method of definition, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which the various sciences have been able to make any progress depended on the degree to which they have been able to get rid of this essentialist method. (this is why so much of our 'social science' still belongs to the Middle Ages.) This discussion of this method will have to be a little abstract, owing to the fact that the problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright. (Popper 1945, Vol. II, p 9).

4.

see Soros (2006)

1"open societies and closed societies" A Dictionary of Sociology. John Scott and Gordon Marshall. Oxford University Press 2005. Oxford Reference Online. Oxford University Press.

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- - - . (1992). *In search of a better world* [Auf der Suche nach einer besseren Welt.] (Laura J. Bennett, with additional material by Melitta Mew Trans.). London ; New York: Routledge.

1.

Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.

An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements.

We can see that life–even at the level of the unicellular organism–brings something completely new into the world, something that did not previously exist: problems and active attempts to solve them; assessments, values: trial and error.

It may be supposed that, under the influence of Darwin's natural selection, it is the most active problem solvers, the seekers and the finders, the discoverers of new worlds and new forms of live, that undergo the greatest development.

Each organism also strives to stabilize its internal conditions of life and to maintain it's individuality – an activity whose results biologists call 'homoeostasis'. Yet this too is an internal agitation, an internal activity: an activity that attempts to restrict the internal agitation, a feedback mechanism, a correction of errors. The homoeostasis must be incomplete. It must restrict itself. Were it completely successful, it would mean the death of the organism, or, at the very least, the temporary cessation of all its vital functions. Activity, agitation, search are essential for life, for perpetual restlessness, perpetual imperfection; for perpetual seeking, hoping, evaluation, finding, discovering, improving, for learning and for the creation of values; but also for perpetual error…

Darwinism teaches that organisms become adapted to the environment through natural selection. And it teaches that they are passive throughout this process. But it seems to me far more important to stress that the organisms find, invent and reorganize new environments in the course of their search for a better world…

All organisms are fully occupied with problem-solving. *Their first problem is survival*. But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.

According to this optimistic interpretation, it is through natural selection and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche.

This pressure from within results in a choice of niches; that is, in forms of behavior that may be regarded as a choice of lifestyles and of surrounding. This must be taken to include choice of friends, symbiosis, and above all, perhaps most importantly… the choice of a mate… [All italics mine, Popper 1992].

- - - . (1999). *All life is problem solving* [Alles Leben ist Problemlosen.] . London ; New York: Routledge.

- - - . (1956). *Realism and the aim of science* (1983, including Popper's introduction from the 1982 edition and Popper's preface from 1956 edition ed.). London: Routledge.

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- - - . (1959). *The Logic of Scientific Discovery* [Logik der Forschung, 1935, Vienna, Austria] . London ; New York: Routledge.

1.

The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man—whether it is a musical theme, a dramatic conflict, or a scientific theory—may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge. This latter is concerned not with questions of fact (Kant's quid facti?), but only with questions of justification or validity (Kant's quid juris?). Its questions are of the following kind. Can a statement be justified? And if so, how? Is it testable? Is it logically dependent on certain other statements? Or does it perhaps contradict them? In order that a statement may be logically examined in this way, it must already have been presented to us. Someone must have formulated it, and submitted it to logical examination.

Accordingly I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically. As to the task of the logic of knowledge—in contradistinction to the psychology of knowledge—I shall proceed on the assumption that it consists solely in investigating the methods employed in those systematic tests to which every new idea must be subjected if it is to be seriously entertained.

Some might object that it would be more to the purpose to regard it as the business of epistemology to produce what has been called a 'rational reconstruction' of the steps that have led the scientist to a discovery—to the finding of some new truth. But the question is: what, precisely, do we want to reconstruct? If it is the processes involved in the stimulation and release of an inspiration which are to be reconstructed, then I should refuse to take it as the task of the logic of knowledge. Such processes are the concern of empirical psychology but hardly of logic. It is another matter if we want to reconstruct rationally the subsequent tests whereby the inspiration may be discovered to be a discovery, or become known to be knowledge. In so far as the scientist critically judges, alters, or rejects his own inspiration we may, if we like, regard the methodological analysis undertaken here as a kind of 'rational reconstruction' of the corresponding thoughtprocesses. But this reconstruction would not describe these processes as they actually happen: it can give only a logical skeleton of the procedure of testing. Still, this is perhaps all that is meant by those who speak of a 'rational reconstruction' of the ways in which we gain knowledge.

It so happens that my arguments in this book are quite independent of this problem. However, my view of the matter, for what it is worth, is that there is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these . . . laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience.' (Popper 1959, pp 7-9)

2.

(a) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.

(b) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.

(c) If a proposed solution is refuted through our criticism we propose another solution.

(d) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.

(e) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.

(f) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism – the logical contradiction – is objective (Popper 1992, pp. 66-67).

3.

It is often difficult enough for the expert, and certainly in many instances impossible for the layman, to distinguish between legitimate and illegitimate claims advanced in the name of science.... If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass (Nobel 1974).

4.

Emile Zola described a work of art as a corner of nature seen through a temperament. The philosopher Karl Popper, the economist F.A. Hayek, and the art historian K. H. Gombrich have shown that the creative process in science and art consists of two main activities: an imaginative jumping forward to a new abstraction or simplified representation, followed by a critical looking back to see how nature appears in the light of the new vision (Nobel 1978).

5.

The New Zealand interlude was... notable because there Eccles met the philosopher, Karl Popper, from whom he learnt the relationship of the scientist to hypotheses; how to be daring in developing hypotheses of the greatest generality, and at the same time how to test them with the utmost rigour with the consequence either of falsification in whole or in part, or at best corroboration; but never confirmation. *He feels that this relationship to hypotheses has not only increased his conceptual power, but has also greatly helped emotionally! He can now rejoice even in the falsification of a cherished theory, because even this is a scientific success* [italics mine] (Nobel 1963).

5.

My characteristics as a scientist stem from a non-conformist upbringing, a sense of being something of an outsider, and looking for different perceptions in everything from novels, to art to experimental results. I like complexity, and am delighted by the unexpected. Ideas interest me. I was influened early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper... (Nobel 1996).

6.

Popper believed the "discovery was not a matter of logic" but rather the application of methodology, which fits the discovery of cointegration. This insight intrigues me… (Nobel 2003).

- - - . (1962). *Conjectures and refutations : the growth of scientific knowledge* (First Edition Preface from the 1963 Routledge edition ed.).

Abstract: The essays and lectures of which this book is composed are variations upon one very simple theme--the thesis that we can learn from our mistakes. They develop a theory of knowledge and of its growth. It is a theory of reason that assigns to rational arguments the modest and yet important role of criticizing our often mistaken attempts to solve our problems… Though it stresses our fallibility it does not resign itself to skepticism, for it also stresses the fact that knowledge can grow, and that science can progress - just because we can learn from our mistakes (xi)

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Abstract: This problem had been seen and solved long before; first, it appears, by Xenophanes, and then by Democritus, and by Socrates… The solution lies in the realization that all of us may and often do err, singly and collectively, but that this very idea of error and human fallibility involves another one-the idea of objective truth: the standard which we may fall short of. Thus the doctrine of fallibility should not be regarded as part of a pessimistic epistemology. This doctrine implies that we may seek for truth, for objective truth, though more often than not we may miss it by a wide margin. And it implies that if we respect truth, we must search for it by persistently searching for our errors: by indefatigable rational criticism, and self-criticism (p 21).

- - - . (1992). *In search of a better world* [Auf der Suche nach einer besseren Welt.] (Laura J. Bennett, with additional material by Melitta Mew Trans.). London ; New York: Routledge.

1.
(i) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.
(ii) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.
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(iv) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.
(v) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.
(vi) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism – the logical contradiction – is objective (pp 66-67).

Popper, K. R., & Bartley, W. W. (1956). *Realism and the aim of science* (1983, including Popper's introduction from the 1982 edition and Popper's preface from 1956 edition ed.). London: Routledge.

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Ramaekers, S. (2006). No Harm Done: The Implications for Educational Research of the Rejection of Truth. *Journal of Philosophy of Education, 40*(2), 241-257.
Abstract: In much educational theory there is concern about claims that the concept of truth has no place anymore in educational thinking. These claims are generally identified as 'postmodernist' or 'poststructuralist'. The fear is that when abandoning the quest for truth we enter the domain of mere belief, and in this way leave education without firm grounds. In this article I examine some examples of what is often crudely lumped together as 'postmodernist' educational research. What is at stake here, I argue, is not so much a rejection of the quest for truth as rather a shift of focus to a different set of questions and interests: for example, existential questions. Against the contemporary, dominant focus on evidence-based practice, which conceals the person behind the method (textbook, rules, techniques), here the embodied person with her individual investment in education is brought into the light again.

Rampino, M. R. (2002). Supereruptions as a Threat to Civilizations on Earth-like Planets. *Icarus, 156*(2), 562-569.
Abstract: The largest explosive volcanic eruptions (supereruptions) produce >1000 km3 of ejected material and ≥1000 Mt (1015 g) of submicron atmospheric aerosols and dust. These eruptions may be capable of creating global climatic disturbances sufficient to cause severe problems for world agriculture and modern civilization. Supereruptions are estimated to occur on average about every 50,000 years, which is about twice the frequency of impacts by comets and asteroids ≥1 km diameter predicted to cause similar climatic effects. Prediction, prevention, and mitigation of global volcanic climatic disasters may be potentially more difficult than planetary protection from the threat of large impacts, so that explosive volcanism might limit the longevity of technological civilizations.

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> Most people…complain about the meanness of nature, because we are born for a brief span of life, and because this spell of time that has been given to us rushes by so swiftly and rapidly that with very few exceptions life ceases for the rest of us just when we are getting ready for it. Nor is it just the man in the street and the unthinking mass of people who groan over this - as they see it - universal evil: the same feeling lies behind complaints from even distinguished men. Hence the dictum of the greatest of doctors: 'Life is short, art is long.' Hence too the grievance, most improper to a wise man, which Aristotle expressed when he was taking nature to task for indulging animals with such long existences that they can live through five or ten human lifetimes, while a far shorter limit is set for men who are born to a great and extensive destiny. *It is not that we have a short time to live, but that we waste a lot of it. Life is long enough, and a sufficiently generous amount has been given to us for the highest achievements if it were all well invested* [italics mine]. But when it is wasted in heedless luxury and spent on no good activity, we are forced at last by death's final constraint to realize that it has passed away before we knew it was passing. So it is: we are not given a short life but we make it short, and we are not ill-supplied but wasteful of it. Just as when ample and princely wealth falls to a bad owner it is squandered in a moment, but wealth however modest, if entrusted to a good custodian, increases with use, so our lifetime extends amply if you manage it properly.
>
> Why do we complain about nature? She has acted kindly: *life is long if you know how to use it* [italics mine]. But one man is gripped by insatiable greed, another by a laborious dedication to useless tasks. One man is soaked in wine, another sluggish with idleness. One man is worn out by political ambition, which is always at the mercy of the judgment of others. Another through hope of profit is driven headlong over all lands and seas by the greed of trading. Some are tormented by a passion for army life, always intent on inflicting dangers on others or anxious about danger to themselves. Some are worn out by the self-imposed servitude of thankless attendance on the great. Many are occupied by either pursuing other people's money or complaining about their own. Many pursue no fixed goal, but are tossed about in ever-changing designs by a fickleness which is shifting, inconstant and never satisfied with itself. Some have no aims at all for their life's course, but death takes them unawares as they yawn languidly – so much so that I cannot doubt the truth of that oracular remark of the greatest poet: 'It is a small part of life we really live.' (pp 1-2).

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Abstract: My goal is to defend what one might call a scientific *worldview* -- defined broadly as a respect for evidence and logic, and for the incessant confrontation of theories with the real world; in short, for reasoned argument over wishful thinking, superstition and demagoguery. And my motives for trying to defend these old-fashioned ideas are basically *political*. I'm worried about trends in the American Left -- particularly here in academia -- that at a minimum *divert* us from the task of formulating a progressive social critique, by leading smart and committed people into trendy but ultimately empty intellectual fashions, and that can in fact *undermine* the prospects for such a critique, by promoting subjectivist and relativist philosophies that in my view are inconsistent with producing a realistic analysis of society that we and our fellow citizens will find compelling.

David Whiteis, in a recent article, said it well:

> Too many academics, secure in their ivory towers and insulated from the real-world consequences of the ideas they espouse, seem blind to the fact that non-rationality has historically been among the most powerful weapons in the ideological arsenals of oppressors. The hypersubjectivity that characterizes postmodernism is a perfect case in point: far from being a legacy of leftist iconoclasm, as some of its advocates so disingenuously claim, it in fact … plays perfectly into the anti-rationalist -- really, anti-*thinking* -- bias that currently infects "mainstream" U.S. culture.

Now of course, no one will admit to being against reason, evidence and logic -- that's like being against Motherhood and Apple Pie. Rather, our postmodernist and poststructuralist friends will claim to be in favor of some new and *deeper* kind of reason, such as the celebration of "local knowledges" and "alternative ways of knowing" as an antidote to the so-called "Eurocentric scientific methodology" (you know, things like systematic experiment, controls, replication, and so forth).

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Abstract: When it comes to the practice of democratic politics, do size and insularity matter? A number of studies suggest that small island states are more likely to be democratic than others, regardless of levels of economic development. The Commonwealth islands, especially, have done very well on indices of political and civil rights and have provided the basis for vibrant civil societies. But this research also indicates that in other instances, rigid control exercised by elites may result in nepotism and patronage. As well, "islandness" has proved little protection against severe ethno-cultural cleavages and, in small archipelagos, to secessionist movements.

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Abstract: The Earth has a long and violent history of collisions with extraterrestrial bodies such as asteroids and comet nuclei. Several of these impacts have been large enough to produce major environmental changes, causing mass extinctions and severe alterations to weather patterns and geography. There is no reason to suppose that the likelihood of such collisions will be any less in the future and the spread of human settlement, civilisation, and particularly urbanisation, makes it much more likely that a future impact, even relatively small, could result in the massive loss of human life and property. Despite the fact that the technology exists to predict and to some extent prevent such events, there is currently no co-ordinated international response to this threat. This article presents a realistic assessment of the threat to Earth from NEOs, describes the (underfunded) efforts so far made to counter it and makes a plea for further action to produce a fully functioning Spaceguard Foundation.

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Abstract: While differential equations have been commonly used to model the population dynamics of biological systems, it is uncommon for such models to include the evolutionary potential of the species being modeled. As a consequence, the focus of such models has generally been directed toward ecological stability rather than on evolutionary stability. Here, an evolutionary game approach to modeling is

presented that allows for a very clear distinction between ecological and evolutionary stability. Necessary conditions are given for each type of stability so that they may be studied separately. In order to include evolution into management models, we are faced with two fundamental questions: what is evolving, and where is it evolving to? In the evolutionary game theory presented here, the 'what' are parameters in the differential game model associated with characteristics of the species that are clearly adaptive (such as sunlight conversion efficiency for plants or body length in animals), which we call strategies. The 'where' is the evolutionarily stable strategies (ESS) to which these parameters can evolve. These strategies can be determined using the ESS maximum principle presented here. The ESS maximum principle when used with appropriate models, has the capacity to predict the evolutionary response of biological systems subject to a wide range of inputs, including physiographic changes, harvesting, and the introduction or removal of new species and/or resources. Applications are discussed in terms of some typical managed ecosystems. A detailed example, illustrating use of the theory, is given in which the treatment of cancer with drugs is 'simulated'.

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Abstract: Genetic recombination is a central and repeated topic of study in the evolution of life. However, along with the influence of recombination on evolution, we understand surprisingly little of how selection shapes the nature of recombination. One explanation for recombination is that it allows organisms to escape from perilous situations where they experience very low fitness. As a corollary, it has been suggested that selection should favor recombination at low fitness and not at high fitness (fitness-associated recombination, FAR), and theory suggests that such strategies can indeed be selected. Here we develop models to further investigate the evolution of FAR. Consistent with previous works, we find that FAR can invade and dominate over a strategy of uniform recombination that is independent of fitness. However, our simulation results suggest that extreme FAR strategies, known as group-elitism, are not necessarily superior to other FAR strategies. Moreover, we argue that FAR domination will often occur with a net loss of mean population fitness. Interestingly, this suggests that the strategy of not recombining at high fitness will sometimes be analogous to a defector strategy from the famous "prisoner's dilemma" game: a selfish strategy that is selected but leads to a loss of mean fitness for all players.

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Abstract: We investigated the deep-sea fossil record of benthic ostracodes during periods of rapid climate and oceanographic change over the past 20,000 years in a core from intermediate depth in the northwestern Atlantic. Results show that deep-sea benthic community "collapses" occur with faunal turnover of up to 50% during major climatically driven oceanographic changes. Species diversity as measured by the Shannon–Wiener index falls from 3 to as low as 1.6 during these events. Major disruptions in the benthic communities commenced with Heinrich Event 1, the Inter-Allerød Cold Period (IACP: 13.1 ka), the Younger Dryas (YD: 12.9–11.5 ka), and several Holocene Bond events when changes in deep-water circulation occurred. The largest collapse is associated with the YD/IACP and is characterized by an abrupt two-step decrease in both the upper North Atlantic Deep Water assemblage and species diversity at 13.1 ka and at 12.2 ka. The ostracode fauna at this site did not fully recover until approximately 8 ka, with the establishment of Labrador Sea Water ventilation. Ecologically opportunistic slope species prospered during this community collapse. Other abrupt community collapses during the past 20 ka generally correspond to millennial climate events. These results indicate that deep-sea ecosystems are not immune to the effects of rapid climate changes occurring over centuries or less.

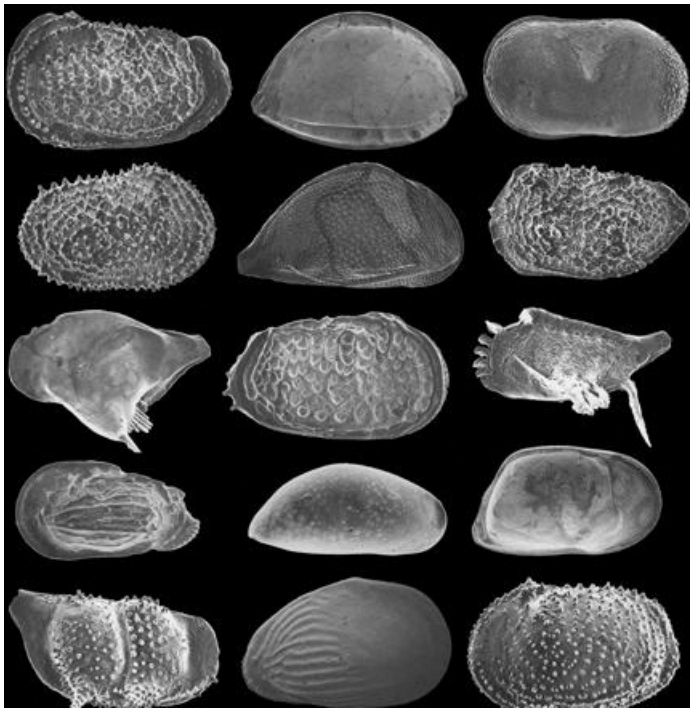

Photo: Ostracodes, which are small, clam-shaped crustaceans, have a rich fossil record unlike most deep-sea animals and are an important "window" into the ancient history of benthic ecosystems. The various shapes indicate high biodiversity. Yasuhara *et al*... show that deep-sea biodiversity is linked to global climate and has collapsed repeatedly over the past 20,000 years.

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Bertrand Arthur William Russell (b.1872 - d.1970) was a British philosopher, logician, essayist, and social critic, best known for his work in mathematical logic and analytic philosophy. His most influential contributions include his defense of logicism (the view that mathematics is in some important sense reducible to logic), and his theories of definite descriptions and logical atomism. Along with G.E. Moore, Russell is

generally recognized as one of the founders of analytic philosophy. Along with Kurt Gödel, he is also regularly credited with being one of the two most important logicians of the twentieth century.

Over the course of his long career, Russell made significant contributions, not just to logic and philosophy, but to a broad range of other subjects including education, history, political theory and religious studies. In addition, many of his writings on a wide variety of topics in both the sciences and the humanities have influenced generations of general readers. After a life marked by controversy (including dismissals from both Trinity College, Cambridge, and City College, New York), Russell was awarded the Order of Merit in 1949 and the Nobel Prize for Literature in 1950. Also noted for his many spirited anti-war and anti-nuclear protests, Russell remained a prominent public figure until his death at the age of 97.

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Karl Popper is generally regarded as one of the greatest philosophers of science of the 20th century. He was also a social and political philosopher of considerable stature, a self-professed 'critical-rationalist', a dedicated opponent of all forms of scepticism, conventionalism, and relativism in science and in human affairs generally, a committed advocate and staunch defender of the 'Open Society', and an implacable critic of totalitarianism in all of its forms. One of the many remarkable features of Popper's thought is the scope of his intellectual influence. In the modern technological and highly-specialised world scientists are rarely aware of the work of philosophers; it is virtually unprecedented to find them queuing up, as they have done in Popper's case, to testify to the enormously practical beneficial impact which that philosophical work has had upon their own.

On the Problem of Breathing, Eating, & Drinking Poison: An introduction to problem solving, nobility of purpose under adverse circumstances, and the search for truth with Sir Karl Popper on Prince Edward Island

Funk, Matt
Funk Island Trust

01. November 2008

On the Problem of Breathing, Eating, & Drinking Poison—

An introduction to problem solving, nobility of purpose under adverse circumstances, and the search for truth with Karl Popper

on

Prince Edward Island

In Honour of Dr Ron Matsusaki

4.0
3 April 2009

Matt Funk, Fellow
The Linnean Society of London
matt@funkisland.org

Eppur si muove[1]

1 "I, Galileo, son of the late Vincenzo Galilei, Florentine, aged seventy years, arraigned personally before this tribunal, and kneeling before you, Most Eminent and Reverend Lord Cardinals, Inquisitors-General against heretical depravity throughout the entire Christian commonwealth, having before my eyes and touching with my hands, the Holy Gospels, swear that I have always believed, do believe, and by God's help will in the future believe, all that is held, preached, and taught by the Holy Catholic and Apostolic Church. But whereas -- after an injunction had been judicially intimated to me by this Holy Office, to the effect that I must altogether abandon the false opinion that the sun is the center of the world and immovable, and that the earth is not the center of the world, and moves, and that I must not hold, defend, or teach in any way whatsoever, verbally or in writing, the said false doctrine, and after it had been notified to me that the said doctrine was contrary to Holy Scripture -- I wrote and printed a book in which I discuss this new doctrine already condemned, and adduce arguments of great cogency in its favor, without presenting any solution of these, and for this reason I have been pronounced by the Holy Office to be vehemently suspected of heresy, that is to say, of having held and believed that the Sun is the center of the world and immovable, and that the earth is not the center and moves.

Therefore, desiring to remove from the minds of your Eminences, and of all faithful Christians, this vehement suspicion, justly conceived against me, with sincere heart and unfeigned faith I abjure, curse, and detest the aforesaid errors and heresies, and generally every other error, heresy, and sect whatsoever contrary to the said Holy Church, and I swear that in the future I will never again say or assert, verbally or in writing, anything that might furnish occasion for a similar suspicion regarding me; but that should I know any heretic, or person suspected of heresy, I will denounce him to this Holy Office, or to the Inquisitor or Ordinary of the place where I may be. Further, I swear and promise to fulfill and observe in their integrity all penances that have been, or that shall be, imposed upon me by this Holy Office. And, in the event of my contravening, (which God forbid) any of these my promises and oaths, I submit myself to all the pains and penalties imposed and promulgated in the sacred canons and other constitutions, general and particular, against such delinquents. So help me God, and these His Holy Gospels, which I touch with my hands

I, the said Galileo Galilei, have abjured, sworn, promised, and bound myself as above; and in witness of the truth thereof I have with my own hand subscribed the present document of my abjuration, and recited it word for word at Rome, in the Convent of Minerva, this twenty-second day of June, 1633.

I, Galileo Galilei, have abjured as above with my own hand."

Legend has it that as Galileo rose to his feet, he said under his breath, *Eppur si muove* [*And yet, it moves*]. The remark captivated scientists and scholars for centuries, as it represented defiance of obscurantism and nobility of purpose in the search for truth under the most adverse circumstances [Hawking 2002, as cited in Galilei 1638, pp xi-xiii].

ABSTRACT

This paper introduces Karl Popper's approach to problem solving in the social sciences. These methods fundamentally represent the scientific method of the natural sciences. Popper's problem solving technique is outlined in six steps, including an introductory treatment of his solution to Hume's *Problem of Induction*. These six steps are then applied in the form of a test and logical deduction of our illustrative theory: *Cancer rates on Prince Edward Island have dramatically increased as a result of an extraordinary increase (900% in the past decade) in potato production, and a corollary increase of secondary agricultural inputs, namely a increase of chlorothalonil (trade name: Bravo) applications in less than ten years.* We conclude our theory is true and, in order to complete our demonstration of Popper's methods, open this theory to criticism and refutations. APPENDIX A offers a brief review of relevant literature on the philosophy of science, and APPENDIX B offers readers a brief introduction to the fundamentals of relevant island-based methods.

The author would like to thank

Godfrey Baldacchino

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Key words: Popper, Hume, Hayek, truth, scientific method, philosophy of science, induction, economics, island studies, insularity, dependency, Prince Edward Island, closed societies, confederacy of dunces, commercial agriculture, cancer, chlorothalonil, Bravo, manufacture of consent.

Great spirits have always encountered violent opposition from mediocre minds. The mediocre mind is incapable of understanding the man who refuses to bow blindly to conventional prejudices and chooses instead to express his opinions courageously and honestly.

—Albert Einstein, in a letter to the department of Philosophy at the College of the City of New York, criticizing the refusal of the appointment of Bertrand Russell, 1940

In a time of universal deceit, telling the truth becomes a revolutionary act.
—George Orwell, *1984*, 1949

INTRODUCTION

1. Science = Problem Solving:

The natural as well as the social sciences always start from problems, from the fact that something inspires amazement in us, as the Greek philosophers used to say. To solve these problems, the sciences use fundamentally the same method that common sense employs, the method of trial and error. To be more precise, it is the method of trying out solutions to our problem and then discarding the false ones as erroneous. This method assumes that we work with a large number of experimental solutions. One solution after another is put to the test and eliminated.[1]

2. Problem Solving[2] =All Life

This procedure seems to be the only logical one. It is also the procedure that a lower organism, even a single-cell amoeba, uses when trying to solve a problem. In this case we speak of testing movements through which the organism tries to rid itself of a troublesome problem. Higher organisms are able to learn through trial and error how a certain problem should be solved. We may say that they too make testing movements—mental testings—and that to learn is essentially to try out one testing movement after another until one is found that solves the problem. We might compare the animal's successful solution to an expectation and hence to a hypothesis or a theory. For the animal's behaviour shows us that it expects (perhaps unconsciously…) that in a similar case the same testing movements will again solve the problem in question.[3]

3. Scientific Method = [0],

I assert that no scientific method exists… To put it in a more direct way:
(i) There is no method of discovering a scientific theory.
(ii) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.
(iii) There is no method of ascertaining whether a hypothesis is 'probable', or probably true.[4]

Our brief introduction to problem solving with Karl Popper is encapsulated within these three axioms. We trust the first two points are fairly straightforward: (1) *Science* is *problem solving*, thus it must begin with a *problem,* and (2) that *all things living* are constantly engaged in problem solving (*The Struggle for Life*).[5] Our third tenant, however, may appear to present an untenable and vicious circle, but Popper is merely emphasizing the critical point that, contrary to the assertion of many, there is no *single* way to solve problems. All problems and all solutions are unique, thus we have no single scientific method.

1 Popper 1999, p3
2 Popper 1992, pp vii-viii
3 Ibid
4 Popper 1956, pp 5-6
5 Darwin 1859

> There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these… laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience'.[1]

And although we may consider our assertion of the non-existence of scientific method was held by Einstein,[2] Whewell,[3] Russell, and Reichenbach,[4] we will not imply validation by resting on these laurels, we will, rather, illustrate the implications of this assertion with an applicable example:

Our present approach to problem solving, for example, may be described as an archipelago of inter-connected islands of theories and thought, namely the modern synthesis of evolutionary biology, cultural evolution, Austrian economics,[5] Icelandic freedom,[6] and Swiss democracy[7]—all within a framework which acknowledges

1 Popper 1959, p 37

2 Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels…. And, as recent research into Einstein's personal papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity…. Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern…. *Other scientists had come close to his insight, but they were too confined by the dogmas of the day*. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics since Newton. "Imagination is more important than knowledge," Einstein later said. Indeed, if we are ever going to unravel the further mysteries of dark matter, come up with a unified theory, or discover the true nature of energy, we should carve that proclamation above all of our blackboards [italics mine, Isaacson 2007, pp35-36].

3 Scientific discovery must ever depend upon some happy thought, of which we cannot trace the origin; — some fortunate cast of intellect rising above all rules. No precepts will elevate a man of ordinary endowments to the level of a man of genius: nor will an inquirer of truly inventive mind need to come to the teacher of inductive philosophy to learn how to exercise the faculties which nature has given him (Whewell 1849, p 117).

4 See Reichenbach 1951

5 (a) Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics (Kirzner 2006, p1).
(b) The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers (Hayek, Bartley, & Kresege 1991, pp 8-9).
(c) What made Vienna the distinctive city that it was, as much as any other the fount of Western culture, is a question to be kept in mind…What we might observe is that a milieu such as that in which Hayek [and Popper] spent his childhood and youth, a society in which family and associates, position and accomplishment, knowledge and history were so tightly intertwined, meant that the members of such a society were quickly and always apprised of what *mattered* [italics Bartley's].This is no small feat, as any teacher of the present generation of youth knows too well. It is the *significance* [italics Bartley's] of knowledge and information that leads to the evolution of understanding (Hayek, Bartley, & Kresge 1991, p 5).

6 "Size isn't everything by any means," he said aloud to the dog, as if suspecting her of entertaining high ideas. "Take my word for it, freedom is of more account than the height of a roof beam. I ought to know; mine cost me eighteen years' slavery. The man who lives on his own land is a n independent man. Hi is his own master. If I can keep my sheep alive through the winter and can pay what has been stipulated from year to year—then I pay what has been stipulated; and I have kept my sheep alive. No, it is freedom that we are all after, Titla. He who pays his way is a king. He who keeps his sheep alive through the winter lives in a palace" (Laxness 1946, p 13).

7 (a) British democracy owes its emergence to a sense of pride and independence among the upper nobility… Swiss democracy resulted not from the pride, independence, and individualism of an upper nobility, but from the pride, independence, and

the incessant noise, misinformation, and irrationality generated by *The Problem of Induction*,[1] *The Problem of Closed Societies,*[2] *The Problem of Manufactured Consent*[3], and *The Problem of Media Toxicity.*[4]

We are deluged with an unending torrent of clever "new" *interdisciplinary*, *intra-disciplinary, multidisciplinary*, and *pluri-disciplinary* fields of study. In economics alone, we have neoclassical economics, Austrian economics, behavioural economics, experimental economics, new institutional economics, ecological economics, and neuroeconomics—just to name a *few*. And yes, of course they are *all* in fact interdisciplinary—can you imagine a "monodisciplinary" science? Even physics must acknowledge the reality that humans conduct the experiments, interpret the results, and apply them within a social construct. I submit there is not a branch of science that is *not* multidisciplinary, *intra*-disciplinary, *inter*-disciplinary, or pluri-disciplinary.

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individualism of mountain farmers.

These completely different beginnings and traditions have led to quite different traditional institutions and quite different traditional systems of values (Popper 1958, pp 81-82).

(b) The problem is to provide incentives for those so entrusted to act on behalf of those who they are supposed to be serving—the standard principle agent problem. Democracy—contestability in political processes—provides a check on abuses of the powers that come from delegation just as it does in economic processes; but just as we recognize that the take-over mechanism provides an imperfect check, so too we should recognize that the electoral process provides an imperfect check. Just as we recognize that current management has an incentive to increase asymmetries of information in order to enhance its market power, increase its discretion, so to in public life. And just as we recognize that disclosure requirements—greater transparency—and specific rules of the game (e.g. related to corporate governance) can affect the effectiveness of the take-over mechanism and the overall quality of corporate governance, so too the same factors can affect political contestabilty and the quality of public governance (Stiglitz 2001, p 522 - 523).

1 See Hume 1739

2 Popper 1945. Also see Soros 2006

3 That the manufacture of consent is capable of great refinements no one, I think, denies. The process by which public opinions arise is certainly no less intricate than it has appeared in these pages and the opportunities for manipulation open to anyone who understands the process are plain enough.

The creation of consent is not a new art. It is a very old one which was supposed to have died out with the appearance of democracy. But it has not died out. It has, in fact, improved enormously in technic, because it is now based on analysis rather than on rule of thumb. And so, as a result of psychological research, coupled with the modern means of communication, the practice of democracy has turned a corner. A revolution is taking place, infinitely more significant than any shifting of economic power.

Within the life of the generation now in control of affairs, persuasion has become a self-conscious art and a regular organ of popular government. None of us begins to understand the consequences, but it is no daring prophecy to say that the knowledge of how to create consent will alter every political calculation and modify every political premise…It has been demonstrated that we cannot rely upon intuition, conscience, or the accidents of casual opinion if we are to deal with the world beyond our reach (Lippmann 1922, p 158). Also see Herman & Chomsky 1988.

4 A certain Canadian city was unable to receive any TV signals up until 1973, due to its location in a steep valley. Otherwise, it was similar to two cities in the vicinity used as control cases. A study by Williams (1986) suggests that the introduction of TV crowded out other activities, in particular those outside the home, such as sports' activities and visiting clubs. It also reduced the reading abilities and creative thinking of children and fostered more aggressive behavior and stereotyped ideas about gender roles. TV also reduced the problem solving capacities of adults (Frey, Benesch & Stutzer 2005, p 8).

> Herbert Simon, in his entry 'behavioural economics' in *The New Palgrave Dictionary of Economics and Law*, 1998, pointed out that the term 'behavioral economics' is a sort of pleonasm, for what else is economics about than a study of human behavior. How could it possibly be that all the work done in departments of psychology, sociology and anthropology are irrelevant to economics? The discovery of behavioral economics in the past decade or two is really a return to reality from an untenable position that the rational optimizing model is the only framework for economics (Shiller 2000, p 4).

Yes, this reasoning is sound, but it does not follow its own truth to the complete and logical conclusion, because even 'economics'[1] does not exist. Consider the first sentence of the first chapter of the first book of Marshall's (1890) *Principles of Economics*: "Political Economy or Economics is a study of mankind in the ordinary business of life." Although we're getting closer to the heart of the matter, Marshall did not consider the biosphere, atmosphere, nor lithosphere part of *the ordinary business of life*. Thus 'externalities' such as pollution, extinction, and deforestation were outside the so-called subject of 'economics' and were left to 'other subject matters' to deal with, and thus, we begin to understand that the so-called 'science' of economics has generated convenient but life-threatening *myths*. Moreover, we begin to understand the absolute truth of *On the Non-Existence of Subject* Matters, a paper Sir Karl Popper delivered at a meeting of the Fellows of the 'Center for Advanced Study in the Behavioral Sciences' at Stanford, California, in November of 1956:

> As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.
>
> It is in several senses that my subject does not exist, and I shall mention a few of them.
>
> First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of enquiry: there are only problems, and the urge to solve them* [italics mine]. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects (pp 5-6).

1 There is only one social science.... While scientific work in anthropology and political science and the like will become increasingly indistinguishable from economics, economists will reciprocally have to become aware of how constraining has been their tunnel vision about the nature of man and social interaction. Ultimately, good economics will also have to be good anthropology and sociology and political science and psychology (Landa 1999, p 7).

Again, when it all comes down in the end, *all life is problem solving,*[1] and "*no man can be a pure specialist without being in the strict sense an idiot*" (Shaw 1903, ln 41).

If we consider *The Problem of Global Warming*, for example there is no *single* academic department able to solve this problem, as the problem spans ecology, economics, political science, physics, evolutionary biology, etc. It is not critical to accept the assertion that subject matters do not exist, but it may be critical to understand *why* subject matters may not exist, as this false and misguided assumption has inhibited and continues to inhibit our ability to find a meaningful solution. It is thus, by use of the same logic, equally important to understand why no single scientific method exists.

Generally speaking, the particular methods employed will depend upon the nature of the enquiry and the ultimate purpose of the particular problem solving endeavour (the solution's intended audience). Let's consider the solution to a single, relatively simple problem as presented to three separate audiences: The opportunity to study Islands at the one and only Master's program in island studies presents several enticing value propositions and a few potential problems as well: A prospective student must decide if the investment in time and money is a feasible and/or worthwhile pursuit. Would this quest bear the fruits of knowledge, reveal hidden truths, and offer illuminating island elixirs? Would the journey offer a rare and valuable islander's perspective? An *Earth Island* perspective? Opportunities? Solutions to critical problems? Exotic sojourns?

Naturally, the considerations are manifold, many of which may or may not be fully formed and articulated in the mind of the prospective student, but one consideration which must be addressed, either directly or

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1 The natural as well as the social sciences always start from problems, from the fact that something inspires amazement in us, as the Greek philosophers used to say. To solve these problems, the sciences use fundamentally the same method that common sense employs, the method of trial and error. To be more precise, it is the method of trying out solutions to our problem and then discarding the false ones as erroneous. This method assumes that we work with a large number of experimental solutions. One solution after another is put to the test and eliminated (Popper 1999).
At bottom, this procedure seems to be the only logical one. It is also the procedure that a lower organism, even a single-cell amoeba, uses when trying to solve a problem. In this case we speak of testing movements through which the organism tries to rid itself of a troublesome problem. Higher organisms are able to learn through trial and error how a certain problem should be solved. We may say that they too make testing movements – mental testings – and that to learn is essentially to try out one testing movement after another until one is found that solves the problem. We might compare the animal's successful solution to an expectation and hence to a hypothesis or a theory. For the animal's behaviour shows us that it expects (perhaps unconsciously or dispositionally) that in a similar case the same testing movements will again solve the problme in question [all italics Popper's 1999, p3].

indirectly, is *The Problem of Tuition*. If the candidate has the financial means to address this problem independently, the methodological treatment of this problem solving endeavour may pass unconsciously in an intuitive moment with a decision to simply register, pay tuition, and begin classes.

The method will differ, however, depending upon necessary audiences. If the student requires parental financial assistance, they may need to be able to articulate the reasons for their desire to study islands and forward persuasive arguments. Perhaps the parents would like their hopeful progeny to jot down some of the goals associated with their desire to continue a formal education. If the student requires financial aid or a grant, the method becomes even more formalized. Perhaps they will be required to write an essay, detailing the basis for their desire to study islands, what they hope to accomplish in doing so, and what contributions they would endeavour to make. Likewise, a psychologist may, for example, initially 'test' a theory in her own mind, or simply verbally run it past a colleague for criticism; or, perhaps she will submit this theory formally in an APA journal for criticism from a much broader audience. Let's also briefly consider a more complex problem solving endeavour:

> Evolutionary biology is a historical science It is very different from the exact sciences in its conceptual framework and methodology. It deals, to a large extent, with unique phenomena, such as the extinction of the dinosaurs, the origin of humans, the origin of evolutionary novelties, the explanation of evolutionary trends and rates, and the explanation of organic diversity. There is no way to explain these phenomena by laws. Evolutionary biology tries to find the answer to "why" questions. Experiments are usually inappropriate for obtaining answers to evolutionary questions. We cannot experiment about the extinction of the dinosaurs or the origin of mankind. With the experiment unavailable for research in historical biology, a remarkable new heuristic method has been introduced, that of historical narratives. Just as in much of theory formation, the scientist starts with a conjecture and thoroughly tests it for its validity, so in evolutionary biology the scientist constructs a historical narrative, which is then tested for its explanatory value. Let me illustrate this method by applying it to the extinction of the dinosaurs, which occurred at the end of the Cretaceous, about sixty-five million years ago. An early explanatory narrative suggested that they had become the victims of a particularly virulent epidemic against which they had been unable to acquire immunity. However, a number of serious objections were raised against this scenario, which was therefore replaced by a new proposal, according to which the extinction had been caused by a climatic catastrophe. However, neither climatologists nor geologists were able to find any evidence for such a climatic event and this hypothesis also had to be abandoned. However, when the physicist Walter Alvarez postulated that the extinction of the dinosaurs had been caused by the consequences of an asteroid impact on earth, all observations fitted this new scenario. The discovery of the impact crater in Yucatan further strengthened the Alvarez theory. No subsequent observations were in conflict with this theory. The methodology of historical narratives is clearly a methodology of historical science.[1]

1 Mayr 2004 pp 32-33

(I) THE METHOD OF THE SOCIAL SCIENCES, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.

(II) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.

(III) If a proposed solution is refuted through our criticism we propose another solution.

(IV) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.

(V) Thus the method of science is one of the tentative attempts… to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.

(VI) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism—the logical contradiction—is objective.[1]

1 Popper 1992, pp. 66-67

APPLICATION

Following is an example of Poppers six-step methodological approach to the social sciences at work in a simplified, yet very practical application. Before embarking on a discourse on scientific method, however, please note

> (1) my present design… is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own…. This tract is put forth merely as… a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all… It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgements of our friends are to be suspected when given in our favour.[1]
>
> (2) False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for every one takes a salutary pleasure in proving their falseness: and when this is done, one path towards error is closed and the road to truth is often at the same time opened.[2]

With this disclosure in mind, our investigation does *not* begin with observations, measurements, or statistical data.[3] Our investigation begins with a problem:

(I) Cancer rates on Prince Edward Island have increased sharply over the past decade, and, since there seem to be a fair number of people in disagreement over possible causation,[4] perhaps this strikes us as a problem worthy of our attention. We propose an initial solution as a *theory* which we will subject to tests and open to others for their criticism and tests. This brings us to a minor stumbling block and source of unnecessary confusion:

Theory = Hypothesis = Conjecture = Thesis.[5]

In many contemporary research settings, the variations in the definitions of these terms are often-misunderstood, disregarded, or used interchangeably. Thankfully, there's no need for confusion or intimidation by the arbitrary interchange between these terms, as this represents an inconsequential and thoroughly avoidable

1 Descartes 1637, p 1
2 Darwin 1883, p 1
3 Popper 1992, pp 67-68
4 See IU 2008
5 Anon 1999, p 2

matter of semantics. This confusion is further exacerbated by the fact that a more recent etymological evolution of Thesis = Dissertation. Thus, will stick with *theory,* as this term's relatively common usage and relatively clear meaning may serve us well:

"Every scientific theory is a system of sentences… or ASSERTED STATEMENTS or, for short, simply statements."[1]

Thus, the which we propose for our demonstration is quite simply, a statement:

Cancer rates on Prince Edward Island have significantly increased (26% in four years) as a result of a significant increase (700% in less than thirty years) of chlorothalonil applications.[2]

Many assert researchers must present the basis upon which their theory was founded; this notion is misguided.[3] Although our theory is based on a simple, logical deduction, associated problems relating to the difficulty of establishing causation are significant, yet not insurmountable.

First, our logical deduction:

1. Data in support of a non-linear mechanism for carcinogenicity demonstrate exposure to chlorothalonil yields carcinogenicity amongst mammals.
2. Men, women, and children are mammals.
3. Therefore exposure to chlorothalonil is a mechanism for carcinogenicity amongst men, women, and children.
4. Men, women, and children throughout Prince Edward island are exposed to carcinogenic levels of chlorothalonil which demonstrate a mechanism for carcinogenicity.[4]
5. Therefore exposure to chlorothalonil on Prince Edward Island demonstrates a mechanism for

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1 Tarski 1941, p 3

2 See Delaney 2006, (1). Also see Mittelsteadt 2006 (1) ; Abassi 2004 ; Novaczek 2007

3 Popper 1959, pp 7-9; Also see Whewell 1849

4 With about 7,000 fields spanning 110,000 acres, [Prince Edward Island] produces more than a billion kilograms of potatoes every year, making PEI one of the most intensely-farmed areas in Canada…. The crops are sprayed about 20 times per year—every four days in blight season—and the three main fungicidals used on the potatoes have been classed as carcinogens by the U.S. government….
In a 1999 Environment Canada study… chlorothalonil, also called Bravo, was present in every air sample taken on the island—even in the control area which was at the end of a wharf away from any fields. The study also found that concentrations of the fungicide were just as high or higher on days when no spraying occurred as on days when it did [italics mine, Delaney 2006, p 1]; Also see Novaczek 2007.

carcinogenicity, morbidity, and mortalities amongst men, women, and children on Prince Edward Island.

In light of the aforementioned difficulty in regards to establishing causation, our next step is to attempt to determine if our theory is true, but first we must define *truth*[1] in contradistinction with *certainty*:

> Knowledge consists in the search for truth—the search for objectively true, explanatory theories… It is not the search for certainty. To err is human. All human knowledge is fallible and therefore uncertain. It follows that we must distinguish sharply between truth and certainty. That to err is human means not only that we must constantly struggle against error, but also that, even when we have taken the greatest care, we cannot be completely certain that we have not made a mistake.
>
> In science, a mistake we make—an error—consists essentially in our regarding as true a theory that is not true… to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can never be completely certain that we have not made a mistake.[2]

(II) We proceed and endeavour to determine if our theory is true by attempting to *refute* (or *falsify)* our theory and by opening it to refutation and falsification attempts by others.

(III) If our theory is refuted, we propose another in our attempt to solve the problem.

(IV) If our theory withstands criticism, we will accept it as *true*, but the theory will remain forever held tentatively, and will remain open to criticism:

1. What, then, are we to trust? What are we to accept? The answer is: whatever we accept we should trust only tentatively, always remembering what we are in possession, at best, of partial truth (or rightness), and that we are bound to make at least some mistake or misjudgement somewhere.[3]
2. We can never excel others in our reasonableness in a way that would establish a claim to authority.[4]
3. No theory is final.[5]

(V) Let's consider competing theories and all known attempts to refute and falsify our theory. To our best knowledge, they may be encapsulated in the following three critiques:

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1 Popper 1963, p 21. And: I'm a stodgy old scientist who believes, naively, that there exists an external world, that there exist objective truths about that world, and that my job is to discover some of them. (If science were merely a negotiation of social conventions about what is agreed to be ``true'', why would I bother devoting a large fraction of my all-too-short life to it?) (Sokal 1996c, pp 2-3).

2 Popper, 1992, p 4

3 Ibid, p 391

4 Ibid, p 227

5 Ibid, p 261

1. PEI is known nationwide for… beaches, a friendly people, lighthouses…, and for its staggeringly vast potato production. But the… island may soon come to be associated with another, far less benign feature: some of the highest rates of cancer and asthma in the country. *Despite repeated assertions from government officials that the statistics don't provide any proof* (italics mine), many PEI residents believe that heavy pesticide use on the island's potato farms is causing high rates of cancer and other diseases.[1]

   [Recall that all knowledge is uncertain, proof is impossible, and thus this common line of criticism is invalid (be it of naivete or intentional political propaganda. Thus these untestable and thus unscientific 'assertions' may be rejected without further consideration]

2. Labchuk points out that because PEI is densely populated—the most densely-populated province in Canada, by far—the potato fields are interspersed among the homes, hospitals, daycares and schools, which means that people are constantly within range of the sprays [True: PEI has no provincial land-use policy]. *But experts disagree on whether this chemical exposure has resulted in unusually high cancer rates on the island* [italics mine].[2]

   [These 'experts' represent the grave danger of subjectivism,[3] authoritarianism,[4] totalitarianism, and the manufacture of consent), and may also be rejected as unscientific.][5]

3. Dr. Ron Matsusaki, emergency room physician at Western Hospital in Alberton, says that in all the years he's worked as a doctor both in Canada and the U.S., he hasn't seen cancer rates that come even remotely close to what he's seeing in the West Prince area of PEI. He says he has no doubt that these cancers are caused by "an insane amount" of chemical pesticides. Every second household in Mimnegash, a fishing village in West Prince surrounded by potato fields, has been afflicted with cancer, according to Matsusaki. "West Prince is a laboratory for rare and aggressive cancers. It's not uncommon to find people who have up to ten family members with cancer, that's how crazy it is here." West Prince resident Noralee Harper believes her five year-old-son contracted B cell lymphoma when her family lived next to a potato field. She's convinced the chemicals seeped into the well the family used, adding that there are no government regulations in place for testing pesticide levels in the island's drinking water. Though her son is in remission now, she says she's lucky because she knows families who have lost more than one child to cancer. "With each month that goes by, we hear of somebody new we that know personally who's been diagnosed with cancer. It's like the common cold, like a natural part of life. Living here, we worry non-stop, it's a daily concern." The only doctor to speak out about the link between pesticides and high cancer rates on the island, Matsusaki says that although he has received a letter of acknowledgement from the Canadian Medical Association, many of his colleagues in the medical profession as well as the Mayor of Mimnegash are "in denial" about the severity of the situation. He believes non-Hodgekins lymphoma is the most common cancer in West Prince, followed a close second by renal cell cancer, a particularly aggressive cancer that doesn't present symptoms until it's in the latter stages. PEI Health Minister Chester Gillan said in January that he's willing to look at research backing Matsusaki's claims, and *if he receives scientific proof*

1 Delaney 2006, p 1

2 Ibid

3 Popper , pp xxxi-xxxii. Also see Sokal 1996b, pp 126-129 ; Chomsky 1997.

4 A lot of the blame for this state of affairs rests, I think, with the scientists. The teaching of mathematics and science *is* often authoritarian; and this is antithetical not only to the principles of radical/democratic pedagogy but to the principles of science itself. No wonder most Americans can't distinguish between science and pseudoscience: their science teachers have never given them any rational grounds for doing so. (Ask an average undergraduate: Is matter composed of atoms? Yes. Why do you think so? The reader can fill in the response.) Is it then any surprise that 36% of Americans believe in telepathy, and that 47% believe in the creation account of Genesis? (1996c, pp 8-9).

5 Popper 1945 ; Herman & Chomsky 1988 ; Sokal 1996 ; Fuller 2000 ; Stiglitz 2001, p 474 ; Shaw 1903, lns 5-11.

that pesticides are poisoning PEI residents he'll act swiftly to ban the offending chemicals [italics mine].[1]

[Again, scientific proof (certainty) is, and forever will be, impossible to establish. This invalid logic may stem from the time-inconsistent incentives faced by politicians. In other words,

(1) the successful politician owes his power to the fact that he moves within the accepted framework of thought, that he thinks and talks conventionally. It would be almost a contradiction in terms for a politician to be a leader in the field of ideas. His task in a democracy is to find out what the opinions held by the largest number are, not to give currency to new opinions which may become the majority view in some distant future;[2]

(2) politicians do not find any attractions in a view which does not lend itself to party declamation, and ordinary mortals prefer views which attribute misfortune to the machinations of their enemies. Consequently people fight for and against quite irrelevant measures, while the few who have a rational opinion are not listened to because they do not minister to any one's passions.[3]

The points regarding notions of 'proof' and 'proving' theoretical propositions are extremely important, and once grasped, may serve as valuable problem solving tools themselves, especially in in light of our scholarly duty to, like Pyrrho[4] always be on the look-out and never hesitate to offer our criticism;[5]

For example, several years ago, our present author reviewed *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*,[6] and although the complex arguments and quantum mathematics appeared vaguely sound, there was sufficient smoke (displayed ignorance of *The Problem of Induction*, hubris, and authoritarian assertions[7]) to suspect fire an warrant a thorough, critical investigation:

It would have been hard to imagine at the outset that by applying *high-brow* mathematical and statistical

1 See Delaney 2006, p 1

2 Hayek 1982

3 Russell 1928, p 3

4 Sceptic: A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity… holds that there are no adequate grounds for certainty as to the truth of any proposition… Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet…to look out (Oxford English Dictionary 1997).

5 If our civilization is to survive, we must break with the habit of deference to great men. Great men may make great mistakes…Their influence, too rarely challenged, continues to mislead those on whose defence civilization depends, and to divide them. The responsibility for this tragic and possibly fatal division becomes ours if we hesitate to be outspoken in our criticism of what admittedly is a part of our intellectual heritage. By our reluctance to criticize some of it, we may help to destroy all of it (Popper 1945, preface).

6 De Vany 2004

7 Under the influence of passing moods, our critics may have fumbled towards conclusions. They may have acted from impulse and prejudice, and used their status to ennoble their hunches. They may have built up their thoughts like inebriated amateur potters. Unfortunately, unlike pottery, it is initially extremely hard to tell a good product of thought from a poor one. It isn't difficult to identify the pot made by the inebriated craftsman and the one by the sober colleague… *A bad thought delivered authoritatively, though without evidence of how it was put together, can for a time carry all the weight of a sound one. But we acquire a misplaced respect for others when we concentrate solely on their conclusions–which is why Socrates urged us to dwell on the logic they used to reach them* [italics mine, de Botton 2001, pp 30-31].

science we would end up *proving* Goldman's fundamental truth [all italics mine].[1]

Then, perhaps with a heightened sense of scepticism, a fatally flawed, critical assumption the author had made became apparent and lead to a sound falsification of *Hollywood Economics*' central thesis.[2]

Presently, we will return to the final, sixth stage of the test of our theory:

(VI) As Popper notes, "We… leave it to the competition between theories to eliminate the unusable ones."[3] The previously detailed three-point summary of criticisms directed toward our theory (which represent, to the best of our knowledge, all known criticisms to date) do not forward a single *competing theory*, thus we may tentatively accept our theory as *true*. In other words, if it were reasonable to believe that, for example, island dairy production facilities or Tim Horton's Coffee had been laced with some known carcinogen for the past several decades, then the establishment of causation may be more difficult to *reasonably* determine, but since we have no competing theories, we accept our theory as true and therefore valid.

1 Ibid, p. 28
2 See Funk 2007d
3 1992, p 28

We will not make any presumptions regarding the general acceptance of this logical proof, but if readers find the plausibility of the democratic rejection of truth (at the provincial level on Prince Edward Island), and thus passive, acquiescent, and institutionalized self-destruction difficult to entertain, we apologize that the scope of this brief introduction does not facilitate treatment of institutionalized irrational human behaviour. In the meantime, we may consider two relevant conjectures, then view a snapshot of a two-island comparative study:

> (1) It is customary to suppose that the bulk of our beliefs are derived from some rational ground, and that desire is only an occasional disturbing force. The exact opposite of this would be nearer the truth: the great mass of beliefs by which we are supported in our daily life is merely the bodying forth of desire, corrected here and there, at isolated points, by the rude shock of fact. Man is essentially a dreamer, wakened sometimes for a moment by some peculiarly obtrusive element in the outer world, but lapsing again quickly into the happy somnolence of imagination.[1]

> (2) History shows that our theories have been wrong more often than right, resulting in the demise of whole civilizations when we have misinterpreted what is happening to us….
>
> It would be comforting to believe that humans have been prescient enough to understand what is happening to themselves and act accordingly. But… the way the mind understands the external environment—the beliefs humans construct to explain the external world are frequently incorrect, particularly if the changes are creating really novel situations. And clearly, humans have evolved environments radically different from anything that existed before.[2]

Now here's our snapshot, a brief compare and contrast of the independent modus operandi on Iceland with dependent modus operandi on Newfoundland with three outlined points:

> (1) The North Atlantic island communities of Iceland and Newfoundland have much in common. Both are resource-based, export-oriented economies with fish as the major staple… Both are sparsely populated islands of approximately 100,000 km^2, with most of the settlements scattered in small communities along the coast, leaving the interior virtually uninhabited….
>
> There are also fundamental differences. Newfoundland… is one of ten provinces in Canada, whereas Iceland is an independent nation. Newfoundland has experienced high unemployment and low income per capita, while Iceland has enjoyed almost full employment and considerably higher income per capita. *Newfoundland has depended on transfer payments from the federal government for over forty years, with approximately half of the provincial government's revenue coming from federal sources* [the ratio is similar on PEI and this is no coincidence.[3]

1 Russell 1928. Also see Herman & Chomsky 1988

2 North 2007, p 26

3 Institutional factors in the form of direct democracy (via initiatives and referenda) and federal structure (local autonomy) systematically and sizeably raise self-reported individual well-being in a cross-regional econometric analysis. This positive effect can be attributed to political outcomes closer to voters' preferences, as well as to the procedural utility of political participation possibilities. Moreover, the results of previous microeconometric well-being functions for other countries are generally supported. Unemployment has a strongly depressing effect on happiness. A higher income level raises happiness, however, only to a small extent (Frey & Stutzer 2000a, abstract). Also: Benz & Frey (early release).

Newfoundland and Iceland have experienced fundamental differences in history, politics, and religion. *In Newfoundland there have been relatively rigid religious cleavages and class divisions*; Iceland has experienced these… to a much lesser degree…. *Icelanders knew that they came to the island as independent settlers, whereas the immigrants to Newfoundland [and PEI] were beholden to the colonial power to protect them* (Jónsson 1995, p 269-270).

(2) [In Newfoundland], in 1949, after two referendums, a slim majority agreed to Confederation with Canada. Confederation, with its promise of a vastly improved standard of living as a result of Canadian social welfare programs and lower prices, gained its greatest support in rural areas, where incomes were lowest.

Confederation confirmed both the hopes of its advocates and the fears of its opponents. *Its immediate impact was to increase personal disposable income and consumer spending through social welfare programs, the most important of which were family allowance and unemployment insurance*.

Joseph Smallwood became the first premier of the province and held his position until his electoral defeat in 1972. Smallwood defended Confederation, first and foremost, *on the basis of the transfers it would bring about to families….*

In 1954 the Newfoundland Department of Welfare began a program which assisted people in isolated communities to move to larger communities…. it continued until 1975.

In the early 1950's… Smallwood launched a massive program of industrialization. The purpose of the program was both to create economic growth and to reduce the level of dependency on the fisheries. This program of industrialization largely failed to create the income and jobs expected, and the provincial government had to inject massive funds to keep alive the new enterprises.

Smallwood showed little faith in the fisheries and did not appear to have seen the tremendous potential provided by the offshore grounds of Newfoundland (Ibid, p 279-280).

Recall that this discourse has suggested that, in light of difficulties associated with whole-systems complexity, the study of islands may be primary, paramount, perhaps even utterly necessary for human survival; that islands may serve us well as lighthouses, as socio-economic and ecological models far more representative and descriptive than mathematical models; that island-based analysis enables us to break through myths, and grasp global complexity and uncertainty that is beyond our reach.

The three points above which summarize the essence of this discourse do not merely tell the tragic tale of

Therefore, it is true that cancer rates on Prince Edward Island have increased significantly as a result of a significant increase of chlorothalonil applications.

We do not, however, follow the misguided assertion that we must attempt to ascribe a probability to the truth or validity of our theory in order to attempt to justify our conclusion. It is simple true, and we may offer no more nor more less, because

> the question whether inductive inferences are justified, or under what conditions, is known as *The Problem of Induction* [italics and capitalization mine].[1] The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences….
>
> Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity'.[2]
>
> At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.
>
> Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads… to an infinite regress.[3]

This rejection of inductive methods represents the essence of Popper's monumental solution[4] to Hume's *Problem of Induction*.[5] "There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility

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1 THE PROBLEM OF INDUCTION
According to a widely accepted view… the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white (Popper 1959, pp 3-4).

2 Reichenbach 1930, p 186

3 Popper 1959, pp 31-35

4 See Popper 1959

5 See Hume 1739

we must ready ourselves for."[1] Furthermore, this illumination on the deficiencies of probability theory also captures the essence of Cournot's earlier (1838) insight: economics and the social sciences at large have been erected upon a false and sandy foundation. And, although Cournot's and Popper's (and Russells and Reichenbach's and Hayek's and Taleb's, etc.) realization does find its way to the meek and the few, it generally does not find its way to the mighty nor the many, as it does not serve authoritarian institutional interests. And this problem is ancient: Einstein and Popper have both proposed it is borne of an innate yearning for certainty which began with the philosophy of Plato.[2] But Cournot's realization did find its way to an author, hedge fund manager, and professor of Uncertainty Science at NYU:

> I am now convinced that, perhaps, most of econometrics could be useless—much of what financial statisticians know would not be worth knowing. For a sum of zeros, even repeated a billion times, remains zero; likewise an accumulation of research and gains in complexity will lead to naught if there is no firm ground beneath it.[3]

Funk 2007a;c;d;e examined *The Problem of Induction* in greater detail, but we will illuminate and contextualize this important matter by illustrating the plague of pseudo-scientific inductive inferences by briefly returning to Newfoundland. Kurlansky chronicles the Canadian governments religious faith in one of Britain's most authoritarian *and influential* (and thus, inherently dangerous) scientists in Huxley, and, furthermore, the modeling of their fisheries policies on Huxley's authoritarian, inductive logic to the very bitter end: the collapse of the great Newfoundland cod fishery.

> At the 1883 International Fisheries Exhibition in London, which was attended by most of the great fishing nations of the world, Huxley delivered an address explaining why overfishing was an unscientific and erroneous fear: "Any tendency to over-fishing will meet with its natural check in the diminution of the supply,… this check will always come into operation long before anything like permanent exhaustion has occurred."….
>
> For the next 100 years, Huxley's influence would be reflected in Canadian government policy. An 1885 report by L.Z. Joncas in the Canadian Ministry of Agriculture stated:
>
> > The question here arises: Would not the Canadian fisheries soon be exhausted if they were worked on much larger scale and would it be wise to sink a larger amount of capital in their improvement?…. As to those fishes which, like cod, mackerel, herring, etc. are the most

1 De Botton 2001, p 90
2 Popper 1945
3 Taleb, 2001, p 114. Also see Taleb 2007

> important of our sea fishes, which form the largest quota of our fish exports and are generally called commercial fishes—with going so far as to pretend that protection would be useless to them —I say it is impossible, not merely to exhaust them, but even noticeably to lessen their number… *For the last three hundred years fishing has gone on in the Gulf of St. Lawrence and along the coast of our Maritime Provinces, and although enormous quantities of fish have been caught, there are no indications of exhaustion* [italics mine] (pp 121-123).

We trust now that it *is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of cod we may have observed, this does not justify the conclusion that cod is inexhaustible.*[1] Every inductive inference is inextricably embedded with unquantifiable uncertainty illustrated by this inductive disaster.

Two subsequent opportunities for *correction of error*:

> Only a decade after reassuring the Canadians and the world that the waters around Great Britain "show no sign of exhaustion," such a thing being scientifically impossible, the British discovered that the cod stocks in the North Sea had been depleted (p 144).

Returning to the problem of breathing, eating, and drinking poison on Prince Edward Island: Extending this research and/or building upon the arguments herewith merely yields diminishing margins of return: again, our theory is true. We may, however, always seek further confirmation (and refutation). If our problem solving interests extend beyond scientific inquiry and into Darwin's *Struggle for Life* (a natural extension, as noted in the introduction), the next step to consider would, naturally, entail developing the arguments herewith into a legal motion, and filing a class-action law suit (naming Syngenta—the manufacturer of chlorothalonil—the Provincial Government of Prince Edward Island, and, perhaps, the Federal government). Although it could be argued that this marks a line of demarcation from the realm of so-called 'scientific method', the methods for a legal case of such magnitude (possibly several hundred million $CAD?), would be under such scrutiny, and in the hands of what must by definition *not* be scientific theorists (a jury), that our conclusion must yield truth beyond the slightest (and most liberal) shadow of a doubt. In this case, we could seek data which detail per-capita cancer instances by postal code, then plot this data (on a per capita basis) upon a map of Prince Edward Island. It may also prove fruitful to

1 Popper 1959, Chapter 1

compare this map to an existing map: The provincial land-use map which details potato production. We could also go into the field and collect primary empirical data by sampling and testing well water (island-wide, of course) as thoroughly as time, money, and reason permit. And naturally, you may wish to gather evidence in the form of testimony from the likes of two individuals noted in this paper: former PEI physician Dr Ron Matsusaki and U.S. senior toxicologist Dr Timothy F. McMahon.

Yet always bear in mind mind, despite the assertions of Professors De Vany, Chinneck,[1] and many others, even the most convincing, seemingly unquestionable evidence could never prove nor disprove our theory. We sought only truth and we found it.

1 1988, p 2

FUTURE RESEARCH

Many assert research is incomplete without the inclusion of (1) a review of literature pertaining to your problem, attempted solutions, and competing theories and (2) a proposal for future research. Both assertions are false. Your sole task is to test a theory and make a *contribution to knowledge*. Everything else is gravy (though potentially helpful, possibly excess fat). Remember, there is no method. We suggest an Appendix[1] may be a more suitable (read: optional) venue for a literature review (thus, see APPENDIX A: LITERATURE REVIEW). Again, however, there is no method, the choice is yours, and it will vary according to the nature of your problem, proposed solution, and your audience. And, as noted in our introduction, structural requirements from various audiences (journals, academic departments, judges and juries, governments, the SEC, NGO's, etc.) may state explicit structural requirements which are quite independent of the philosophy of science (and also independent of your independent decision to adopt or reject any or all of such so-called 'requirements'). The highly formalized nature and mal-aligned equity stakes of peer-reviewed journals (only a small handful of journals are edited by individuals whom hold equity in the journal), however, is largely counter-productive. Bruno S. Frey[2] surveys this problem in his 2002 *Publishing as Prostitution? Choosing Between One's Own Ideas and Academic Failure:*

> Even among extremely successful economists, crowned by the Nobel Prize, there are some who harshly criticize the existing journal publication system. Examples are Leontief 1971, Coase 1994 or Buchanan 2000; see more generally Leijonhuvfud 1973 and Cassidy 1996.[3]

In fact, the insights, clarity, and unhindered accessibility of Frey's working papers serve as a great testament to his credibility on this issue. And, to this point, he draws our attention to a fortunate reversal in the counter-

1 In the *Principles*, Marshall [1890] confined his use of diagrams and other mathematical notations to footnotes and appendixes so as not to allow his mathematics to detract from his economics. He was interested above all in plain communication—with businessmen as well as with students. Moreover, he was acutely aware that over reliance on mathematics "might lead us astray in pursuit of intellectual toys, imaginary problems not conforming to the conditions of real life: and, further, might distort our sense of proportion by causing us to neglect factors that could not easily be worked up in the mathematic machine" [Pigou, Memorials, p. 84] (Ekelund, p 341).

2 I believe I have some experience and competence in this area. I have published more than 250 papers in over 140 refereed journals during the period 1965–2002. Among them are leading economics journals such as AER, JPE, RES, REcsStats, EJ, JEcLit and JecPersp., but also in political science (e.g. APSR), psychology, law and sociology journals. I have also tried the alternatives to journal publications by writing 16 books and by being a columnist for a leading weekly newspaper. I have served as one of the two (and later three) managing editors of *Kyklos* since 1970, am a member of the board of editors of 23 journals and over the years have served as referee for numerous journals (Frey 2002, p 6).

3 Frey, 2002 p 15. Also see Sokal 1996 a,b,c,d ; Chomsky 1997

productive nature of peer-review journals:

> The advent of wide spread internet publishing reduces the stifling impact of the refereeing process on the papers accepted and submitted to journals. Economics scholars are less bound to devote a large part of their time and effort on formalisms. They have more leeway to concentrate on matters of content. This greater freedom also improves the chances that the advice and suggestions proposed by economic methodologists are put into practice, provided they are of practical use for research. The dominance of orthodoxy is reduced.[1]

This critical point, however, is merely to mark the distinction between scientific method and the structural requirements of various audiences. Even at the PhD dissertation level, however, the sole requirement is the defense of *your contribution to knowledge*. Many formalisms, such as the irrational nature of word and page-count requirements and or restrictions,[2] are counter-productive:

> Most non-economists—as well as an increasing number of economists—would whole-heartedly agree that the economics literature has become arcane and inaccessible, especially so far as the 'serious' (i.e. refereed) and most prestigious journals are concerned. This is only partly due to a specialized language (other social sciences also use jargon). More important is the fact that economists have a high degree of consensus about what constitutes high academic quality. 'Good' economics is considered to be abstract and model oriented. This automatically gives a premium to formal mathematical work. Empirical relevance is of secondary importance….; real-life problems are not the centre of concern of most economists who publish in the leading journals.
>
> One of the unfortunate results of this definition of 'good' economics is that outsiders find it difficult to understand why a particular problem is treated, and if so, why such a high level of formalism is used (Frey & Serna 1995, pp 343-344).

And thus, should we become lured into this brothel of peer-reviewed journals, we ultimately fail to accomplish what we had set out to do: *solve problems*. Instead, *we create more problems*:[3]

> the ordinary citizen is struck dumb with awe when he is told about gold reserves, note issues, inflation, deflation, reflation, and all the rest of the jargon. He feels that anyone who can converse glibly about such matters must be very wise, and he does not dare to question what he is told.[4]

Let's consider John Nash's 27 page PhD dissertation,[5] successfully defended in the department of

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1 Frey 2000 p 9

2 Funk 2007e

3 And, in the process, realize the Kuhnian dream: see APPENDIX A.

4 (a) Russell 1956, p 61
(b) My father, who was an unflagging though friendly critic, once told me that I would never again write so good a book as this my first one because, as I grew older and wiser, I would "know too much" and the books would inevitably be harder to read (Mead 1928, preface). Also:
(c) There are, so Montaigne implied, no legitimate reasons why books in the humanities should be difficult…; wisdom does not require a specialized vocabulary or syntax, nor does an audience benefit from being wearied….Every work presents us with a choice of whether to judge the author inept for not being clear, or ourselves stupid for not grasping what is going on. Montaigne encouraged us to blame the author. (de Botton 2001, p 158).

5 Nash 1950. Refer to Nash 1951 for a more legible reprint of 1950.

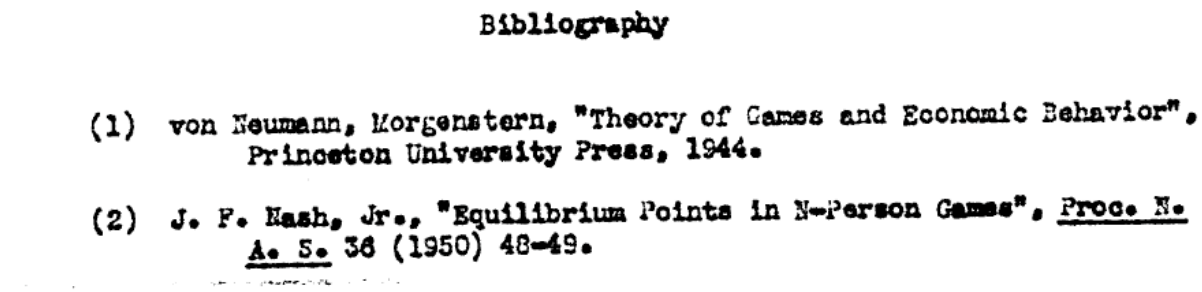
philosophy at Princeton, the dissertation which was attributed as the contribution to economics which merited Nash's 1994 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. As previously noted, many will insists research presentations must begin with a review of literature. The full extent of Nash's literature review begins and ends in the first paragraph of page 1:

Introduction

Von Neumann and Morgenstern have developed a very fruitful theory of two-person zero-sum games in their book Theory of Games and Economic Behavior. This book also contains a theory of n-person games of a type which we would call cooperative. This theory is based on an analysis of the interrelationships of the various coalitions which can be formed by the players of the game.

Our theory, in contradistinction, is based on the absence of coalitions in that it is assumed that each participant acts independently, without collaboration or communication with any of the others.

Indeed, Neumann & Morgenstern (1944) was one of the only two references listed in his Bibliography on page 27. The other reference, we note, was to his own prior work:



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(1) von Neumann, Morgenstern, "Theory of Games and Economic Behavior", Princeton University Press, 1944.

(2) J. F. Nash, Jr., "Equilibrium Points in N-Person Games", Proc. N. A. S. 36 (1950) 48-49.

We may note two additional observations: Nash did not suggest future research, and, despite Purdue University Professor Anon's[1] assertion that dissertations may not be written in the 'We'-imperial 'voice' (the stylistic manner in which this paper has been authored, for example), Nash disregarded this common, arbitrary formalism as well.

An argument could also be advanced suggesting that both literature reviews and suggested research may inject bias, but, again, there is no method: if either or both of the aforementioned constitute an aspect of your contribution to knowledge, then so be it.

This introduction to the problem solving methods has, by design, presented a single-sided (Karl Popper's) introduction, but we will shortly serve due notice to a highly influential approach to the philosophy of science which is antithetical to much of the philosophy and methods presented herewith; it is arguably also more popular. Before doing so, however, we will back-up and address a question readers may be pondering…

Who was Karl Popper?

> Karl Popper is generally regarded as one of the greatest philosophers of science of the 20th century. He was also a social and political philosopher of considerable stature, a self-professed 'critical-rationalist', a dedicated opponent of all forms of scepticism, conventionalism, and relativism in science and in human affairs generally, a committed advocate and staunch defender of the 'Open Society', and an implacable

1 1999, p 7

> critic of totalitarianism in all of its forms. One of the many remarkable features of Popper's thought is the scope of his intellectual influence. In the modern technological and highly-specialized world scientists are rarely aware of the work of philosophers; it is virtually unprecedented to find them queuing up, as they have done in Popper's case, to testify to the enormously practical beneficial impact which that philosophical work has had upon their own.[1]

Perhaps some readers may also inquire, "If Popper was one of the greatest philosophers of science of the 20th century, then why haven't we heard of him or read his work?"

This is an interesting and relatively common question amongst philosophy scholars. Some have suggested it is because he never held a chair at Oxford or Cambridge. Others have noted that

> in intellectual circles Popper was very much admired. But because *The Open Society and Its Enemie*s was hostile to so much academic pretension it was treated less than respectfully by those in the various specialties upon whose turf it trod (Jarvie & Pralong 1999, p 6).

Indeed, many very prominent and influential academics, such as Leo Strauss,[2] condemned and actively lobbied against Popper and his philosophy.

However, far more, and arguably far greater intellectuals (at least the kind of intellectuals whom are awarded Nobel prizes)[3] have, as Zalta noted above, lined up to praise and attest to his methods. As F.A. von Hayek remarked near the end of his 1974 Nobel Lecture, *The Pretence of Knowledge*:

> It is often difficult enough for the expert, and certainly in many instances impossible for the layman, to distinguish between legitimate and illegitimate claims advanced in the name of science…. If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. *We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass.*

1 Zalta 2006, p 1
2 Steinberg 2003 ; Shultz 2007
3 See Popper 1959

APPENDIX A: LITERATURE REVIEW

For readers with interest in an alternative, yet sound and complimentary 20-page introduction to scientific method, we suggest *The Myth of 'Scientific Method' in Contemporary Educational Research* (Rowbottom & Aiston 2006):

> The Latin word *scientia*, from which our word 'science' comes, originally meant nothing more than 'systematic knowledge of the true causes of particular things' (Smith, 1997, p. 16), as opposed to the revealed knowledge that came from religion. It did not mean what we have come to designate in the 20th century as the 'natural sciences' (ibid.). It was in the 16th and 17th centuries, in what is usually called the Era of Scientific Revolutions, that 'science' began to acquire its modern connotations of empiricism and experimentalism. Thus conceived, 'science' began to seem, because of its spectacular successes, the only game in town, which is why the social sciences came to be so called and why, riding on the prestige of experimental science, some people talk of management science, political science and even the science of literary criticism. They do things differently elsewhere. The German language, for example, does not speak of the social sciences but of the *Geisteswissenschaften*, sometimes translated as the 'humanities' or the 'humanistic study of culture' (literally it means the ways of knowing the human mind or spirit, *Geist*), and distinguishes the *Geisteswissenschaften* from the *Naturwissenschaften* or ways of knowing the natural world. Continental Europe is more hospitable to theory than the Anglophone countries. It is a sobering thought that the influence of the scientific paradigm may be largely an accident of history and of the English language.
>
> Behind the 'what works' dogma there seem to lurk not only the idea that 'science' supplies the model to which all claims to knowledge should aspire, but fantasies and misconceptions concerning science itself. Sarah Aiston and Darrell Rowbottom… [noted above] examine these misconceptions, and analyse the false contrasts often drawn between 'scientific' and 'non-scientific' approaches. They see here the origins of the idea that educational research is centrally a matter of employing particular methods, an idea they find prevalent in standard research methods textbooks.[1]

For those who may hold deeper interests yet, please proceed:

As previously noted, Popper has had many critics, some of which have been the most influential academics of the twentieth century. The most notable (and perhaps most influential) amongst these critics was Leo Strauss:

> In 1950, Popper went to Harvard to deliver the prestigious William James lectures. During his time in the States he appears to have given a talk at the University of Chicago, where Strauss taught. Strauss told Voegelin that the talk "was very bad," "the most washed-out, lifeless positivism" (Emberly and Cooper 1993: 67), and inquired of his opinion of Popper. Voegelin replied with a vicious letter. He reports having reluctantly read Popper because so many people insist his Open Society is a masterpiece. His judgement is that the book is "impudent, dilettantish crap. Every single sentence is a scandal . . ." (ibid.). Noting that Popper takes the concept of open society from Bergson, he comments that Bergson did not develop it "for the sole purpose that the coffeehouse scum might have some-thing to botch." Voegelin believed that Bergson would have thought that "Popper's idea of the open society is ideological rubbish" (ibid.). Voegelin is only just getting started. He accuses Popper of "impertinent disregard for the achievements in this particular problem area [the history of political thought]" (Emberly and Cooper 1993: 68) and of being

1 Bridges & Smith 2006, pp 132-133

> unable to reproduce accurately the ideas of Plato and Hegel. Popper is "a primitive ideological brawler." Voegelin then strings more epithets together, "a failed intellectual," "rascally impertinent, loutish; in terms of technical competence as a piece in the history of thought, it is dilettantish, and as a result is worthless" (Emberley and Cooper 1993: 67). The reader astonished at this undignified diatribe needs to remember that in the book in question Popper is vehement about the duty to think for oneself and not to defer to the authority of experts. Strauss and Voegelin agree on the opposite, and on the duty of the enlightened elite to defend standards. Strauss had said he was willing to keep Voegelin's remarks to himself. Voegelin concludes: "It would not be suitable to show this letter to the unqualified. Where it concerns its factual contents, I would see it as a violation of the vocational duty you identified, to support this scandal through silence" (Emberly and Cooper 1993: 69). Following this invitation, Strauss showed the letter to Kurt Riezler, "who was thereby encouraged to throw his not inconsiderable influence into the balance against Popper's probable appointment here [in the US]. You thereby helped to prevent a scandal." With hindsight one might think that the scandal is that someone who had dared to challenge the traditional Germanic learning, the worship of the great men, the enemies of science and Enlightenment, is not met out in the open with argument, but is disposed of behind the scenes, as quietly as possible, by the self-righteous use of power.
>
> Not all readers, we trust, will value Strauss' position or lend considerable weight to his criticism. Indeed,

some readers, perhaps, may, in light of *Strauss' positions, influences, protoge's*, and *associates*, suspect that Popper's philosophy may indeed hold the *Constitution of Liberty,*[1] and perhaps even a tentative solution to perhaps the greatest and gravest problem facing humankind, the solution to Popper's first manifesto,[2] namely an attack on enemies of the Open Society:

> In a June 17, 1996 article by Richard Lacayo, *Time* magazine named the late University of Chicago philosopher Leo Strauss (1899-1973) as one of the most influential and powerful figures in Washington, D.C.—the man most responsible for the Newt Gingrich "Conservative Revolution" on Capitol Hill, and the intellectual godfather of [Gingrich's] "Contract on America".
>
> If Strauss' influence on politics in the capital of the most powerful nation on Earth was awesome in 1996, it is even more so today. The leading "Straussian" in the Bush Administration is Deputy Defense Secretary Paul Wolfowitz, who was trained by Strauss' alter-ego and fellow University of Chicago professor Allan Bloom. Wolfowitz leads the "war party" within the civilian bureaucracy at the Pentagon, and his own protégé, I. Lewis "Scooter" Libby, is Vice President Dick Cheney's chief of staff and chief national security aide, directing a super-hawkish "shadow national security council" out of the Old Executive Office Building, adjacent to the White House. According to Bloom biographer Saul Bellow, the day that President George H.W. Bush rejected Wolfowitz and Cheney's demand that U.S. troops continue on to Baghdad, during Operation Desert Storm in 1991, Wolfowitz called Bloom on his private phone line to bitterly complain. It seems that "Bush 41" was not enough of a Nietzschean "superman" for Wolfowitz's taste....
>
> On March 3, in a widely circulated radio interview on the Jack Stockwell Show in Salt Lake City (see EIR, March 14), Lyndon LaRouche had singled out Strauss as one of the leading intellectual figures... steering the United States into a disastrous replay of the Peloponnesian War, which led to the collapse of Athens. Within days of the LaRouche interview, Leo Strauss was the subject of a series of public attacks, in the German, French and American media... for his role in producing the current generation of neo-

1 See Hayek 1960

2 1945

conservatives.

> Indeed, author Shadia B. Drury, in her 1997 book, *Leo Strauss and the American Right*, named the following prominent Washington players as among Strauss' protégés: Paul Wolfowitz; Supreme Court Justice Clarence Thomas; Judge Robert Bork; [neo-conservative] propagandist and former Dan Quayle chief of staff, William Kristol; former Secretary of Education William Bennett; the National Review publisher William F. Buckley; former Reagan Administration official Alan Keyes; current White House bio-ethics advisor Francis Fukuyama; Attorney General John Ashcroft; and William Galston, former Clinton Administration domestic policy advisor, and co-author, with Elaine Kamark, of the Joe Lieberman-led Democratic Leadership Council's policy blueprint.
>
> Earlier Strauss allies and protégés in launching the post-World War II neo-conservative movement were Irving Kristol, Norman Podhoretz, Samuel Huntington, Seymour Martin Lipset, Daniel Bell, Jeane Kirkpatrick, and James Q. Wilson....
>
> The hallmark of Strauss' approach to philosophy was his hatred of the modern world, his belief in a totalitarian system, run by "philosophers," who rejected all universal principles of natural law, but saw their mission as absolute rulers, who lied and deceived a foolish "populist" mass, and used both religion and politics as a means of disseminating myths that kept the general population in clueless servitude. For Strauss and all of his protégés (Strauss personally had 100 Ph.D. students, and the "Straussians" now dominate most university political science and philosophy departments), the greatest object of hatred was the United States itself (Steinberg 2003).

Indeed, perhaps future generations may thank Leo Strauss for criticizing Popper in the same way we may thank Aristotle for criticizing those brave, anonomous Greek citizens who had the courage to criticize slavery: If it weren't for Aristitle's criticisms, we would have no account that there were significant objections amongst the citizenry to slavery at all.[1]

The second-most dominant line of criticism direct towards Popper: The most heavily cited reference on the philosophy of science in the twentieth century was not a book by Karl Popper. It was a book written by another philosopher of science: *The Structure of Scientific Revolutions* (1962) by Thomas Kuhn. One very favourable aspect of the philosophy of science is that there are two very clear, well-marked, and heavily travelled contemporary points of departure: Kuhn and Popper:

> (1) The Kuhn-Popper debate, strictly speaking, refers to an encounter that took place at the former Bedford College, University of London on 13 July 1965, as part of the International Colloquium in the Philosophy of Science. It was designed to pit a relatively young theorist of science (Kuhn, aged 43) whose 1962 book, *The Structure of Scientific Revolutions*, was touted as the latest word from the United States, against a relatively old theorist of science (Popper, aged 63) whose seminal book, *The Logic of Scientific Discovery*, had been translated into English on in 1959, a quarter-century after it first appeared in German.[2]

1 Popper 1945
2 Fuller 2003, p10

> (2) Kuhn and Popper tapped into long-simmering, deep-rooted disagreements that went well beyond the pages of their major works on science…. Sometimes behind such scholastic fodder that frames philosophical debate lie opponents who are not so different from each other after all…. But sometimes the stereotype, for all its crudeness, *does* [italics Fuller's] capture differences in sensibility that become deeper the more one looks. This is certainly the case with Popper and Kuhn.[1]
>
> (3) The clash between Popper and Kuhn is not about a mere technical point in epistemology. It concerns our central intellectual values, and has implications not only for theoretical physics but also for the underdeveloped social sciences and even moral and political philosophy.[2]

This author's very brief assessment of the Kuhnian revolution is as follows: Kuhn wrote an encyclopaedia article on the philosophy of science which was ultimately published as Kuhn (1962). In this article, Kuhn detailed the dominant institutional (authoritarian academic and government institutions) phenomena in scientific research: feedback loops and herding behaviour (which he famously termed *paradigm*). This observation was in-part (1) misconstrued as a blueprint for *the* method of science, and (2) adopted as *the* method of science for and by the authoritarian institutions whom benefited most from its adoption: the dominant academic institutions and the dominant cold-war era United States. Indeed, U.S. political and U.S. academic institutional credibility and dominance were near an all-time highs; a very strong argument may, afterall, be tabled that the Manhattan project, borne out of Princeton, had possibly saved the world. The book has indeed been noted as the perennial favourite of politicians: Al Gore has stated that it is his favourite book and George Bush has claimed to have read it as well (though researchers have not found confirmation that Bush has read any books). Indeed, we submit its great appeal to politicians may stem from its position on subjectivism (everything, including truth, is negotiable), relativism, and authoritarianism. Indeed, Popper traces Kuhn's philosophical lineage to Plato:

> The greatest principle of all is that nobody, whether male or female, should be without a leader. Nor should the mind of anybody be habituated to letting him do anything at all on his own initiative ; neither out of zeal, nor even playfully. But in war and in the midst of peace—to his leader he shall direct his eye and follow him faithfully. And even in the smallest matter he should stand under leadership. For example, he should get up, or move, or wash, or take his meals… only if he has been told to do so. In a word, he should teach his soul, by long habit, never to dream of acting independently, and to become utterly incapable of it.[3]

Popper's philosophical lineage, on the other hand, traces back to Plato's teacher, Socrates. Reviewing the

1 Ibid, pp14-15
2 Lakatos 1978, vol 1, p 9
3 Republic, *c.* 360 B.C

literature on this contemporary philosophical debate will invariably lead to philosophers from both schools (Plato left Socrates's school, so to speak, to start a school of his own; Plato's first pupil was Aristotle). These lineages are assembled in Popper (1945).

Although this author is tempted to cite Popper's positions on Kuhn's philosophy, the object of this review is to draw our attention to the fact that an antithetical approach to the method of science exists and that our proposed problem solving technique may be presented in error. Recall that this tenant is central to our method: "We can never excel others in our reasonableness in a way that would establish a claim to authority."[1] You will not discover this acknowledgement of uncertainty in Kuhn (1962). Again, however, we encourage readers to follow their own independent-minded processes of discovery regarding this weighty debate. Fuller (2000) is excellent, but heavily opinionated in Popper's favour. Stanford (2004) provides a more even assessment, and serves as an excellent introduction to Kuhn. Unfortunately, *The Structure of Scientific Revolutions* was Kuhn's only major work, and, not long after the debate cited above, Kuhn stepped out of both the public and academic spotlights and refused to grant interviews. Thus, many open questions pertaining to his philosophy were left to students such as Feyerabend (1975) to answer.

Kuhn's students may or may accurately reflect his philosophy.

Popper, on the other hand, was one of the most prolific philosophers of any century, granted a stream of interviews, and is published in over fifty languages. His complete bibliography lists 1292 entries and is 132 pages long (which we will happily forward upon request).

For an alternative, brief introduction to Popper, consider Anderson (2004). We highly suggest, however, a first-hand encounter:

Perhaps the best first-hand introduction to Popper is *In Search of a Better World* (1992), which could be followed up with its sequel, *All Life is Problem Solving* (1999). These two collections represent a distillation of Popper's opus, assembled during the last decades of his life.

1 Ibid, p 227

Alternatively, Popper's first major work, written while in exile in Australia from the Nazi Germany, *The Open Societies and Its Enemies* (1945). Popper mailed the original manuscript (his only copy!) to his fellow Austrian and close friend, F.A. von Hayek, at the London School of economics. Hayek procured a publisher, then later procured Popper's position at LSE. The topical, contemporary aspect of this great work is that, although it was written during the rise of Nazi Germany as cautionary tale regarding the rise of 'Closed' (totalitarian) Societies, it is very difficult to read this text today without drawing uncanny parallels with post-Eisenhower U.S. foreign policy. *The Open Societies and Its Enemies*' central thesis echoes in Hayek (1944).[1]

Researchers in the natural sciences will be well-served by Popper's magnum opus, *The Logic of Scientific Discovery* (1959), but we would encourage any researcher considering the acceptance of inductive logic to review chapters I (which surveys the problem of induction), II (*On the Problem of a Theory of Scientific Method*), III (*Theories*), and VIII (*Probability*). The original manuscript for this great works has been reported to have been anywhere between 2,000 and 5,000 pages (our present edition is 513), but the extensive Appendices were published as individual volumes which may be of interest to researchers in the natural sciences.

Our final recommendation to consider as secondary and tertiary readings to complement those noted above: *Conjectures and Refutations*:

> The essays and lectures of which this book is composed are variations upon one very simple theme--the thesis that we can learn from our mistakes. They develop a theory of knowledge and of its growth. It is a theory of reason that assigns to rational arguments the modest and yet important role of criticizing our often mistaken attempts to solve our problems…Though it stresses our fallibility it does not resign itself to skepticism, for it also stresses the fact that knowledge can grow, and that science can progress - just because we can learn from our mistakes.[2]

Popper was influenced by members of his peer group, the Vienna Circle, his good friend F.A. von Hayek, and especially by the teachings of Socrates,[3] Democritus, Xenophanes Einstein, Wittingstein, Reichenbach,[4] and,

1 Is there a greater tragedy imaginable than that, in our endeavour consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving? (Hayek 1944, p 4).

2 Popper 1962, p xi

3 I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not fancy I do. In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know (Socrates 399 BC).

4 Reichenbach 1930 ; 1938 ; 1940 ; 1942 ; 1949

perhaps most significantly, the great logician and founder of analytical philosophy, Bertrand Russell:[1]

> A follower of the Enlightenment speaks as simply as possible: we want to be understood. In this respect Bertrand Russell is our great master.[2]

Many of their writings express analogue and complementary philosophies. For an equalled panorama of the western philosophical landscape upon which these philosophies rest, Russell (1945) is simply without equal, thoroughly enjoyable, and thus very highly recommended.

And with Russell in mind, in hindsight, it seems likely we have not stressed the extraordinary, positively essential role sharp criticism plays in the problem solving process, indeed in the process of the growth of all knowledge. We will offer two closing remarks on this point:

> (1) The results of failure in politeness, however bad from the point of view of social occasion, are admirable from the point of view of dispelling myths. There are two ways in which our natural beliefs are corrected: one the contact with fact, as when we mistake a poisonous fungus for a mushroom and suffer pain in consequence; the other, when our beliefs conflict, not directly with objective fact, but with the opposite beliefs of other men.[3]
>
> (2) It is not only the hostility of others that may prevent us from questioning the status quo. Our will to doubt can be just as powerfully zapped by an internal sense that *societal conventions* [italics mine] must have a sound basis, even if we are not sure exactly what this may be, because they have been adhered to by a great many people for a long time. It seems implausible that our society could be gravely mistaken in its beliefs and at the same time that we would be alone in noticing the fact. We stifle our doubts and follow the flock because we cannot conceive of ourselves as pioneers of hitherto unknown, difficult truths.[4]

And finally, after borrowing these three used, tested, very high-mileage ideas, I might also add that, from an economics perspective, the search for truth, the endeavour to test new theories and new ideas is very costly. Thus, it may prove fruitful, as we have done so throughout this paper, to hang your arguments and build upon as many sound, old, tested ideas as possible:

> Most economists enter this market in new ideas, let me emphasize, in order to obtain ideas and methods for the applications they are making of economics to the thousand problems with which they are occupied: these economists are not the suppliers of new ideas but only demanders. Their problem is comparable to

1 Uncertainty, in the presence of vivid hopes and fears, is painful, but must be endured if we wish to live without the support of comforting fairy tales. It is not good either to forget the questions philosophy asks, or to persuade ourselves we have found indubitable answers to them. To teach how to live without certainty, and yet without being paralysed by hesitation, is perhaps the chief thing that philosophy, in our age, can do for those who study it (Russell 1945). Also see Russell 1908 ; 1915 ; 1922 ; 1928 ; 1940 ; 1948 ; 1953 ; 1956.

2 Popper 1999, p 206

3 Russell 1928, pp 17-18

4 De Botton 2001, p 13

that of the automobile buyer: to find a reliable vehicle. Indeed, they usually end up by buying a used, and therefore tested, idea. *Those economists who seek to engage in research on the new ideas of the science - to refute or confirm or develop or displace them - are in a sense both buyers and sellers of new ideas. They seek to develop new ideas and persuade the science to accept them, but they also are following clues and promises and explorations in the current or preceding ideas of the science. It is very costly to enter this market: it takes a good deal of time and thought to explore a new idea far enough to discover its promise or its lack of promise.* The history of economics, and I assume of every science, is strewn with costly errors: of ideas, so to speak, that wouldn't run far or carry many passengers [italics mine].[1]

1 Stigler 1982, p 57

APPENDIX B: ~~ISLAND BIOECONOMICS~~ PROBLEM SOLVING

For those readers particularly interested in the peculiarities and nuances of various island-based methods, Baldacchino (2007) is also without equal, marks the best entrance to the world of island, and delivers a first-rate bibliographical review of island studies. We will merely note a few exceptional and foundational works: Darwin (1859), Carlquist (1974), and Wallace (1880). Arnason, Felt, Bartmann, & Cairns (1995) and Baldacchino, Greenwood, MacKinnon, & Bartmann (1998), and Baldacchino, Milne, Bartmann, Srebrnik, Paterson, & Jolliffe, (2000) were the three foundational collections of our Institute of Island Studies and offer very insightful island methods and case studies. The best case studies, however, are likely only to be discovered by *living, studying,* and *problem solving* on islands.

Although we submit islands offer significant opportunities for problem solving, we trust by now, dear reader, that, since subject matters, including the subject matter of 'scientific method', do not exist, 'Island Bioeconomics' does also not exist. Thus, we notate our recognition of the value of modelling various aspects of relative insularity as ~~*Island Bioeconomics*~~ *Problem Solving*:[1]

Islands serve as lighthouses, as *synecdoches,*[2] socio-economic and ecological models far more representative and far more descriptive than mathematical models.[3] Although our island-based methods do employ mathematics, they do so in the *opposite direction*[4] common to 'continental' economic analysis. These methods have been developed and adopted in light of our recognition of two fundamental economic methodological problems: (1)

1 Funk 2007e

2 Islands are synecdoches: their understanding facilitates a 'coming to grips' with a more complex whole. They also act as advance indicators or extreme reproductions of what is future elsewhere. Crucial, new insights into evolutionary theory, and the realization of so much species differentiation on islands in modern zoogeography, are primarily due to the unwitting and haphazard stumbling of what, at first sight, may have appeared to be inconsequential, island-based, island-specific fieldwork. This includes such investigations as the study of Darwin's finches on the Galapagos Islands (Darwin, 1979; Lack, 1947) or Alfred Wallace's study of birds-of-paradise on the Aru Islands (Wallace, 1975)… The forays of Bronislaw Malinowski amongst the Trobriand (or Kiriwina) Islanders of Papua New Guinea (1922), Margaret Mead to Samoa and the Admiralty Islands (1928; 1934) and Raymond Firth to Tikopia (1936) led to the birth of ethnography (Baldacchino 2007b, p 9).

3 Taleb 2001, p 177 ; Menger & Hayek 1871, p 15 ; Maxwell 1873, p 400 ; Pigou, Memorials, p. 84 ; Hayek 1945, pp 519-530 ; Hayek 1945, pp 519-530 ; Stiglitz 2001, p 475 ; Hayek 1956, pp 519-520.

4 Russell 1919, pp1-2 & pp 194–195

economics is a *derivative science*[1] hereto lacking a tenable theory of value,[2] and (2) that applied mathematical models invariably do not represent truth, because integers do not compete for natural resources and sexual selection.

Darwin's powerful and effective *island-based analysis* enabled us to break through *convenient myths,*[3] *attendant myths,*[4] and grasp global complexity and uncertainty that was beyond our reach; using similar methods *Collapse of Easter Island: Lessons for Sustainability of Small Islands*[5] echoes Von Bertallanfy: "The island microcosm can… help to simplify understanding… related to larger and more complex system dynamics."[6] And "although it is often said that the *Origin of Species* convinced people of evolution because it provided an easily-understood mechanism (natural selection) for evolution, the deluge of articles and books published in 1909, 50 years after the origin, show clearly that it was principally the facts of geographical distribution that had convinced the majority."[7]

In other words, Darwin was able to *describe a very large complex, closed system* (earth) by modeling it with *much smaller,*

1 See Russell 1938

2 See Stigler 1982

3 Modern industrial civilization has developed within a certain system of *convenient myths* [italics mine]. The driving force of modern civilization has been individual material gain which is accepted as legitimate, even praiseworthy, on the grounds that private vices yield public benefits in the classic formulation. Now it's long been understood, very well, that a society that is based on this principle will destroy itself in time. It can only persist with whatever suffering and injustice it entails as long as it's possible to pretend that the destructive forces that humans create are limited, that the world is an infinite resource, and that the world is an infinite garbage can. At this stage of history either one of two things is possible. Either the general population will take control of its own destiny and will concern itself with community interests guided by values of solidarity and sympathy and concern for others. Or alternatively, there will be no destiny for anyone to control. In this possibly terminal phase of human existence, democracy and freedom are more than values to be treasured, they may well be essential to survival (Chomsky 1992, Finale).

4 Human events spring from passions, which generate systems of *attendant myths* [italics mine]. A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason (Russell 1928, pp 6-7).

5 Nagarajan 2006

6 Baldacchino, 2007, p 84.

7 Italics mine, Baldacchino, 2007, p 202.

simplified, semi-closed systems (islands).[1] Island processes are amplified through compression[2] and thus, relative to continents, exhibit explosive rates of evolution.[3] *Therefore islands may enable us to model our Earthly future, to observe socio-economic, political, and ecological conditions on islands (of various degrees of insularity) and to model future global implications: The Problem of Breathing, Eating, & Drinking Poison on Prince Edward Island today is the Problem of Breathing, Eating, & Drinking Poison on Earth tomorrow:*

> All across North America rates of cancer, thyroid dysfunction, learning disabilities, birth defects, environmental sensitivity and other debilitating health conditions are unacceptably high. The costs of these trends are crippling for health care systems, social programs and budgets of all levels of government.[4]

~~*Island Bioeconomics*~~ *Problem Solving* is an island-based methodological approach to economics which rests on a foundation of a theory of value based on relative insularity. Although this methodological approach addresses economic inquiries pertaining to any and *all geographical* locales, we submit you may discover this approach addresses the *false and sandy foundations*[5] of economics which are especially vexing to those who inhabit islands.[6]

But if this method accomplishes nothing else, we hope that it will at least truthfully and irrefutably demonstrate that *we are all islanders!*

---

1 Compared with continents… [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range… their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (Wallace 1880, pp 241-242).

2 It appears almost all ecological and evolutionary processes…are amplified on islands; generally speaking, the smaller the island, the more amplified these processes are. Small size and low diversity seem to be the main factors. With populations existing in miniature, they are prone to stochastic, or random, processes…. Such a mosaic of habitats in a tiny area promotes evolutionary radiation. Conversely, the small size of islands means that they are exquisitely vulnerable to biological invasion and disturbance as there are few distance barriers to dispersal, and few areas are immune to disturbance by inaccessibility. On the plus side, 'amplification by compression' makes islands particularly useful…on islands, process that may be subtle on continents tend to be more clearly exposed (Baldacchino 2007b, p 193).

3 *Rapid evolution of island immigrants is not only possible but frequent. Change after arrival is inevitable.*
"Explosive" evolution is demonstrated by various groups that have had good ecological opportunities [italics Carlquist's 1974, p 20].

4 Novaczek 2007, p2. Also see Barry 2005

5 Keynes 1936

6 My first visits to the developing world in 1967, and a more extensive stay in Kenya in 1969, made an indelible impression on me. Models of perfect markets, as badly flawed as they might seem for Europe or America, seemed truly inappropriate for these countries [and/or SIDS, Stiglitz 2001, p 473).

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(1) One of the most salient features of our culture is that there is so much bullshit. Everyone knows this. Each of us contributes his share. But we tend to take the situation for granted. Most people are rather confident of their ability to recognize bullshit and to avoid being taken in by it. So the phenomenon has not aroused much deliberate concern, nor attracted much sustained inquiry. In consequence, we have no clear understanding of what bullshit is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory (Frankfurt 2005, p 1).

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Funk, M. (2007a). On the problem of global warming: A solution for william funk, albert gore and richard branson. *IIS* working paper.

Abstract: This paper forwards the conjecture that, contrary to consensus, "*The Problem of Global Warming*," is *not* the anthropogenic superheating of the Earth—because this is clearly not the problem—it is merely a single symptom of far more significant problems, which stem from the *Problem of Induction*. In short, *The Problem of Induction* has generated convenient myths which encourage men to act irrationally. Irrationality spawns and

maintains irrational institutions which manufacture consent, drive irrational conspicuous consumption, and, moreover, foster hyperirrational resource consumption—which is *not* limited to the consumption of superheating fossil fuels. This paper proposes a variety of counter-intuitive, viable solutions, but concludes the problem may be insoluble, as the philosophical and methodological foundations which render dominant irrational agents and institutions unable to recognize the true nature of the problem and/or unwilling to act upon otherwise viable solutions.

Funk, M. (2007b). On the problem of global warming II: a brief history of a new & unpopular theory in an open letter to john gillis & ragnar arnason. *IIS* working paper.

Abstract**:** This paper traces the history, evolution, and development of this new and unpopular theory.

Funk, M. (2007c). On the problem of dependent people: natural resource valuation errors in atlantic canadian Island Jurisdictions. *IIS* working paper.

Abstract: Prince Edward Island's Economics, Statistics and Federal Fiscal Relations Division's *33rd Annual Statistical Review* theorized (reported) the total value of 2006 fish landings was CAD 166.6 MM. This paper refutes this conjecture: The total value of fish landings for 2006 was approximately CAD 416.5 MM. Furthermore, this paper submits this error has been consistently generated for all 33 years that the *Annual Statistical Review* has been published. Moreover, this entrenched, systemic error has promoted far more significant problems: a ripple-effect of bias throughout all relative natural resource valuations and destructive land-use policies. These *significant problems* include (1) *The Problem of Continental Economics* and (2) *The Problem of Dependent People*. ~~*Island Bioeconomic*~~ *Problem Solving* comparitive models propose tentative solutions by contrasting fishery management methodology and practice amongst dependent Canadian islanders with the fishery management methodology and practices amongst independent Icelandic islanders. In conclusion, the possibilities that independent people enjoy higher levels of rationality, efficiency, happiness, economic sustainability, general well-being, and are thus, ceteris paribus, less likely to commit errors associated with *The Problem of Induction* are discussed. Likewise, this paper suggests dependent people are more likely to exhibit irrational behaviour, develop deeper dependencies, and to contribute to a wide-array of systemic errors, such as those which exacerbate *The Problem of Global Warming*.

Funk, M. (2007d). On the problem of hollywood economics: de vany's error—george lucas knows something. *IIS* working paper.

Abstract: Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's '*Nobody knows anything*' theory and advance our replacement theory: *George Lucas knows something*.

Funk, M. (2007e). On the problem of sustainable economic development: introducing ~~*island bioeconomics*~~ *problem solving* & an economic theory of value. *IIS* working paper.

Abstract: This paper presents a solution to an open problem in economics: Stigler's 1982 *Problem of Value*. This

universal solution is based upon relative geographical insularity. Ever since Menger's 1883 *Problems of Economics and Sociology*, conscientious economists have understood the implications of Stigler's *Problem of Value*; ever since the *Silent Spring* of 1962, conscientious people everywhere have intuitively understood Stigler's *Problem of Value*. Unfortunately, this near-universal understanding has culminated in a thoroughly misguided quest for *Sustainable Economic Development*. Over the past century, a landfill of literature dedicated to this topic has revealed a significant and near-universal error: Those most able to navigate the perilous seas of economics, astutely demonstrate that neoclassical economic theory fails to pass the test of the second law of thermodynamics, then proceed to report this finding as if at long last Stigler's *Problem of Value* had been solved. Text books, refereed journals, and working papers (especially those denoting "Ecological Economics" as key words) alike conclude that, based upon this *revolutionary new perspective,* we are now positioned to *reshape economic theory and policy.* The primary problem, which appears to elude them all is this: economics is a *derivative* science, not a *primary* science. This paper employs ~~*Island Bioeconomics*~~ *Problem Solving*—an island-based economic modelling technique—in order to demonstrate this fundamental error, and the irrational economic errors and ecological degradation it is generating. Lessons are drawn from Iceland, Prince Edward Island, and beyond. Our *Economic Theory of Value* based on relative insularity axiomates an inverse relationship between relative insularity and economic development. This theory produces a robust, innovative and counterintuitive solution for *Sustainable Economic* Development, and, perhaps a tenable solution to *The Problem of Global Warming*.

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Hayek, F. A. (1960). *The constitution of liberty* (1978 ed.). London: Routledge.

LIBERTY AND EQUALITY: He who confuses political liberty with freedom and political equality with similarity has never thought for five minutes about either. Nothing can be unconditional: consequently nothing can be free. Liberty means responsibility. That is why most men dread it. The duke inquires contemptuously whether his gamekeeper is the equal of the Astronomer Royal; but he insists that they shall both be hanged equally if they murder him. The notion that the colonel need be a better man than the private is as confused as the notion that the keystone need be stronger than the coping stone. Where equality is undisputed, so also is subordination. Equality is fundamental in every department of social organization. The relation of superior to inferior excludes good manners (Shaw 1903, lns 23-30).

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Hume, D. (1739). *A treatise of human nature: Being an attempt to introduce the experimental method of reasoning into moral subjects.*

(1) Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove,*

that those instances, of which we have had no experience, resemble those, of which we have had experience (Hume 1739, Book I, Vol I, p 137).

(2) To falsify a knowledge-claim is to provide evidence that it is false. Since the time of David Hume, empiricist philosophy of science has struggled with the problem of induction: namely, how is it possible to justify inference, from a finite set of instances, to the truth of a universal law whose scope is potentially infinite? In the absence of a convincing answer to this question, our everyday and scientific belief in a regular, ordered, and predictable universe must seem to be a physiologically indispensable, but still irrational, habit of mind.

The original approach to this problem pioneered by Karl Popper involved a reasoned rejection of the question itself. Popper accepted that the problem of induction was insoluble, but it did not follow that science was irrational, or that it could not progress. Instead of seeing discovery of the truth as the aim of science, we should, rather, see scientific activity as a systematic attempt to 'falsify'—or refute—bold and imaginative conjectures about the nature of the world. Popper's formulation of this principle is widely acknowledged as one of the most original contributions to the modern philosophy of science1.

(3) It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this* [italics mine] (Popper 1992, p 36).

(4) *The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today* [italics mine]. But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory.

The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. *Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge* [italics mine] (Popper 1992, p 37).

(5) Hume has permanently influenced the development of the best of philosophers who came after him. *Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing* [italics mine] (Einstein 1956 p 21-22).

(6) There is a problem in inference well-known as the problem of induction. It is a problem that has been haunting science for a long time, but hard science has not been as harmed by it as the social sciences, particularly economics, even more the branch of financial economics (Taleb 2001, p 117).

(7) The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers (Hayek 1991, p 9).

(8) Kant, in his *Critique of Pure Reason*, asserted under the influence of Hume that pure speculation or reason, whenever it ventures into a field in which it cannot possibly be checked by experience, is liable to get involved in contradictions or 'anti-anomies' and to produce what he unambiguously described as 'mere fancies' ; 'nonsense' ; 'illusions' ; 'a sterile dogmatism' ; and 'a superficial pretension to the knowledge of everything' (Popper, 1945, vII, p38).

(9) Reared on Merton's and Scholes teachings of efficient markets, the professors [Nobel Laureates Robert S. Merton and Myron Scholes] actually believed that prices would go and go directly where the models said they should. The professors' conceit was to think that models could forecast limits of behavior. In fact, the models could tell them what was reasonable or what was predicable based on the past" (Lowenstein 2000, p. 234).

(10) Belief that tomorrow's risks can be inferred by from yesterday's prices and volatilities prevails at virtually every investment bank and trading desk." (Ibid, p. 235).

IU. (2008). *Thesis Statements.* Retrieved 1/21/2008, 2008, from http://www.indiana.edu/~wts/pamphlets/thesis_statement.shtml

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Jarvie, I. C., & Pralong, S. (1999). Popper's Open society after fifty years. London ; New York: Routledge. http://rlproxy.upei.ca/login?url=http://site.ebrary.com.rlproxy.upei.ca/lib/upei/Doc?id=10017068

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Menger, C. (1883). *Problems of economics and sociology (untersuchungen über die methode der socialwissenschaften und der politischen oekonomie insbesondere)*. 1963 edition. Urbana: University of Illinois Press.

McMahon, Timothy F. (1998). *Carcinogenicity of chlorothalonil: data in support of a non-linear mechanism for carcinogenicity*. The United States of America Environmental Protection Agency Scientific Advisory Panel (SAP) Risk Assessment and Science Support Branch, Antimicrobials Division Senior Toxicologist Report, Session 4: July 1998 Meeting: http://www.epa.gov/scipoly/sap/meetings/1998/july/session4.pdf

Abstract: The Office of Pesticide Programs, U.S. Environmental Protection Agency (U.S. EPA), has recently characterized the fungicide Chlorothalonil as "likely" to be a human carcinogen" by all routes of exposure (Memorandum dated October 20, 1997 from Timothy F. McMahon to Walter Waldrop/Andrew Ertman). This decision is based on: 1) evidence of increased incidence of renal adenoma, carcinoma, and adenoma/carcinoma combined in Fischer 344 rats following chronic administration of chlorothalonil at doses of 15 and 175 mg/kg/day; 2) papilloma and/or papilloma/carcinoma of the forestomach combined in Fischer 344 rats at 175 mg/kg/day, and 3) increased incidence of forestomach carcinoma in CD-1 mice at 214 mg/kg/day. Based on the evidence characterizing the mode of action for production of renal and forestmach tumors, the Office of Pesticide Programs (OPP) concluded that Chlorothalonil met the cancer risk assessment guideline criteria for non-linearity of the dose response and that the Margin-of-Exposure approach be used for purposes of cancer risk assessment for chlorothalonil. Following is background material leading to this determination.

Mittelstaedt, M. (2006, 06/12/2006). PEI'S killing fields: 'Pesticides are what is killing our kids'. *Globe & Mail*.

Abstract: PEI would be a good place to shed more light on the health effects of agricultural chemicals because areas such as Kensington have some of the highest airborne concentrations of pesticides around farm fields in the world, and a sizeable rural population literally living on the doorstep of the spraying (p 1).

Nasar, S. (1998). *A beautiful mind : a biography of John Forbes Nash, Jr., winner of the Nobel Prize in economics, 1994*. New York: Simon & Schuster.

Nash, J. F. (1950). *Non-cooperative games* from http://www.princeton.edu/mudd/news/faq/topics/Non-Cooperative_Games_Nash.pdf

Nash, J. (1951). Non-Cooperative Games. *The Annals of Mathematics, 54*(2), 286-295. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0003-486X%28195109%292%3A54%3A2%3C286%3ANG%3E2.0.CO%3B2-G

Novaczek, I. (2007). *Submission to the standing committee for agriculture, forestry and environment*. Submitted by Dr Irene Novaczek, Director IIS, UPEI at Charlottetown, PEI, Tuesday 11 December 2007.

Pesticides are designed to kill, and scientific evidence increasingly supports the public's perception that exposure to even small amounts - whether in the air we breathe, the water we drink or the food we eat - is likely to increase our risks of contracting cancer or suffering other impacts such as thyroid dysfunction and nervous system impairment. Of particular concern are impacts on children which can include increased risk of ADD/ADHD and violent personality disorders; impacts on pregnant women and both men and women of childbearing age, in the form of increased rates of birth defects; and impacts on people whose health is already poor, such as the elderly infirm and people with highly sensitive or compromised immune systems.

We know from the 1999 provincial water quality report, and from the federal government's air quality research, that mixtures of pesticides at parts per billion concentrations can be found in domestic wells close to potato and blueberry fields; that an even greater array of toxins are detectable in PEI streams and rivers; and that airborne pesticides, especially the fungicide chlorothalonil, are in every breath we take over the summer and autumn agricultural season. This is not just a human health issue but one that affects the whole food chain. Recent laboratory studies performed by Dr Wayne Fairchild of DFO indicate that such low concentrations (ppb) of certain commonly used insecticides are lethal or damaging to larval lobsters. Clams in estuaries such as the Mill River already exhibit a haemolytic disease that in other jurisdictions has been linked to toxins in the environment. And fish kills continue to plague our rivers despite efforts to control runoff of pesticides and fertilizers from agricultural land….

All across North America rates of cancer, thyroid dysfunction, learning disabilities, birth defects, environmental sensitivity and other debilitating health conditions are unacceptably high. The costs of these trends are crippling for health care systems, social programs and budgets of all levels of government. Demographic research reveals that on PEI, despite the absence of heavy industry, the bucolic landscape and appearance of pristine environments that attract tourists, we suffer from higher than average rates of cancer compared to other provinces, even after controlling for our ageing population. Thyroid problems, ADD in children, asthma and environmental diseases are also serious concerns….

On PEI, we have a population of 138,000 on a total land base of 566,000 hectares. Just under half of the land is used for agriculture; between 6 and 9% is under municipal governance - around 40,000 hectares. PEI's annual pesticide sales amount to over 1.1 million kg of active toxic ingredients/yr: that's 8 kg/yr for every man, woman and child living on the island – far in excess of the North American average (1.5 kg/person/yr).

Estimates from other jurisdictions suggest that 90% of all pesticides sold are applied for agricultural purposes, with about 10% being used at the household level. Urban use of pesticides, although less than agricultural use in terms of total annual weight, is of concern because these applications are made intensively, in environments where humans are most concentrated. Also, urban pesticide users apply a relatively greater amount of highly toxic insecticides, whereas agricultural chemicals used on PEI are predominantly (by weight) fungicides and herbicides.

Typically, application rates for agricultural pesticides are in the range of 0.8-1 kg of active ingredients per hectare. On PEI we may have an anomalous situation, judging from Environment Canada research that shows that potato fields may receive more than 6 kg ai/hectare over the growing season. In general, urban garden applications of pesticides in Canada are similarly intense, averaging 3-4 kg ai/hectare. Much of this intensive pesticide application–probably in excess of 100,000 kg ai/yr–is being applied in our top 10 most populous municipalities where over 70% of Islanders live and many more work–most notably in Charlottetown and Summerside (pp 1-3).

Von Neumann, J., & Morgenstern, O. (2004). *Theory of games and economic behavior* (60th anniversary ed.). Princeton, N.J. ; Woodstock: Princeton University Press.

North, D. C. *Corporate Leadership in an Uncertain World*. Retrieved 10/22/2007, 2007, from http://www.conference-board.org/publications/annualEssay.cfm

Popper, K. R. (1945). *The open society and its enemies*. London: G. Routledge & Sons, Ltd.

Popper, K. R. (1956). ON THE NON-EXISTENCE OF SCIENTIFIC METHOD. (preface from 1956 edition, Vol. I of the Postscript to 1983 edition of The Logic of Scientific Discovery edited by W.W. Bartley III ed.,). London: Routledge.

Popper, K. R. (1959). *The logic of scientific discovery* [Logik der Forschung, 1935, Vienna, Austria] . London ; New York: Routledge.

Abstract: This is the book where Popper first introduced his famous "solution" to the problem of induction. Originally publish in German in 1934, this version is Popper's own English translation undertaken in the 1950s. It should go without saying that the book is a classic in philosophic epistemology--perhaps the most important such work to appear since Hume's "*An Enquiry Concerning Human Understanding.*" Popper argues that scientific theories can never be proven, merely tested and corroborated. Scientific inquiry is distinguished from all other types of investigation by its testability, or, as Popper put, by the falsifiability of its theories. Unfalsifiable theories are unscientific precisely because they cannot be tested (Nyquist, 2001).

(1) Emile Zola described a work of art as a corner of nature seen through a temperament. The philosopher Karl Popper, the economist F.A. Hayek, and the art historian K. H. Gombrich have shown that the creative process in science and art consists of two main activities: an imaginative jumping forward to a new abstraction or simplified representation, followed by a critical looking back to see how nature appears in the light of the new vision (Peter Mitchell, *Nobel Banquet Speech*, 1978).

(2) My characteristics as a scientist stem from a non-conformist upbringing, a sense of being something of an outsider, and looking for different perceptions in everything from novels, to art to experimental results. I like complexity, and am delighted by the unexpected. Ideas interest me. I was influened early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper… (Peter C. Doherty, *Nobel Lecture*, 1996).

(3) Popper believed the "discovery was not a matter of logic" but rather the application of methodology, which fits the discovery of cointegration. This insight intrigues me. (Clive Granger, *Nobel Lecture*, 2003).

Popper, K. R. (1962). *Conjectures and refutations : The growth of scientific knowledge* (First Edition Preface from the 1963 Routledge edition ed.)

Popper, K. R. (1963). *Conjectures and refutations : The growth of scientific knowledge* (Originally published: 5th ed., rev. London ; New York : 2002. ed.). London ; New York: Routledge Classics.

Popper, K. R. (1992). *In search of a better world* [Auf der Suche nach einer besseren Welt.] (Laura J. Bennett, with additional material by Melitta Mew Trans.). London ; New York: Routledge.

All the great scientists realized that every solution to a scientific problem raises many new and unsolved problems. Our knowledge of our ignorance, becomes increasingly conscious, detailed and precise, the more we learn about the world. Scientific research is the best method we have for obtaining information about ourselves and about our ignorance. It leads us to the important insight that there may be great differences between us with regard to minor details of what wed may perhaps know, yet we are all equal in our infinite ignorance (, p 40).

Popper, K. R. (1999). *All life is problem solving* [Alles Leben ist Problemlösen.] . London ; New York: Routledge.

Popper, K. R., & Bartley, W. W. (1956). *Realism and the aim of science* (1983, including Popper's introduction from the 1982 edition and Popper's preface from 1956 edition ed.). London: Routledge.

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Reichenbach, H. (1938). *On probability and induction*, Philosophy of Science, 5, 21–45.

Reichenbach, H. (1940). *On the justification of induction*, The Journal of Philosophy, 37, 97–103.

Reichenbach, H. (1942). From copernicus to einstein. New York: Alliance Book Corp.

Reichenbach, H. (1949). *The theory of probability*, University of California Press.

Reichenbach, Hans. (1951). University of California Press (full, searchable online version at Google Books: http://books.google.com/books?vid=ISBN9780520010550.

Abstract: This book represents a new approach to philosophy. It treats philosophy as not a collection of systems, but as a study of problems.

Rowbottom, D.P., Aiston, S.J. (2006). The Myth of 'Scientific Method' in Contemporary Educational Research. *Journal of Philosophy of Education, 40*(2), 137-156.

Russell, B. (1908). Mathematical Logic as Based on the Theory of Types. *American Journal of Mathematics, 30*(3), 222-262. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0002-9327%28190807%2930%3A3%3C222%3AMLABOT%3E2.0.CO%3B2-G

Russell, B. (1915). *War, the offspring of fear*. London: Union of Democratic Control.

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Russell, B. (1922). *Free thought and official propaganda*. London: Watts & co., etc.

Russell, B. (1928). *Sceptical essays*. London: G. Allen & Unwin.

(1) The search for happiness based upon untrue beliefs is neither very noble nor very glorious. There is a stark joy in the unflinching perception of our true place in the world, and a more vivid drama than any that is possible to those who hide behind the enclosing walls of myth (p 21).

Russell, B. (1938). *Power*. London: Routledge Classics 2004 edition, preface by Samuel Brittan, introduction by Kirk Willis.

Economic power, unlike military power, is not primary, but derivative. Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but *when large issues are involved it depends upon war or the threat of war.* It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it [all italics mine, p 95].

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Abstract: The lecture focuses on the reasons that new ideas are accepted or rejected by a science. A distinction is drawn between pre-scientific and scientific stages of a discipline. The diverse fates of new ideas are illustrated by a variety of episodes in the history of economics, including the economics of information and the theory of economic regulation.

(1) In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This

central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories (p 61).

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On the Problem of Sustainable Economic Development I:
The Funk-Zweikampf Solution to this Prisoner's Dilemma

Introducing a Unified Theory of Value for the Biological and Social Sciences
in an Open Letter to Partha Dasgupta

. . . . ill hold. There are situations in economics or international politics in which, effectively, a group of interests are involved in a non-cooperative game without being aware of it; the non-awareness helping to make the situation truly non-cooperative.

(John Nash, NON-COOPERATIVE GAMES,[1] 1950)

Setting Day, 1 May 2008

Matt Funk
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Charlottetown, PE, Canada
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1 (a) It is conventional to call these situations "games" when they are being studied from an abstract mathematical viewpoint. Here the original situation is reduced to a mathematical description, or model. In the abstract "game" formulation only the minimum quantity of information necessary for the solution is retained. What the actual alternative courses of action are among which the individuals must choose is not regarded as essential information. These alternatives are treated as abstract objects without special qualities and are called "strategies." Only the attitudes (like or dislike) of the two individuals towards the ultimate results of the use of the various possible opposing pairs of strategies are considered (Nash 1953, 128).
(b) A game is non-cooperative if it is impossible for the players to communicate or collaborate in any way (Ibid, pp 128-129).
(c) Nowadays it almost seems to be obvious that the correct application of Darwinism to problems of social interaction…requires the use of non-cooperative game theory (Selten 1994, p 168).

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ABBREVIATIONS & DEFINITIONS

Byr **Billion Years**

ESS **Evolutionary Stable Strategy**

Maynard Smith and Price (1973) introduced the concept of an evolutionarily stable strategy (ESS). Initially they were not aware of the relationship between the concept of an ESS and that of a Nash equilibrium. Rational game theory looked at mixed strategies as produced by conscious randomization. Nash's interpretation of a mixed equilibrium as a mass action phenomenon was buried in his unpublished dissertation and not found in textbooks on game theory. In biology the mass action interpretation is very natural and guided the work on evolutionary stability already from its beginning. In their original paper, Maynard Smith and Price (1973) restricted their attention to two person games in normal form. They defined an ESS as a strategy prescribed by a symmetric equilibrium point.[1]

GEMS **Globalized Economic Military Superpowers**

Presently, the United States of America represents the only true player in this arena, but our definition includes all five signatory members of the UK-USA agreement (UK, USA, Canada, Australia, and New Zealand), often referred to as AUSCANZUKUS, and six other nations which have developed, detonated, and maintain nuclear weapons (Russia, France, China, India, Pakistan, and North Korea). As noted below (RIIS), however, GEMS status is not absolute.

Myr **Million Years**

NE **Nash Equilibrium**

The notion of an equilibrium point is the basic ingredient in our theory. This notion yields a generalization of the concept of the solution of a two-person…game. It turns out that the set of equilibrium points of a two-person…game is simply the set of all pairs of opposing "good strategies."[2]

RIIS **Relatively Insular Island States**

This category includes sovereign island nations, sub-national island jurisdictions, insular provinces (i.e. Newfoundland & Labrador), states (i.e. Hawaii), municipalities (i.e. Vancouver Island), and relatively insular jurisdictions (i.e. The Alpine Convention[3]) Given relative insularity (see Axiom VII), we divide geopolitical regions into (1) RIIS and (2) GEMS, but in reality, naturally, the true relative insularity of each region lies along a sliding scale with a true GEMS at one end (The United States) and a true RIIS, such as the big island of Hawaii[4] at the other.

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1 Selten 1994, p 168.

2 Nash 1950, p 286.

3 AWARE that the Alps are one of the largest continuous unspoilt natural areas in Europe, which, with their outstanding unique and diverse natural habitat, culture and history, constitute an economic, cultural, recreational and living environment in the heart of Europe, shared by numerous peoples and countries, RECOGNIZING that the Alps constitute the living and economic environment for the indigenous population and are also vitally important for extra-Alpine regions, being the site of important transport routes, for example, RECOGNIZING the fact that the Alps constitute an essential habitat and last refuge for many endangered species of plants and animals AWARE of the substantial differences existing between national legal systems, natural conditions, population distribution, agriculture and forestry, the state and development of the economy, the volume of traffic and the nature and intensity of tourism, AWARE that the evergrowing pressures caused by man are increasingly threatening the Alpine region and its ecological functions, and that the damage is either irreparable or rectifiable only with great effort, at considerable cost and, as a rule, over a long period of time, CONVINCED of the need for economic interests to be reconciled with ecological requirements (Alpine Conference Ministers, 1989).

4 This early, preliminary finding may surprise some, as an intuitive hunch may bring to mind islands which may seem more insular to mind, such as Pitcairn. However, consider Pitcairn's major insularity values (Funk, forthcoming) are: Land Area: 62 km², Nearest Continent: 4800 km, Nearest Neighbour: 1000km, Population Density: 9.3 km², International Airports: 0, Deep water Harbours: 0, Tourist visits/year: 0 Forested Land: 70%, Commercial Agriculture Production: 0%, Subsistence Agriculture/Fishing: 100%, Elevation: 4m, Sovereign Power: 0, Constitutional Power: 0, Military Power 0. Naturally, these values will be discussed in great detail (in Parts II and III of this discourse), but we will merely note for the sake of contextualization that, despite impressive numbers (such as distance from continent and subsistence agriculture/fishing: 100%), the Elevation, and the Sovereign, Constitutional, and Military Power values have a decidedly negative impact on Pitcairn's otherwise relatively high-degree of relative insularity.

TPD **The Prisoner's Dilemma**

(a) Al Tucker was on leave at Stanford in the Spring of 1950 and, because of the shortage of offices, he was housed in the Psychology Department. One day a psychologist knocked on his door and asked what he was doing. Tucker replied: "I'm working on game theory.", and the psychologist asked if he would give a seminar on his work. For that seminar, Al Tucker invented the Prisoner's Dilemma as an example of game theory.[1]

(b) The Prisoner's Dilemma… is a game where two players have the option to cooperate or to defect. If both cooperate they receive the reward, *R*. If both defect they receive the punishment, *P.* If one cooperates and the other defects, then the cooperator receives the sucker's payoff, S, while the defector receives the9 temptation, *T*. The Prisoner's Dilemma is defined by the ranking $T>R>P>S$.

Would you cooperate or defect? Assuming the other person will cooperate it is better to defect, because $T>R$. Assuming the other person will defect it is better to defect, because $P>S$. *Hence, no matter what the other person will do it is best to defect. If both players analyze the game in this rational way then they will end up defecting. The dilemma is that they both could have received a higher payoff if they had chosen to cooperate. But cooperation is irrational*.[2]

(c) This "collective-risk social dilemma" exists in various social scenarios, the globally most challenging one being…climate change.[3]

TPGW **The Problem of Global Warming**

Contrary to popular opinion, "*The Problem of Global Warming*," is *not* ecological distress due to the superheating of the Earth—because this is clearly not the problem—it is merely a single symptom of far more significant, inter-related problems, which stem from the *Problem of Induction.* In short, this *Problem of Induction* generates myths which may encourage irrational behaviours which result with unintended outcomes. In short, this problem is synonymous with *The Problem of Sustainable Economic Development*.[4]

TVAL **Theory of Value**

(a) As a man's judgement about value, so, in the last resort, must his judgement about economics. Value is the essence of things in economics. Its laws are to political economy what the law of gravity is to mechanics. Every great system of political economy up till now has formulated its own peculiar view on value as the ultimate foundation in theory of its applications to practical life, and no new effort at reform can have laid an adequate foundation for these applications if it cannot support them on a new and more perfect theory of value (Wiesel 1893, p xxx).

(b) In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories (Stigler 1982, p 61).

TPI **The Problem of Induction**[5]

[Solution Part I:] Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience*.[6]

[Solution Part II:] According to a widely accepted view… the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be

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1 Kuhn 1994, p 161. For A.W. Tucker's version, see APPENDIX I: TUCKER 1950.

2 Italics mine, May & McLean, 2007, p 8. Also see APPENDIX I, Cressman 1996, Hauert 2006, Weibull & Salomonsson 2006

3 Milinski et. al. 2008, p 2291.

4 Funk 2007a.

5 Also see Cournot 1838, Reichenbach 1930, 1966, Reichenbach et. al. 1971, Russell 1903, 1908, 1913, 1919, 1948, and Wittgenstein 1969. Most works by Popper address this problem from various angles and within variable contexts.

6 Italics mine, Hume 1739, Book I, Vol I, p 137.

identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences.…

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity' [Reichenbach, Erkenntnis 1, 1930, p. 186]. At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads…to an infinite regress.[1]

(exempli gratia: a) It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this*.[2]

(exempli gratia: b) *The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today.* But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory.

The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. *Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge*.[3]

(exempli gratia: c) Hume has permanently influenced the development of the best of philosophers who came after him. *Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing.*[4]

(exempli gratia: d) There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility we must ready ourselves for.[5]

(exempli gratia: e) The assumption that economists can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers.[6]

(exempli gratia: f) There is a problem in inference well-known as the problem of induction. It is a problem that has been haunting science for a long time, but hard science has not been as harmed by it as the social sciences, particularly economics, even more the branch of financial economics.[7]

(exempli gratia: g) Reared on Merton's and Scholes teachings of efficient markets, the professors actually believed that prices would go and go directly where the models said they should. The professors' conceit was to think that models could forecast limits of behavior. In fact, the models could tell them what was reasonable or what was predicable based

1 Popper 1959, pp 31-35.

2 Italics mine, Popper 1994, p 36.

3 All italics mine, Popper 1994, p 37.

4 Italics mine, Einstein 1956 p 21-22.

5 Botton 2000, p 90.

6 Hayek 1991, p 9.

7 Taleb 2004, p 117.

on the past.[1]

(exempli gratia: h) Recall that I have waged a war against the charlatanism of some prominent financial economists for a long time. The points are as follows. One Harry Markowitz received something called the Nobel Memorial Prize in Economics…

What is his achievement? Creating an elaborate method of computing *future* uncertainty… An immediate result of Dr. Markowitz's theory was the near collapse of the financial system in the summer of 1998… by Long Term Capital Management ('LTCM'), a Greenwich, Connecticut, fund that had for principals two of Dr Markowitz's colleagues, 'Nobels' as well"…

Somehow they thought they could scientifically 'measure' their risks. They made absolutely no allowance in the LTCM episode for the possibility of their not understanding markets and their methods being wrong."[2]

(exempli gratia: i) Kant, in his Critique of Pure Reason, asserted under the influence of Hume that pure speculation or reason, whenever it ventures into a field in which it cannot possibly be checked by experience, is liable to get involved in contradictions or 'anti-anomies' and to produce what he unambiguously described as 'mere fancies' ; 'nonsense' ; 'illusions' ; 'a sterile dogmatism' ; and 'a superficial pretension to the knowledge of everything.'[3]

TPSED **The Problem of Sustainable Economic Development[4]**

TSL **The Struggle for Life**

(a) Nothing is easier than to admit in words the truth of the universal S*truggle for Life*, or more difficult--at least I have found it so--than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.[5]

(b) Our objective here is not to come up with a ponderous definition of war,[6] but rather to grasp its essence: *Zweikampf*:[7] *The Struggle for Life*. War is actually nothing but a series of *Struggles for Life*. It may be most helpful to think of the innumerable struggles that make up war as a single unit, to imagine two wrestlers locked in a hold, each struggling to impose his will, to attack, to defend against counter-attack, to render his opponent incapable or further resistance, and, both generally and ultimately, to survive the *Struggle for Life*.[8]

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1 Lowenstein 2000, p 234.

2 Taleb 2001, pp 241-242.

3 Popper, 1945, vII, p38.

4 See page 4: *The Problem of Global Warming* ; also see page 8: Axiom II.

5 Darwin 1859, p 62.

6 (a) Can war be rational?… The answer is yes, it can be. In one of the greatest speeches of all time – his second inaugural – Abraham Lincoln said: "Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came." It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem (Aumann 2005, p 351).

(b) We need to think very carefully about how military force is used. Game theory can serve us in such analysis, by providing a framework for probing the inextricable connections between our adversaries' decision problems and our own (Myerson 2007b, p1).

7 The essence of war is a violent struggle between two hostile, independent, and irreconcilable wills, each trying to impose itself on the other. War is fundamentally an interactive social process. Clausewitz called it a *Zweikampf* [*The Struggle for Life*]…and suggested the image of a pair of wrestlers locked in a hold, each exerting force and counterforce to try to throw the other. War is thus a process of continuous mutual adaptation, of give and take, move and countermove (Gray 1997).

8 Clauswitz 1832, p 1. The author would like to thank Simone Stahel-Webster for her assistance with this English translation; naturally, any errors or omissions may be attributed singularly to the author.

ABSTRACT

This paper offers two independent proofs of our solution to *The Problem of Sustainable Economic Development,* and a solution to *The Problem of Economic Value*.[1] We introduce a unified theory of value for the biological and social sciences,[2] axioms, and demonstrate our theory's power with a falsification of "Ecological Economics." Our axioms serve as the first of our two independent derivations of our economic development solution.[3] Next, we model contemporary global economic development by playing a non-cooperative game within the boundaries of our axioms. We divide biogeographical[4]/political regions, and, based upon relative insularity, distil 2 players:[5] P_1: *Relatively Insular Island States* (RIIS), and P_2: *Global Economic Military Superpowers* (GEMS). Economic development strategies: S_1: *Maximum Economic Development,* and S_2: *Maximum Ecological Preservation.* We discover the optimal strategy for RIIS = S_2 and GEMS = S_1, and the rational economic rational output from each strategy is S_1 = GUNS and S_2 = BUTTER. This subjective, correlated equilibrium recognizes uncertainties inherent in our axioms. We note our solution represents the Prisoner's Dilemma. We also note, that, ceteris paribus, based upon revealed 20th and 21st century preferences, RIIS strategy has been (again, in general, all else held equal) sub-optimal/irrational (S_1). Strategic[6] Equilibrium[7]/ESS[8] is attained when players pursue respective rational, opposing (*Zweikampf*)[9] economic development strategies. Equilibrium, however, offers windfalls: surplus value is created (RIIS-driven ecological preservation); equilibrium also balances (1) *Political* and (2) *Planetary* uncertainties. Moreover, our non-cooperative, strategic equilibrium paves the way for rational, mutually beneficial, cooperative behaviour, and a net increase of ecological preservation: RIIS cooperate, form coalitions, and struggle for greater insularity (ecological preservation). At the same time, GEMS fight for development, finance national and global defense R&D, extraterrestrial exploration, and seek solutions to critical threats to life on earth. Surplus value is also created through strategic transparency: when GEMS and RIIS recognize their respective opposing and antithetical strategies are both rational, then each side negotiates more rationally, efficiently, and effectively.

1 See page 4: THEORY OF VALUE.

2 Which, naturally, also serves as our *Economic Theory of Value.*

3 Which is accomplished by the end of page 12.

4 Biogeography is the study of the distribution and patterns of distribution of plants, animals and other organisms across the globe, on land, in the sea and in the air (Spellerberg & Sawyer 1999, p xi).

5 The chief justification for this brutal abstraction is that it allows many of the underlying processes to be described simply and more clearly (Coulson & Godfray 2007, p 17).

6 What do I mean by "strategic equilibrium"? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior*. Sharing that Prize were John Harsanyi, for formulating and developing the concept of *Bayesian* equilibrium, i.e., strategic equilibrium in games of incomplete information; and Reinhard Selten, for formulating and developing the concept of *perfect* equilibrium, a refinement of Nash's concept… Along with the concepts of *correlated* equilibrium (Aumann 1974, 1987), and *strong* equilibrium (Aumann 1959), both of which were cited in the 2005 Prize announcement, the above three fundamental concepts constitute the theoretical cornerstones of noncooperative game theory [all italics Aumann's 2005, p 352].

7 See page 3.

8 See page 3.

9 See page 6: *The Struggle for Life.*

A UNIFIED THEORY OF VALUE FOR THE BIOLOGICAL AND SOCIAL SCIENCES[1]
&
SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT

> We give two independent derivations of our solution of the two-person…game. The [first] approach is by the axiomatic method. *One states as axioms several properties that it would seem natural for the solution to have and then one discovers that the axioms actually determine the solution uniquely. The two approaches to the problem, via the negotiation model or via the axioms, are complementary; each helps to justify and clarify the other.*[2]

AXIOM I The Ground Zero Premise

The Problem of the Struggle for Life

Survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a survival enterprise. It follows that survival is the… "problem" for human societies as well; it is a prerequisite for any other, more exalted objectives. Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely.…Our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern governments… [is] either directly or indirectly related to the meeting of our basic survival needs.[3]

AXIOM II The R-3[4] Premise

The Problem of Sustainable Economic Development

Global natural Resource consumption is approximately three times (3x) the earthly replenishing rate. In light of *The Tragedy of the Commons,*[5] though this problem may be soluble on local, municipal, regional, and even on national levels, it is insoluble on a global scale.

AXIOM III The Ecologcial Uncertainty Premise

Axiom II threatens Axiom I.

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1 These 7 Axioms rest upon the fundamental physical laws of science (and, naturally all established sub-sets of these laws), but naturally acknowledge the well-established conclusion that, although both Einstein's and Newton's theories have been verified consistently, both cannot be valid. This footnote merely acknowledges our solution adheres to and does not conflict with the Physical Laws of Science: (i) *Fluid Mechanics* (Archimedes' Principle), (ii) *Force, Mass, and Inertia* (Kepler's Three Laws of Planetary Motion, Newton's Three Laws of Motion, Newton's Law of Universal Gravitation), (iii) *Heat, Energy, and Temperature* (Newton's Law of Cooling, Boyle's Law, Law of Conservation of Energy, Joule's First and Second Law, The Four Laws of Thermodynamics), and (iv) *Quantum Mechanics* (Heisenberg's Uncertainty Principle). Furthermore, we hereby submit our unified theory of the biological and social sciences maps the range of scientific knowledge: (1) lower limit of what must be known, and (2) the upper limit of what may be known.

2 Italics mine, Nash 1953, p 129.

3 Corning 2000, abstract.

4 Resource Replenishing Rate.

5 Lloyd 1832 ; Hardin 1968. Also see Ludwig et. al 1993.

AXIOM IV The Political Uncertainty Premise

The Problem of Warfighting:[1]

(i) (1) the system is anarchic, (2) all great powers have some offensive military capability, (3) states can never be certain about other states' intentions, (4) states seek to survive, and (5) great powers are rational actors or strategic calculators.[2]

(ii) Extinction follows chiefly from the competition of tribe with tribe, and race with race. Various checks are always in in action, …which serve to keep down the numbers of each…tribe, such as…famines,…wars, accidents, sickness,… infanticide, and, perhaps, lessened fertility from less nutritious food, and many hardships. If from any cause any one of these checks is lessened, even in a slight degree, the tribe thus favoured will tend to increase; and when one of two adjoining tribes becomes more numerous and powerful than the other, the contest is soon settled by war.[3]

AXIOM V The Planetary Uncertainty Premise

(i) *The Problem of Supernovas*

(ii) *The Problem of Ohmic Decay*[4]

(iii) *The Problem of Meteorites*[5]

(iv) *The Problem of Chaotic Behaviour*[6]

(v) *The Problem of Super-Eruptions*[7]

(vi) *The Problem of Solar Flux*[8]

AXIOM VI The Deductive Premise

The Problem of Induction[9]

Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience*.[10]

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1 Can war be rational?…The answer is yes, it can be. In one of the greatest speeches of all time – his second inaugural – Abraham Lincoln said: "Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came." It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem (Aumann 2005, p 351).

2 Mearsheimer, p 112, 2006c.

3 Darwin 1888, p 912.

4 Kuang & Bloxham 1997.

5 Wisdom 1985.

6 Wisdom 1987.

7 McQuire 2002.

8 Lovelock & Whitfield 1982.

9 See page, p 5.

10 Italics mine, Hume 1739, Book I, Vol I, p 137.

AXIOM VII The Insularity Premise

The Problem of Value[1]

The search for an economic theory of value may have begun with Aristotle.[2] For the next half-century, however, very little progress was made,[3] and the self-refuting theory tabled by in 1776 by Smith[4] was fully adopted by the classical school and generally accepted for nearly a century. The German school grew critical, however, and this Germanic scepticism gave birth to the Austrian School and their quest for a *Theory of Value*, which began with a very independent professor of political economy at the University of Vienna, the Austrian School's founding father, Carl Menger (1840–1921).[5] In his 1871 *Grundsätze der Volkswirtschaftslehre* (*Principles of Economics*)[6], Menger outlines his groundbreaking theory.[7] Perhaps the most convoluted and impossibly complex theory may have been tabled by Walras in 1886.[8] Walras, however, was certainly not alone in his approach. Indeed, all known (to this fairly well-read author, that is) attempted solutions since Menger have, essentially, followed Wieser's method,[9] and, despite the extraordinary efforts from Aristotle to Smith to Menger to Weiser to Stigler, economics has remained without a theory of value (that is, until the present discourse). Note, however, the development of our theory has *not* followed the the methodological

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1 See page 4: *Theory of Value*.

2 As early as Aristotle we find an attempt to discover a measure of the use value of goods and to represent use value as the foundation of exchange value. In the *Ethica Nicomachea* (v. 5. 1133a, 26–1133b, 10) he says that "*there must be something that can be the measure of all goods*. . . . This measure is, in reality, nothing other than need, which compares all goods. For if men desire nothing or if they desire all goods in the same way, there would be no trade in goods [italics mine, Menger 1871].

3 Ibid.

4 It has been said that one finds in Adam Smith nearly all the explanations of value which have ever been attempted. What is certain is that, in his explanation, Adam Smith has put together two views that contradict each other (Wieser 1893, p xxvii).

5 As I feel a bit of reverence building up, I will take a moment to offer discloser in the name of transparency: since I feel a debt of inestimable gratitude for the Austrian School (Hayek and Popper in particular), I may be prone to being overly sympathetic to their positions (I will, for example, mostly ignore Walras and Jevons, whom seem to me as foolish as Irving Fisher (see Funk 2007b).

6 The impartial observer can have no doubt about the reason our generation pays general and enthusiastic tribute to progress in the field of the natural sciences, while economic science receives little attention and its value is seriously questioned by the very men in society to whom it should provide a guide for practical action. Never was there an age that placed economic interests higher than does our own. Never was the need of a scientific foundation for economic affairs felt more generally or more acutely. And never was the ability of practical men to utilize the achievements of science, in all fields of human activity, greater than in our day. If practical men, therefore, rely wholly on their own experience, and disregard our science in its present state of development, it cannot be due to a lack of serious interest or ability on their part. Nor can their disregard be the result of a haughty rejection of the deeper insight a true science would give into the circumstances and relationships determining the outcome of their activity. The cause of such remarkable indifference must not be sought elsewhere than in the present state of our science itself, in the sterility of all past endeavours to find its empirical foundations. Every new attempt in this direction, however modest the effort, contains its own justification. To aim at the discovery of the fundamentals of our science is to devote one's abilities to the solution of a problem that is directly related to human welfare, to serve a public interest of the highest importance, and to enter a path where even error is not entirely without merit (preface).

7 (a) It is in Austria, in the lineal succession to Menger, that the development of the new value theory is to be sought (Wieser 1893, p xxxiv).
(b) In Chapter III, Menger (1871) presents his groundbreaking *Theory of Value;* the essence, clarity, and promethean insight of this chapter may best sampled in Section E: *The value of the services of land, capital, and labour, in particular.*

8 That of Walras, though admirable of its kind, suffers, to my mind, from the preponderance of the mathematical element. The laws which govern amounts of the value undoubtedly allow of a mathematical expression ; nay, the more complicated of these can be expressed exactly only by means of mathematics ; and here certainly mathematics has a great task to fulfil. But in the value theory we have to do with something more than the expression of the laws of amounts. The obscure conception of value is to be made clear ; *all its manifold forms are to be described* [italics mine] ; the service of value in economic life is to be analysed ; the connection of value with so many other economic phenomena is to be shown (Wieser 1893, p xxxiii).

9 The economist who undertakes to explain value has to explain the procedure of those who value. He describes in plain language the meaning of transactions carried on, times without number, by all of us. He does, on a large scale and with a difficult subject, the same thing as one who accurately describes some trade or some mechanical operation, which every one can do, but which it is not easy, without the assistance of concrete instances, to present and follow up in all its complexity of conditions (1893, p 5).

approach common to all previous attempts. Armed with the understanding that insularity is the key to biological diversity and evolutionary fitness (including, for example, *economic* evolutionary fitness),[1] our theory of value is constructed by demonstrating that *value* (V) is a *derivative function* of relative insularity; we are able to quantify value far more accurately *and* far more easily by quantifying it *indirectly*.[2] Aside from the originality of value based upon insular qualities, the *derivative nature* of this theory is what lends this insight elegance,[3] simplicity, and power: $V=f'(I_R)$! The beauty and utter simplicity of this theory, what truly sets it apart from every attempted solution for the past two centuries, is that it is the first which expressly does *not* attempt to "describe all manifold forms," and "the myriad connections of economic phenomena;" rather, this theory describes the *environment*[4] in which economic value is created (from which it is *derived)!* In other words, the relative insularity of a biogeographic region itself is *not* what makes it valuable, the value is *derived* as a byproduct of this insularity. For example, backing out to the most macro-view, a quick look at the *relative insularity* of the Earth's atmosphere reveals that the earth is *more valuable, relatively* speaking, than the other planets in our solar system due to the value of this relatively high level of insularity (the atmosphere) enables the Earth to produce: *Life!*

This, we trust you may discover, is rather remarkable.

Moreover, although our quest had commenced as a search for an *economic* theory of value, in the end, our solution produced a *universal* (economic and biologic) *Theory of Value*, which may represent a solution to what may arguably represent the most fundamental problem in the social sciences. Although this solution was inadvertent, it is in fact a logical outcome, since it is well understood that a useful, truthful economic theory of value required a biogeographical foundation which acknowledged *The Problem of Induction*, including both political and extraterrestrial uncertainties. Our theory was contructed by demonstrating that *value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$.[5] We demonstrate the utility of our theory by sampling simplified, comparative biogeographies which best model pure RIIS/GEMS strategies. We also demonstrate that, contrary to the central thesis of so-called "ecological[6] economics," the Earth is not in fact a closed-system, but rather merely *semi-closed* and thus only relatively insular. Comprehending this concept is critical to the comprehension of our theory; we will clarify this importance with the following application: Applying our *Theory of Value* within requisite biogeographical & political contexts reveals divergent, optimizing rational strategies for *continental* (GEMS, i.e. low I_R) and *insular* (RIIS, i.e. high I_R) economic development.

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1 (a) Carlquist 1974.
(b) Indeed, without isolation new species might never evolve anywhere. If a plant or animal species formed one large interbreeding population without distinctive ecological pockets, changes would likely be wiped out and little progress toward new adaptations could be made (Ibid, p1).

2 I_R is formulated with: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year & % km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), Sovereign Status, Constitutional Balance, and Military Power.* We calibrate our formulae by adjusting relative input weighting in accordance with (1) a positive, linear biogeographical correlation between I_R and number of endemic species and (2) a positive, linear biogeographical correlation between I_R and average human life expectancy, and (3) revealed preference (the average cost of single family dwellings).

3 (a) The chief justification for this brutal abstraction is that it allows many of the underlying processes to be described simply and more clearly (Coulson & Godfray 2007, p 17).
(b) I like simple theories that address important issues. I am always attracted to an elegant theory, even if I think it is wrong-headed. During my graduate school days, I liked certain Marxist theories, not because I agreed with the claims, but because they were simple and intuitively attractive. One of my favorite books for teaching purposes is Lenin's *Imperialism*, which has a simple argument that is boldly stated. It ultimately proved to be wrong, but at least Lenin was asking a big question and making a big argument, which certainly helped me clarify my thinking about how the world works (Mearsheimer 2006c, p 107).

4 One of the great discoveries of game theory came in the early seventies, when the biologists John Maynard Smith and George Price realized that strategic equilibrium in games and population equilibrium in the living world are defined by the same equations. Evolution be it genetic or memetic – leads to strategic equilibrium (Aumann 2005, p 352).

5 Funk, forthcoming.

6 (a) In 1870, the German biologist Earnst Haeckel (1834-1919) first coined the term 'ecology' and defined it as 'the total relations of the animal both to its inorganic and organic environment'. In some ways that encapsulated what ecology is today; the study of the interactions between organisms and their environment (Spellerman & Sawyer 1999, p 14).

Our theory reveals pure *continental* (GEMS) and *insular* (RIIS) strategies are antithetical, yet discover, in light of uncertainty relating to *The Problem of Induction,* these naturally opposing strategies represent the most tenable, rational solution possible. We refer to our solution based upon two opposing rational, mixed strategies as *The Funk-Zweikampf Solution*. How is it possible, one may ask, that two players may arrive at two *different*, antithetical optimal strategies when utilizing the same theory of value? Excellent question. The answer is this: although there is ultimately only one sphere of insularity, this sphere may be broken down into two levels of insularity: (1) insularity pertaining to the biosphere (i.e. Ecology: Axioms I-III, the "whole world" according to the principles of "ecological economics"), and (2) insularity pertaining to the semi-closed nature of the biosphere, including planetary and extra-planetary forces and uncertainties (i.e. meteorites, volcanoes, chaotic gravitational forces, supernovas, etc.: Axiom V), and geopolitical uncertainty (i.e. War: Axiom IV). Generally speaking, pure RIIS strategy protects relative insularity on the first level, while GEMS pure stragy protects relative insularity on the second level. Moreover, our theory of value is as applicable and powerful at the local and individual levels as it is at the national/global level, including its use as a powerful analytical tool applicable to strategies to common problems, such as: (1) where to live (addressing both biogeographical and geopolitical insularity), (2) what to eat, (3) how to vote, (4) where to vacation, (5) what type of vehicle to drive, (6) what types of investments to make, (7) what water to drink, and, most generally, (8) deciding how relative insularity frames strategic decision-making under uncertainty.[1] Furthermore, our *Theory of Value* demonstrates an entrenched, systemic, strategic RIIS error. This error reflects methodological deficiencies associated with economic development theory, time-inconsistent preferences, hyperbolic discounting,[2] and a fundamental democratic constitutional flaw[3] known as *The Tragedy of the Commons.*[4] Our theory suggests that it is no coincidence that the RIIS which best exhibits optimal pure strategy (preservation of relative insularity) is not a *democratic nation*, but rather a *private island*: Mustique, SVI. However, RIIS (including democratic states, municipalities, and even individuals) may optimize with our counter-intuitive *Funk-Zweikampf Solution* through individual, regional, and island state coalitions. Furthermore, adopting our *Unified Theory of Value* may generate butter-fly effects (self-organization), drive constitutional amendments, the privatization of inherently tragic common natural resources (such as International waters), and, thus begin to place stones along the long road to balancing *The Problem of Sustainable Development*.

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1 '*In cases of uncertainty, economic reasoning will be of little value*' [italics mine] (Lucas, 1981, P 224)…. In the case of uncertainty no such probability distribution is possible and in consequence, to quote two of economics most eminent practitioners 'no theory can be formulated in this case' (Arrow, 1951 p. 417) and again 'In cases of uncertainty, economic reasoning will be of little value' (Lucas, 1981, P 224). But human beings do construct theories all the time in conditions of pure uncertainty-and indeed act on them and sometimes die for them…. Therefore the central questions that confront economists in cognitive science are not only how human beings learn and meld beliefs and preferences to reach decisions and hence the choices that underlie economic theory but also how and why do they develop theories in the face of pure uncertainty (North, no date, p 2).

2 It is well known from the literature that hyperbolically discounting agents tend to postpone actions into the future from an ex ante point of view, as declining discount rates imply a change of the relative weight of benefits and losses. It is also well known that naive agents tend to further procrastinate actions from an ex post point of view, as they are not aware of the time-inconsistency problem and that this outcome may be inefficient (e.g., Ackerlof 1991, O'Donoghue and Rabin 1999). Yet, the interesting result derived from the exposition so far is that, no matter whether agents are sophisticated or naive, they will never invest in environmental protection if agent 1 does not invest (Winker 2006, p 13).

3 (a) Politicians do not find any attractions in a view which does not lend itself to party declamation, and ordinary mortals prefer views which attribute misfortune to the machinations of their enemies. Consequently people fight for and against quite irrelevant measures, while the few who have a rational opinion are not listened to because they do not minister to any one's passions (Russell 1928 p 3).
(b) Is there a greater tragedy imaginable than that, in our endeavour consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving? (Hayek 1944, p4)?
(c) The successful politician owes his power to the fact that he moves within the accepted framework of thought, that he thinks and talks conventionally. It would be almost a contradiction in terms for a politician to be a leader in the field of ideas. His task in a democracy is to find out what the opinions held by the largest number are, not to give currency to new opinions which may become the majority view in some distant future (Hayek 1982).

4 Lloyd 1833, Hardin 1968.

EPIGRAPH[1]

If our civilization is to survive, we must break with the habit of deference to great men. Great men may make great mistakes… Their influence, too rarely challenged, continues to mislead those on whose defence civilization depends, and to divide them. The responsibility for this tragic and possibly fatal division becomes ours if we hesitate to be outspoken in our criticism of what admittedly is a part of our intellectual heritage. By our reluctance to criticize some of it, we may help to destroy all of it.

—Sir Karl Popper, *The Open Society and Its Enemies*, 1945

1 Pronunciation: \ˈe-pə-ˌgraf\, Function: *noun,* Etymology: Greek *epigraphē,* from *epigraphein,* Date: 1624. 1 **:** an engraved inscription. 2 **:** a quotation set at the beginning of a literary work…to suggest its theme (Merriam &Webster 2008).

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1 May 2008

RE: A Solution to *The Problem of Sustainable Economic Development*.

Dear Sir:

I am writing to inform you that you have made a great mistake.

Your error came to my attention while reviewing *Nature in Economics.*[1] I emphasize the greatness of this mistake because, upon a broad review of your considerable works,[2] I have discovered that this fundamental error appears entrenched in your most fundamental assumptions, and in short, I conjecture you have committed this error for four primary reasons (possibly 5): (1) you do not understand *The Problem of Induction*, (2) you do not understand that economics is a *derivative science,*[3] and moreover (3) you have failed to comprehend, essentially, *the whole economy of nature;*[4] (4) you do not understand that subject matters do not exist,[5] and (5) another possible

1 2007.

2 See SELECTED BIBLIOGRAPHY.

3 (a) *Economic power, unlike military power, is not primary, but derivative.* Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but *when large issues are involved it depends upon war or the threat of war*. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it [all italics mine, Russell 1928, p 95].

(b) *The very nature of economics is rooted in nationalism….It would never have been developed except in the hope of throwing light upon questions of policy, but policy means nothing unless there is authority to carry it out, and authorities are national* [italics mine Robinson 1962, p 117].

(c) The hidden hand of the market will never work without a hidden fist. McDonald's cannot flourish without McDonnell Douglas… And the hidden fist that keeps the world safe for Silicon Valley's technologies is called the United States Army, Air Force, Navy, and Marine Corps." (Friedman 1999).

(d) Power Projection: The ability of a nation to apply all or some of its elements of national power - political, economic, informational, or military - to rapidly and effectively deploy and sustain forces in and from multiple dispersed locations to respond to crises, to contribute to deterrence, and to enhance regional stability (The United States Department of Defense, publication J1-02, 2001).

4 See page 6: *The Struggle for Life*.

5 As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them*. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the

reason, I suspect, may be related to personal religious beliefs, but since I do not know you personally, I will leave this point for your consideration. If you are a religious man, however, see APPENDIX II: THE PROBLEM OF RELIGION.[1]

Before detailing my critique of *Nature in Economics*, I will note that, despite the impression you may have at this early stage, I admire your endeavours and I am sympathetic to your ostensibly noble quest for a solution to the considerable problem of global resource consumption, as I have been engaged with this problem for quite some time myself, perhaps even longer than I am able to recall.[2] A good friend and fellow sailor once told me that you can learn most of what there is to know about someone by sailing with them for a while; I've also come to believe that you can learn most of what there is to know about the Earth by sailing *alone* for a while, and I believe a brief elaboration upon this belief may prove illuminating: on April 24th, 1895, at the age of 51, Joshua Slocum[3] sailed away from Boston on his 35 ft sloop, *Spray.* Three years later, on June 27th, 1898 he returned, completing the first

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experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(1) There is no method of discovering a scientific theory.

(2) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.

(3) There is no method of ascertaining whether a hypothesis is 'probable', or probably true [Popper 1956, pp 5-6].

1 Also see Hitchens 2007, Weale 2007, Dawkins 2006 ; Darwin 1883, Russell 1931.

2 See APPENDIX III: WHY I WANT TO LEARN ABOUT THE SEA.

3 Captain Joshua Slocum was born in Nova Scotia in 1844. His father was a farmer, but for many generations his had been a seafaring family and, like most small boys along that coast, he spent every minute of his holidays in and out of small boats, though like many other sailors he never learned to swim… He was eight years old when his family moved to Briar's Island and he left school and was put to work on the farm. At the age of twelve he was caught making a ship model in the cellar where he should have been grading potatoes, was given a beating, saw his model smashed and ran away from home. For the next few years he earned a living for himself, as a cook, ship's boy and what not, among the fishermen on the Bay of Fundy. At the age of sixteen he and a friend sailed before the mast in a full-rigged ship from St. John's [sic.], New Brunswick, to Dublin [Ransom's 1947 *Introduction* on p 22 of Slocum 1900].

solo circumnavigation of the Earth. Slocum's independence, resourcefulness,[1] self-sufficiency,[2] and sage advice,[3] to "know the sea, and know that you know it,"[4] has been an inspiration to sailors ever since,[5] as another soloist recently reflected:

> My interest in sustainability has developed over the years quite naturally through sailing, because when you're at sea you have to manage your resources… carefully. You take the minimum you think you can get away with because you want the boat to be as light as possible and you never waste anything, you know where your energy is coming from, you measure it and you measure what you're using, and that's very… different from every day life; you notice the change when you jump off the boat.[6]

Yes indeed, as you also noted in your excellent review of Jared Diamond's *Collapse*: *How Societies Choose to Fail or Survive* (I also found this work deficient), "scarcities lead individuals and societies to search for ways out, which often means discovering alternatives;" the uncertainties and scarcities inherent with sailing (being alone on a stormy sea, for example) also lead individuals to develop flexible tactics.[7] It is even possible that these two

1 Although the $553.62 spent for materials seems high in comparison with Thoreau's $28.12, *Spray* had to endure storms unknown on Walden Pond. Moreover, Thoreau borrowed an axe near the end of March 1845 and began to occupy his house on the Fourth of July, while Slocum spent thirteen solid months rebuilding the old wreck of a sloop… Both constructions served equally well in carrying their amateur builders out of the world; both led to books that have long outlived the timbers (Whitehill 1957, p 541).

2 The day I appeared there was a buzz at the gossip exchange: at last someone had come and was actually at work on the old *Spray*. "Breaking her up, I s'pose?" "No; going to rebuild her." Great was the amazement. "Will it pay?" was the question which for a year or more I answered by declaring that I would make it pay.

My axe felled a stout oak-tree near by for a keel, and Farmer Howard, for a small sum of money, hauled in this and enough timbers for the frame of the new vessel. I rigged a steam-box and a pot for a boiler. The timbers for ribs, being straight saplings, were dressed and steamed till supple, and then bent over a log, where they were secured till set. Something tangible appeared every day to show for my labour, and the neighbours made the work sociable. It was a great day in the *Spray* shipyard when her new stem was set up and fastened to the new keel.…The much-esteemed stem-piece was from the butt of the smartest kind of pasture oak. It afterward split a coral patch in two at the Keeling Islands, and did not receive a blemish. Better timber for a ship than pasture white oak never grew (Slocum 1900 pp 34-35).

3 After nearly sixty years, interest in Captain Joshua Slocum's single-handed voyage around the world grows rather than diminishes. The captain's own narrative, published in 1900 by the Century Company, was kept in print for forty-eight years (and seventeen printings) by them and their successor companies. It was translated into Polish, German, French and Dutch, and has been widely read in England (Whitehill 1957, p 540).

4 Ibid, p 18.

5 Whether you call it "communing with nature" or "feeling at one with the world," there are times single-handing can only be described as a spiritual experience -- days when you marvel at the sea and sky and are awed and humbled by the majesty of nature, days when you savour the interaction of the boat with wind and waves and say to yourself "It just doesn't get any better than this." According to an unpublished study by Dewey, Kahn, Yu, and Howe, these moments are covered by the inverse square rule -- the intensity of the experience decreases by the square of the number of people aboard (Guenther 2004).

6 MacAurthur 2007.

7 Military officers are fond of saying that few plans survive first contact with the enemy, and the same may be said for the plans of the crew of a small vessel encountering heavy weather for the first time. Such plans as have been made have to be flexible. Unexpected events are likely to occur, the weather forecast is often a simplified overview, and people's behaviour may be unpredictable under duress of prolonged exposure to blinding spray, fear, cold temperature, wearying noise and violent motion (Coles 1967, p 155).

powerful elements, (1) circumnavigating the world, and (2) isolation, may offer something even more substantial; as E.O. Wilson noted, the *Journal of Researches into the Natural History and Geology of the Countries Visited During the Voyage of H.M.S. Beagle Round the World* (a.k.a. *Voyage of the Beagle*)[1]

> can be read from several perspectives and interpreted according to taste. One very important but seldom noticed feature is its exemplification of the *Wanderjahre* (years of wandering) in the genesis of the scientific mind. No English term conveys the exact same meaning as the German. It refers originally to the medieval custom of sending young men to other villages or towns to learn a craft and more of the world in a different setting. History has shown that there is no more fruitful way to launch the career of a naturalist than by such an interlude, during which the adventurer travels *alone*, searching, freed from domestic ties, and energized by… visceral ambition…The pages of *Voyage of the Beagle* are the diary of Darwin's *Wanderjahre*. As he proceeds around the world (England-South America-Galapagos-South Pacific-South Africa-South America-England), the young naturalist unconsciously builds the foundation of what was to be his evolutionary view of life.[2]

Finally, I will conclude this anecdote by noting that, last January, after sailing 57 days alone, averaging nearly *20 knots for 26,000 non-stop miles* (!) on his 97 ft trimaran, *Idec II*, Francis Joyon[3] recalled

> there were two very worrying moments… once in the south in the middle of the ice, as the storm started to blow, and in the Doldrums, when I discovered I could lose my mast… *The breaking up of the pack ice and the icebergs floating around at unusual latitudes attracted my attention*.[4]

Revisiting this theme back on shore, Joyon observed that "a boat is like an island, or, indeed, like the planet: you need to protect [it]."[5]

I have indulged in this curious digression because I want to impress upon you that I, like you and the sailors and searchers I admire most, I, too, hold deep curiosities and concerns for the Earth. But, as a fellow champion of

1 Darwin 1836.

2 Wilson 2006, pp 18-19.

3 Those who witnessed his crossing of the start line off Ushant [France] on the morning of 23rd November could never have dreamt that they would be witnessing his return just 57 days, 13 hours, 34 minutes and 6 seconds later - bettering Ellen [MacArthur's] time by a solid 14 days ! Joyon, who sees little merit in the complexities of modern gadgetry, proved he could complete his epic voyage with no more power than could be provided by a small wind generator and a couple of solar-panels. He prefers to leave the weight of an engine - and most other go-fast devices ashore so he has more time to get on with the job of sailing the boat. This is ground-breaking stuff that calls into question the very basis of current thinking in this domain…. Bravo Francis! (Irens 2008).

4 Italics mine, Joyon 2008.

5 Gelder 2008, p 1.

game theory,[1] equally aware of the seemingly distasteful sacrifice implicit[2] in the *rational strategy* to *all Prisoners' Dilemmas*, I trust that, after reviewing the significant contents of his letter, you may be willing to consent that "rational" and "optimal" natural resource consumption levels may be far more difficult to determine than you have presumed. Although it is very true that Joyon's sailboat is a small model of an island, which is in turn, a small model of the Earth, and it is indeed true that we need to *protect* it, since, once again, you do not understand that subject matters do not exist, you have failed to consider fundamental axioms which belong to the so-called subjects of "astronomy," "political science," and, somewhat ironically, "evolutionary biology."

I will also add that there is no shame in correcting an error, the only shame resides in refusal to correct errors. Of course I too have made many great errors, one of which was a two-year failed endeavour to address *The Problem of Sustainable Economic Development* you will find detailed in APPENDIX IV: THE SEA.

I hope that I am deft enough to shatter several inconvenient myths and illusions,[3] break down imprisoning doors of perception,[4] and enable you to correct your error, and, perhaps, chart a new course with present and future endeavours. But then again, I realize how strong these myths and doors[5] may be, and thus realize the breadth

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1 Game theory is a theory of *strategic interaction*. That is to say, it is a theory of *rational behavior* in social situations in which each player has to choose his moves on the basis of what he thinks the other players' *countermoves* are likely to be.

After preliminary work by a number of other distinguished mathematicians and economists, game theory as a systematic theory started with von Neumann and Morgenstern's book, *Theory of Games and Economic Behavior,* published in 1944. One source of their theory was reflection on *games of strategy* such as chess and poker. But it was meant to help us in defining rational behavior also in *real-life* economic, political, and other social situations [all italics Harsanyi's 1994, p 136].

2 Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE. We call these *choices between lesser evils.* We know that whatever we choose, something important will be sacrificed. Whatever we do, someone will get hurt. Worst of all we HAVE to choose. We cannot wait for better information or advice or some new set of circumstances. We have to decide NOW, and we can be sure that there will be a price to pay. If we do not pay it ourselves, someone else will.

These are the kinds of choices we face when dealing with terrorist threats. If we do too little, we will get attacked again. If we do too much, we will harm innocent people. In making these choices, we never have enough information. Some sources exaggerate the threat; others minimize it. Nothing we are told is reliable and nothing we do is ever likely to strike the right balance (Ignatieff 2004, Preface).

3 The results of failure in politeness, however bad from the point of view of social occasion, are admirable from the point of view of dispelling myths. There are two ways in which our natural beliefs are corrected: one the contact with fact, as when we mistake a poisonous fungus for a mushroom and suffer pain in consequence; the other, when our beliefs conflict, not directly with objective fact, but with the opposite beliefs of other men (Russell 1928 pp 17-18).

4 If the doors of perception were cleansed every thing would appear to man as it is… For man has closed himself up, till he sees all things through narrow chinks of his cavern (Blake 1790).

5 Festinger 1957.

of the challenge before me. I have not written this letter to be cruel; it is not my intent to ridicule you. In fact, as I have stated, I do suspect you may be a great man. But, following in the footsteps of Popper, Russell, Pyrrho,[1] and Socrates,[2] it is my intellectual obligation to remain ever on the lookout, and never hesitate to offer criticism. Indeed, my survival depends upon it.[3]

Did you notice the UNIFIED THEORY OF THE BIOLOGICAL AND SOCIAL SCIENCES & SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT I had clipped to the top of this letter?[4] If you considered the axioms carefully, perhaps your great mistake has already occurred to you. I did endeavour, afterall, to make this lesson as simple as possible for you to understand. If it hasn't sunk in yet, note that your assumptions, the framework upon which all of your works have been based for at least the past two decades, are contained within axioms I through III. Although I am not a gambling man, I believe you will discover your mistakes are directly related to the fact that you have failed to comprehend inherent uncertainties associated with axioms IV through VII (of which, naturally, more to follow). Now, this considerable error is certainly nothing to be ashamed of, because *all* of your fellow practitioners of your so-called "ecological economics" (as well as many other economists, naturally) have committed, and continue to commit the exact same error. Yes, I believe you will discover that this discourse is not simply a refutation of *Nature in Economics*, but ultimately a falsification of the theoretical framework and central thesis of "ecological economics."

Over the past forty years, the landfill of literature dedicated to the errant quest for *Sustainable Economic Development* has revealed a fundamental, universal error: those most able to navigate the perilous seas[5] of

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1 Sceptic: A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity… holds that there are no adequate grounds for certainty as to the truth of any proposition… Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet… to look out (OED 1997).

2 I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not fancy I do. In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know (Socrates 399 BC).

3 See page 12.

4 See pages 8-11.

5 There are 'perilous seas' in the world of thought, which can only be sailed by those who are willing to face their own physical

economics,[1] astutely demonstrate that neoclassical economic theory fails to pass the test of the second law of thermodynamics,[2] then proceed to report that, based upon this "revolutionary new perspective", we are now positioned to "reshape economic theory and policy".[3] The problems which appears to consistently elude you all is, once again, (1) economics is a *derivative*[4] science, not a *primary* science,[5] and (2) you have failed to consider critical assumptions (Axioms IV-VII), and of course this is not so unusual. As Coase noted long ago:

> economic theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgement in choosing between rival sets of assumptions.[6]

Take, for example, a recent reformulation of ecological economics' central thesis from one of your so-

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powerlessness. And above all, there is liberation from the tyranny of Fear, which blots out the light of day and keeps men grovelling and cruel. No man is liberated from fear who dare not see his place in the world as it is; no man can achieve the greatness of which he is capable until he has allowed himself to see his own littleness (Russell 1928, pp 22).

1 See Bibliography for many examples; Gowdy, for example, has also consistently failed and continues to fail to make this connection.

2 Economic theory has always maintained that economic value is "generated" solely within the economy where it is fully distributed among the factors of production before being "consumed". According to this theory, the economy is an isolated system that does not need flows to pass across its boundaries in support of its steady state ("general equilibrium"). From a thermodynamic point of view this idea is unacceptable. According to thermodynamic theory, any open system, which allows flows of matter and energy to cross its boundaries, is capable of maintaining itself in steady state only because it "transport" value from its environment to restore the value that has been "consumed" within the system and dissipated. Drawing on the analogy with thermodynamics, this paper replaces the traditional systemic analog of the economy, which is the closed "circular flow" process, with the steady flow process. According to this analog, any efficient economy is an open system both physically and economically requiring a "flow" of economic value to maintain its steady state. In other words, an economically isolated system has to be inefficient and is bound to misallocate and overuse environmental resources. Whether the economy behaves as an economically isolated (inefficient) or open (efficient) system is an empirical question. However, if real economies are economically open and efficient, and environmental resources are abused due to the economy's unrestrained material growth, parts of traditional economic theory, especially those related to benefit evaluation, will have to be modified. Policy recommendations will be affected in any case because internalization, the panacea of resource misallocations, cannot be more than a temporary solution. Instead of opening the economy, internalization encloses the harmed resource and saves it by abusing excessively other environmental resources (Amir 1994, abstract).

3 The policy recommendations of most economists are driven by a view of economic reality embodied in Walrasian general equilibrium theory. Ironically, the Walrasian system has been all but abandoned by leading economic theorists. It has been demonstrated to be theoretically untenable, its basic assumptions about human decision making have been empirically falsified, and it consistently makes poor predictions of economic behaviour. *The current revolution in welfare economics offers opportunities on two related fronts for an evolutionary perspective on human behaviour to reshape economic theory and policy*…. Expanding the role of economic analysis beyond stylized market behaviour to focus on well-being (real utility) has far-reaching consequences for microeconomic policy… Abandoning the Walrasian model also means rethinking the microfoundations approach to the economic analysis of sustainability. This opens the door for economists to engage with the growing body of research on the evolution of whole societies (Gowdy 2006, abstract).

4 See page 15: footnote 3.

5 Robinson 1962, p 117.

6 1930, p 386.

called "field's" founding fathers, Herman E. Daly[1] (*ECONOMICS IN A FULL WORLD*, *Scientific American*, September 2005, Vol. 293, Issue 3):

> But the facts are plain and *uncontestable*: the biosphere is finite, nongrowing, *closed* (except for the constant input of solar energy), and constrained by the laws of thermodynamics. Any subsystem, such as the economy, must at some point cease growing and adapt itself to a dynamic equilibrium, something like a steady state.

But are the *facts plain* and *uncontestable?* Is the biosphere *finite* and *closed*? No, two strikes, wrong on both counts. Both you and Daly, as you will begin to see, have failed to grasp that greatest truth of all truths.[2] Go back and look at those axioms again. Pay attention to Axioms IV and (especially) Axiom V. Think about it: it's *not* a closed system, is it? Thus, the facts are not *plain* and *uncontestable*, are they? I suspect by now you may feel a bit nauseous, perhaps like an obedient sheep who has blindly followed a drunken shepherd over a cliff, in that very brief interval between terminal velocity and the rocks just below. Perhaps by now you are beginning to understand that this letter is not a joke. Please try not to take it personally (in fact, perhaps you may want to imagine that the letter has been written to Daly instead (or Amir or Gowdy or even politicians such as Al Gore), for this critique is as applicable to their positions–and countless others–as it is to yours). Yes, I am wiser than you, and I am wiser than Daly, because I would never be so incredibly naïve to state that *any* facts are *plain* and *uncontestable*. Indeed, I readily consent that all the gold and diamonds I offer herewith may be but pyrite and plexi-glass.[3]

And since it seems that you have difficulty handling complexity and uncertainty, I will make this critical

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1 DALY is a professor in the School of Public Policy at the University of Maryland. From 1988 to 1994 he was senior economist in the environment department of the Work Bank, where he helped to formulate policy guidelines related to sustainable development. He is a co-founder and associate editor of the journal Ecological Economics and has written several books (Daly 2005). Also see Daly 1971.

2 I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not fancy I do. In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know (Socrates 399 BC).

3 My present design… is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own…. This tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all. It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgements of our friends are to be suspected when given in our favour [Descartes 1637, pp 1-2, Also See *Descartes' Error*, Damasio 1994].

point regarding "ecological economics'" false and sandy foundation even more self-evident, with two simple pictures, which compare and contrast the theoretical framework of "ecological economics" with the theoretical framework of *The Funk-Zweikampf Solution* presented herewith. My five year old son, William, drew them for me, and you will find them in APPENDIX V: THE EARTH.

If you have not entered into a state of aesthetic arrest, transfixed by the utter beauty of seven simple axioms (or two simple drawings by a five year old boy) which pound an entire school of economic thought to dust and present a tenable solution to *The Problem of Sustainable Economic Development*, you may be asking yourself, "How did Matt Funk came to understand a deep truth that you Daly, Nicholas Georgescu-Roegen, William Kapp,[1] Karl Polanyi,[2] E.F. Schumacher,[3] Røpke,[4] Splash,[5] Norgaard,[6] Daily,[7] McCauley,[8] Farley,[9] Hawken,[10] Constanza,[11] Olson,[12] Gowdy, and *literally thousands* of other "ecological economists" have failed to understand?

In short, it has taken over five years of relatively focused meditation upon this problem, and it is unlikely that I am able to plot my course accurately; but I am aware of approximately a dozen fundamental advantages I have had, and, although I certainly will not detail all of them, I believe it may prove beneficial to point out a few of the most notable landmarks. I have already indirectly referred to two: (1) sailing and (2) relative isolation (and of which, more to follow). I will presently relate a third advantage I suspect has contributed to the development of my solution.

First, take a look at this photograph:

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1 1950.
2 1944.
3 1973.
4 2004 ; 2005.
5 1999 ; 2007.
6 1994 ; Nogaard & Bode 1998.
7 1997.
8 2006.
9 Daly & Farley 2004.
10 1994 ; Hawken, Lovins et. Al 2000.
11 et al 1997.
12 Et al 1996.

What do you see?

Perhaps you see two men seated, playing chess. Perhaps you even see Boris Spassky and Bobby Fischer, frozen in time in their famous duel of 1972 in Reykjavik, Iceland. If you happen to be a chess fan, you might even know the outcome of the match, the particular game in which this photograph was taken, or, perhaps even some trivia, such as the fact that both Fischer and Spassky were sitting in Eames *Times-Life* chairs,[1] or maybe, fixing your eyes on the photograph of this *Zweikampf*, recall the legend that, given one or two seconds, Fischer was able to see three or four moves ahead in any position; if he had five seconds, it is widely believed he was able to see five or six moves, and with no time limit, perhaps as many as seven, eight, or maybe even nine moves into the game.

But no matter what think when you look at this photograph, I'm willing to bet that you do not see what I see, because I have spent quite some time studying the curious case of Bobby Fischer. In fact, two years ago, I endeavoured in earnest to come to understand how a man who had taught himself to see seven, eight, or nine

1 Charles and Ray Eames designed Eames executive chairs in 1960 to grace the lobbies that they designed for the Time-Life Building in New York City. That's why some people call them Time-Life chairs. They were developed to meet the need for a comfortable chair that was smaller than the Eames lounge chair.

In 1972, chess grand master Bobby Fischer specifically requested the Eames executive chair while he competed in the World Chess Championship in Reykjavik, Iceland. He said he could concentrate well in the chair. When opponent Boris Spaasky saw it, he refused to play until he got one, too (HermanMiller.com 2008).

moves into the game of chess, was hopelessly unable to teach himself to see two or three moves into *the game of life*. How could one of the greatest champions on earth, a "Zeus, a god of all gods," as the German media often referred to him, turn out to be one of the most *easily* and *thoroughly* defeated individuals on Earth? Although I have always enjoyed chess, I have never excelled above the rank of novice, and even after studying the game and facing my computer day-in and day-out throughout the winter of 2005 (when my wife discovered that I had been playing chess all day, everyday for nearly six months, she took my ChessMaster 9000 away for a year), I have never been able to see more than three or four moves into the game. But I do believe I discovered three key behavioural fundamentals which contributed to Fischer's successes and ultimate loss: (1) *He played both sides of the board.* Fischer, more than any other grandmaster, played countless games against himself; the gains from this type of mental training are extraordinary. (2) Fischer was a natural borne killer. Consider this passage from *Bobby Fischer Goes to War: How the Soviets Lost the Most Extraordinary Chess Match of All Time:*[1]

> The most interesting phenomenon about Fischer, however, is not the effect chess had on him, but the effect chess had on his opponents, destroying their morale, making them feel that they were in the grip of an alien hostile force to his powers there was no earthly answer … Fischer appeared to his opponents to function like a micro-chip driven automaton. He analyzed positions with amazing rapidity; his opponent always lagged behind on the clock…Nor did Fischer appear to be governed by any psychologically predetermined system or technique.

I believe I discovered the key behavioural fundamentals which contributed to Fischer's successes and ultimate loss, and, moreover, I have taught myself to incorporate this strategic development into my approach to economics; I submit that I have been able to see what you and others cannot see because (1) I have trained myself to play both sides of the board, and (2) I have taught myself to see the world through the eyes of a white pawn, a black pawn, a hunter, the hunted, an American soldier, an Afghan soldier, etc. As a result of this and other endeavours, although I am still only able to see three or four moves into the game of chess, I believe I have developed the ability to see a bit further into the game of life. And I can also see that, although you and your fellow "ecological

1 Edmonds and Eidinow 2004.

economists," have, like countless other men of genius,[1] learnt how the pieces move, where they are placed upon the board, and how to make it all look especially grand with mathematical magic, you *misunderstand the whole economy of nature*, and thus you're only able to see two or three moves ahead, and you've spent your entire career looking at *your* side of the board, without ever bothering to crawl into a foxhole behind enemy lines and look back at your own position.[2]

I will also note that the third key Fischer behavioural fundamental, the one which may have given birth to irrational strategies, driven him to estrangement, legal entanglements, financial ruin, non-cooperative behaviour, hatred, and an early "end-game," was *religion*.

Although I have not written to speculate upon what institutions, mechanisms, or developmental processes may or may not have contributed to your great mistake, since it is my intention to help you correct this error, I will offer a hunch which, based upon anecdotal evidence, seems plausible: I believe it is quite possible that you have not had the fortune to learn to hunt, fish, or to engage in combat. I've injected this wild speculation because it seems inconceivable that a man endowed with your keen intellect and analytical abilities could have committed these egregious errors if he were intimately connected with *The Struggle for Life* (hereafter TSL, see page 6). Although you may find Ortega y Gasset's *Meditations on hunting*[3] inspiring, I suspect there is no substitute for the real thing:

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1 If there are among my readers any young men or women who aspire to become leaders of thought in their generation, I hope they will avoid certain errors into which I fell in youth for want of good advice. When I wished to form an opinion upon a subject, I used to study it, weigh the arguments on different sides, and attempt to reach a balanced conclusion. I have since discovered that this is not the way to do things. A man of genius knows it all without the need of study; his opinions are pontifical and depend for their persuasiveness upon literary style rather than argument. It is necessary to be one-sided, since this facilitates the vehemence that is considered a proof of strength. It is essential to appeal to prejudices and passions of which men have begun to feel ashamed and to do this in the name of some new ineffable ethic.…

Ignore fact and reason, live entirely in the world of your own fantastic and myth-producing passions; do this whole-heartedly and with conviction, and you will become one of the prophets of your age (Russell 1932, p1).

(b)The belief that fashion alone should dominate opinion has great advantages. It makes thought unnecessary and puts the highest intelligence within the reach of everyone. It is not difficult to learn the correct use of such words as 'complex,' 'sadism,' 'Oedipus,' 'bourgeois,' 'deviation,' 'left'; and nothing more is needed to make a brilliant writer or talker (Russell 1950).

2 Such as looking at the board from outer-space, for example (see Axiom V) or looking at the board from Germany, as Einstein did in 1939 (see Appendix V).

3 *Meditations on Hunting* is the most quoted book in sporting literature. It is the finest work on the essence and ethics of hunting. Today when both hunting and fishing are often condemned, *Meditations* takes on an even greater significance. Ortega points out that life is a dynamic interchange between man and his surroundings. He explains that hunting is part of man's very nature, that:

hunting is a universal and impassioned sport…it is the purest form of human happiness. The essence of hunting or fishing

hunting, fishing, warfighting, and perhaps, even sailing or gardening (especially if one practices canning for winter consumption). The only other suitable remedy which occurs to me is the study of biology; I believe it is unfortunate that one may be conferred with a *PhD in Economics* without first (or concurrently) producing a PhD dissertation in Biology (and preferably evolutionary biology,[1] or perhaps at the very least, evolutionary game theory),[2] as I have discovered that economics without evolutionary biology is about as effective as letters without a language. The famous evolutionary geneticist Theodosius Dobzhansky remarked that, "nothing in biology makes sense except in the light of evolution,"[3] but he had only glimpsed the tip of the iceberg: *nothing on Earth* makes sense except in the light of evolution! In 2004, fifty percent[4] of Americans *still* did not believe in evolution, but the worst part of it is, that I suspect a very large part of the fifty percent of people who *do* believe in evolution are still unable to make sense of the world,[5] due to the framing effects religion continues to play on the evaluation of *social norms* (of which, more to follow). For example, refer back to Darwin's definition of TSL on page 6 and ask yourself, "When I see birds fluttering about, does it *intuitively* occur to me that at every moment these "songbirds" are engaged in *war?*[6] In TSL? At every moment their minds are clear and their goals are fixed: Mate, protect,[7] compete,[8] and endeavour to kill while remaining ever-vigilant of the ever-present threat of being killed. Because if this is not *thoroughly engrained in your mind*, *the whole economy of nature* (including, of course, so-called "economics")

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involves a complete code of ethics of the most distinguished design. The sportsman who accepts the sporting code of ethics keeps his commandments in the greatest solitude with no witnesses or audience other than the sharp peaks of the mountain, the stern oak, and the passing animal (Bodio 2007 ; Gasset 1972)

1 Among the things that science does know, evolution is about as certain as anything we know (Dawkins 2004).

2 See Cressman 1996, Kolstad 2007, Sigmund & Nowak 1999, Stumpf 2001, Vincent 1996, and many excellent works by Weibull.

3 Wilson 2006, p 1479.

4 Americans are certainly capable of belief, and with rocklike conviction if it originates in religious dogma. In evidence is the 60 percent that accept the prophecies of the *Book of Revelation* as truth, and yet in more evidence is the weight that faith-based positions hold in political life. Most of the religious Right opposed the teaching of evolution in public sschool, either by an outright ban on the subject or, at the least, by insisting that it be treated as 'only a theory" rather than a "fact" (Ibid, pp 1479-1480).

5 Many who accept the fact of evolution cannot, however, on religious grounds, accept the operation of blind chance and the absence of divine purpose implicit in natural selection (Wilson 2006, p 1480).

6 War may range from intense clashes between large military forces—sometimes backed by an official declaration of war—to subtler, unconventional hostilities that barely reach the threshold of violence (Gray 1989, p 4)

7 Eggs and chicks, and at times, their mate.

8 With cooperative and non-cooperative organisms alike.

will indeed be quite misunderstood. And if this is not understood, one is not yet ready to study economics, let alone practice (or teach!)[1] it effectively. I do not know if your fellow countryman Keynes hunted or fished, but he did participate in a very long, intensive meditation on Warfighting[2] (which I will demonstrate shares much in common with hunting and fishing), and written record[3] suggests he came to understand the problem to which I am referring. In any case, as Aumann observed, "Economics teaches us that things are not always as they appear,"[4] and if you are willing and able, this is the lesson you are presently struggling to learn.

You see, I do not believe you would have written that "it seems that during *the past three decades* the rich world has enjoyed sustainable development, while development in the poor world (barring China) has been unsustainable,"[5] because if you did in fact understand TSL and the derivative nature of economics, you would know that this has not simply occurred for the past three decades, but rather, *since the beginning of time*. Moreover, this process will march on for as long as *any species* inhabits the earth. Consider another equally naïve position you committed to ink in the same article: "as global environmental problems frequently percolate down to create additional stresses on the local resource bases of the world's poorest people, GNP growth in rich countries can inflict a downward pressure on the wealth of the poor." Again, you failed to understand these "problems" do not *frequently* percolate down, they *always* percolate down, because winners win and losers lose in *every* engagement,

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1 When a man teaches something he does not know to somebody else who has no aptitude for it, and gives him a certificate of proficiency, the latter has completed the education of a gentleman. A fool's brain digests philosophy into folly, science into superstition, and art into pedantry. Hence University education.... Beware of his false knowledge: it is more dangerous than ignorance. Activity is the only road to knowledge. Every fool believes what his teachers tell him.... No man can be a pure specialist without being in the strict sense an idiot (Shaw 1903, lns 31-41).

2 1920.

3 (a) THE power to become habituated to his surroundings is a marked characteristic of mankind. Very few of us realize with conviction the intensely unusual, unstable, complicated, unreliable, temporary nature of the economic organization by which Western Europe has lived for the last half century. We assume some of the most peculiar and temporary of our late advantages as natural, permanent, and to be depended on, and we lay our plans accordingly. On this sandy and false foundation we scheme for social improvement and dress our political platforms, pursue our animosities and particular ambitions....

But perhaps it is only in England (and America) that it is possible to be so unconscious. In continental Europe the earth heaves and no one but is aware of the rumblings. There it is not just a matter of extravagance or "labor troubles"; *but of life and death, of starvation and existence, and of the fearful convulsions of a dying civilization* [italics mine, 1920, pp 3-4].

(b) Pray for the welfare of the government, for without its authority, man would swallow man alive (Aumann 2005, p254).

4 Ibid, p 351.

5 Italics mine, Dasgupta 2007.

and in *every* facet of TSL. This is not *good*, and this is not *bad*, in the same sense that war is not good and war is not bad, it is a part of *nature,* not just human nature, of *Nature*, *it is merely TSL.* War is life and life is war. "To understand biological human nature in depth is to drain the fever swamps of religious and blank-state dogma."[1] I will offer an illustrative analogy: Let's consider national per capita natural resource consumption. First, we will tally all of the natural resources on earth, then divide them into a single, common denominator we will call "gazelles." Now, a general consensus seems to agree that, based on our illustrative method, it takes 3 gazelles per person, per day for human survival.[2] As you're well aware, however, there are many inhabitants of African nations and your birthland of India who struggle to survive on 1 gazelle per day or less. And, of course, here in North America, both here in Canada and my homeland, The United States of America, we consume, on average 20 gazelles per person per day. Based upon the inherently flawed assumptions[3] of ecological economics, analysis would conclude that there is one Earth held fast by the laws of thermodynamics, and thus only a single herd of "gazelles" for all. *But, as I have noted, there are two more realms of uncertainty to consider;* one realm of uncertainty is its *true, almost completely misunderstood biological nature, it's war-like nature*, the other is *planetary uncertainty*. We will presently address warfighting. Although we are, as Keynes noted and I am suggesting, so disconnected with TSL that we do not understand that

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1 Wilson 2006, p 1482.
Today we live in a…disjunction between science and religion, the one born of Darwinism, still roils the public mind. Why does such intense and pervasive resistance to evolution continue 150 years after the publication of *The Origin of Species*, and in the teeth of the overwhelming accumulated evidence favoring it? The answer is simply that Darwinian revolution, even more than the Copernican revolution, challenges the prehistoric and still-remnant self-image of humanity.…

In the more than slightly schizophrenic circumstances of the present era, global culture is divided into… opposing images of the human condition, each logically consistent within its own, independent premises. The dominant of these hypotheses, exemplified by the creation myths of the Abrahamic monotheistic religions (Judaism, Christianity, and Islam), see humanity as a creation of God. He brought us into being and He guides us still as father, judge, and friend. We interpret his will from sacred scriptures and the wisdom of ecclesiastical authorities.

The second worldview is is that of political behaviorism. Still beloved by the now rapidly fading Marxist-Leninist states, it says that the brain is largely a blank state devoid of any inborn inscription beyond reflexes and primitive bodily urges. As a consequence the mind originates almost wholly as a product of learning, and it is the product of a culture that itself evolves by historical contingency. Because there is no biologically based "human nature" people can be molded to the best possible political and economic system, namely, as urged upon the world through most of the twentieth century, communism. In practical politics, this belief has been repeatedly tested and, after economic collapses and tens of millions of deaths in a dozen dysfunctional states, is generally deemed a failure (Wilson 2006, pp 1481-1482).

2 For our purposes, the actual figures are irrelevant, the conceptualization is all we're after; use whichever values you feel are most accurate.

3 See footnote 6: page 20, footnote 1: page 21.

both individuals and cooperative populations we refer to as nations are *all always* as actively engaged with killing[1] and being killed as birds, I trust my gazelle analogy may begin to illuminate the following: those who consume more than 3 gazelles per person per day (including you and your fellow countrymen[2] in England), are killing, have been killing, and continue to kill those who consume less than 3 gazelles per day. Once this is understood, a small application of one's power of reason will demonstrate that mechanisms such as "free-trade," and "globalization," for example, essentially represent the NORTH/GEMS' predatory strategy: hunting, killing, and taking the prey (natural resources) from the SOUTH/RIIS[3] through cooperative, coercive, and combatative behaviours.[4] You do not understand that economics is a derivative science because you do not understand that economics, the profession in which you are ostensibly engaged, was designed to promote national interests and, thus, the unfamiliar war-like nature of economics is not readily apparent to you. If you are unable to accept this truth, I will not be surprised (a court-room scene from the 1992 Academy Award winning *A Few Good Men* comes to mind).[5]

1 Given the difficulty of determining how much power is enough for today and tomorrow, great powers recognize that the best way to ensure their security is to achieve hegemony now, thus eliminating any possibility of a challenge by another great power. Only a misguided state would pass up an opportunity to become hegemon in the system because it thought it already had sufficient power to survive (Mearsheimer 2001, p 35).

2 Not only are references to "men," "countrymen," "mankind," etc., inclusive of both human sexes, these references also include all things living, even asexual unicellular organisms.

3 Note I do not pass judgement on this hunting practice ("good" or "bad"), as we will demonstrate, *The Problem of Induction* spirals such judgements into infinite regress.

4 *Globalization and Its Discontents* was written just after I left the World Band, where I served as senior vice president and chief economist from 1997 to 2000. That book chronicled much of what I had seen during the time I was at the Bank and in the White House, where I served from 1993 to 1997 as a member of the then chairman of Council of Economic Advisers under President…Clinton…. I became convinced that the advanced industrial countries, through international organizatons like the International Monetary Fund (IMF), the World Trade Organization (WTO), and the World Bank, were not only not doing all that they could to help these countries but were sometimes making their life more difficult (Stiglitz 2006, p ix).

5 Jessep [played by Jack Nicholson]: You want answers?
Kaffee [played by Tom Cruise]: I want the truth!
Jessep**:** You can't handle the truth! Son, we live in a world that has walls. And those walls have to be guarded by men with guns. Who's gonna do it? You? You, Lt. Weinberg? I have a greater responsibility than you can possibly fathom. You weep for Santiago and you curse the Marines. You have that luxury. You have the luxury of not knowing what I know: that Santiago's death, while tragic, probably saved lives. And my existence, while grotesque and incomprehensible to you, saves lives…You don't want the truth. Because deep down, in places you don't talk about at parties, you want me on that wall. You need me on that wall.

We use words like honour, code, loyalty…we use these words as the backbone to a life spent defending something. You use 'em as a punchline. I have neither the time nor the inclination to explain myself to a man who rises and sleeps under the blanket of the very freedom I provide, then questions the manner in which I provide it! I'd rather you just said thank you and went on your way. Otherwise, I suggest you pick up a weapon and stand a post. Either way, I don't give a damn what you think you're entitled to! (Sorkin 1992).

(b) The statesman must think in terms of the national interest, conceived as power among other powers. The popular mind, unaware of the fine distinctions of the statesman's thinking, reasons more often than not in the simple moralistic and legalistic terms of absolute

I trust I have detailed this position sufficiently for you, but in the event that I have not, and you remain uncertain, then I might suggest that you may lack the intellectual self-defense to arrive at the logical, self-evident, and rational conclusions I have detailed herewith for you, which would be understandable, as intellectual self-defense is somewhat rare, and furthermore, is not something you're able to acquire in school, not even at Cambridge (in fact academic institutions, as your fellow Cambridge fellow, Russell often noted,[1] render it even *more* difficult to attain).[2]

> Same holds for "intellectual self-defense." It takes a lot of self-confidence--perhaps more self-confidence than one ought to have--to take a position alone because it seems to you right, in opposition to everything you see and hear… Under experimental conditions people deny what they know to be true when they are informed that others they have reason to trust are doing so.

Furthermore, intellectual self-defense and intellectual independence is paramount to the following critical exploration of the conjecture that "independence may engender a certain resolve to make the most of available resources,"[3] and to pursue a rational sustainable economic development strategy. This introduces the dilemma that was fundamental to the genesis of my solution to TPSED: The fourth significant advantage I may have had is the great fortune to live on a small island with a very big problem. Although I will say as little as possible about this big problem for now, I will return to this topic in great detail in the second half of this discourse. For now, I will merely sketch an outline of the problem within the context of my research methods (which I refer to as ~~*Island-Bioeconomics*~~ *Problem Solving*):

Islands serve as lighthouses—beacons far brighter, often far more representative, and far more descriptive than mathematical models.[4] Although my island-based methods employ various mathematical tools, more often

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good and absolute evil (Morgenthau & Thompson 1985, p 165).

1 State education… produces, so far as it is successful, a herd of ignorant fanatics, ready at the word of command to engage in war or persecution as may be required of them. So great is this evil that the world be a better place (at any rate, in my opinion) if State education had never been inaugurated (Russell 1955, p 526).

2 The paradox, of course, is that Russell may have acquired his intellectual self-defense at Cambridge. Thus, perhaps Cambridge and/or Trinity (in light of the extraordinary scholars Trinity has reared, I'd place my bet on Trinity) may offer an exception to this rule.

3 Agnarsson & Arnason 2003.

4 (a) It is an interesting speculation to think what direction the development of Menger's thought would have taken if he had been acquainted with these founders of mathematical analysis. It is a curious fact that, so far as I am aware, he has nowhere commented on

than not our approach to mathematics is in the *opposite direction*[1] common with 'continental' economic analysis. These so-called 'methods' (for, again, in reality, neither *scientific method* nor *subject matters* exist) have been developed and adopted in light of the recognition of two fundamental economic methodological problems: (1) economics is a *derivative science*, and (2) that most applied (economic) mathematical models invariably do not represent truth, because, in short, integers are not engaged in the *Struggle for Life*.

Darwin's powerful and effective *island-based analysis* enabled us to break through *convenient*[2] and *attendant*[3]

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the value of mathematics as a tool of economic analysis. There is no reason to assume that he lacked either the technical equipment or the inclination. On the contrary, his interest in the natural sciences is beyond doubt, and a strong bias in favour of their methods is evident throughout his work….He does not even refer to the mathematical method in any of his writings on methodology…Must we conclude that he felt rather sceptical about its usefulness? (Menger & Hayek 1871, p 15).

(b) Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds (Maxwell 1873, p 400).

(c) Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up (Hayek 1945, pp 519-530).

1 Mathematics is a study which, when we start from its most familiar portions, may be pursued in either of two opposite directions. The more familiar direction is constructive, towards gradually increasing complexity : from integers to fractions, real numbers, complex numbers ; from addition and multiplication to differentiation and integration, and on to higher mathematics. The other direction, which is less familiar, proceeds, by analysing, to greater and greater abstractness and logical simplicity ; instead of asking what can be defined and deduced from what is assumed to begin with, we ask instead what more general ideas and principles can be found, in terms of which what was our starting-point can be defined or deduced (Russell 1919, pp1-2).

2 Modern industrial civilization has developed within a certain system of *convenient myths* [italics mine]. The driving force of modern civilization has been individual material gain which is accepted as legitimate, even praiseworthy, on the grounds that private vices yield public benefits in the classic formulation. Now it's long been understood, very well, that a society that is based on this principle will destroy itself in time. It can only persist with whatever suffering and injustice it entails as long as it's possible to pretend that the destructive forces that humans create are limited, that the world is an infinite resource, and that the world is an infinite garbage can. At this stage of history either one of two things is possible. Either the general population will take control of its own destiny and will concern itself with community interests guided by values of solidarity and sympathy and concern for others. Or alternatively, there will be no destiny for anyone to control. In this possibly terminal phase of human existence, democracy and freedom are more than values to be treasured, they may well be essential to survival (Chomsky 1992, Finalé).

3 Human events spring from passions, which generate systems of *attendant myths* [italics mine]. A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason (Russell 1928, pp 6-7).

(b) Kings are not born: they are made by artificial hallucination. When the process is interrupted by adversity at a critical age, as in the case of Charles II, the subject becomes sane and never completely recovers his kingliness (Shaw 1903, ln 12)

myths and illusions and grasp global complexity and uncertainty that was beyond our reach. And "although it is often said that the *Origin of Species* convinced people of evolution because it provided an easily-understood mechanism (natural selection) for evolution, the deluge of articles and books published in 1909, 50 years after the origin, show clearly that *it was principally the facts of geographical distribution that had convinced the majority* [italics mine]."[1]

In other words, Darwin was able to *describe a very large complex, closed system* (earth) by modeling it with *much smaller, simplified, semi-closed systems* (islands).[2] Island processes are amplified through compression[3] and thus, relative to continents, exhibit explosive rates of evolution.[4] *Therefore islands may enable us to model our Earthly future, to observe biogeographical and political conditions on islands and to model future global implications: The Problem of Sustainable Economic Development on Prince Edward Island today*—for example—may represent *The Problem of Sustainable Economic Development on Earth tomorrow.*

~~*Island Bioeconomics*~~ *Problem Solving* is an island-based approach to economics which rests upon a foundation supported by four cornerstones: Evolutionary Biology, Game Theory, a theory of value based upon relative insularity[5], a simple solution to *The Problem of Induction*. We will furthermore suggest that these four cornerstones

1 Ibid, p 202.

2 Compared with continents… [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range… their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (Wallace 1880, pp 241-242).

3 It appears almost all ecological and evolutionary processes…are amplified on islands; generally speaking, the smaller the island, the more amplified these processes are. Small size and low diversity seem to be the main factors. With populations existing in miniature, they are prone to stochastic, or random, processes…. Such a mosaic of habitats in a tiny area promotes evolutionary radiation. Conversely, the small size of islands means that they are exquisitely vulnerable to biological invasion and disturbance as there are few distance barriers to dispersal, and few areas are immune to disturbance by inaccessibility. On the plus side, 'amplification by compression' makes islands particularly useful…on islands, process that may be subtle on continents tend to be more clearly exposed (Baldacchino 2007b, p 193).

4 Carlquist 1974, p 20.

5 *Value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$. I_R is based upon: *Land Area (km^2), Elevation (m), Distance from nearest Continent (km), Distance from nearest Neighbour (km), Nearest Neighbour Land Area (km^2), Renewable Water Resources (m^3/person/year), Population Density (p/km^2), Exclusive Economic Zone Area (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Subsistence Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (p/yr), Irrigation (m^3/person/year &% km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (grammes/p/day), Food Imports (%), Sovereign Status, Constitutional Constructs and Military Power* (Funk 2008).

are inextricably intertwined. Consider, for example, the intrinsic and complementary similarities between Game Theory and our Island-based approach.

> Game theorists study mathematical models of social interactions. To be useful, a game model should be simple enough to understand but should share some important similarities with the more complex situations of conflict and cooperation that we face in real life. Game theorists use models as simplified versions of life that are meant to clarify some of the logic of life's dilemmas, just as people everywhere use stories to develop new perspectives on important social problems.[1]

Now consider this method again, simply replacing the mathematical models with islands:

> ~~*Island Bioeconomists*~~ *Problem Solvers* study biogeographical *island* models. To be useful, an island model should be simple enough to understand but should share some important similarities with the more complex situations of conflict and cooperation that we face on the larger, more complex island of Earth. *Problem Solvers* use islands as simplified versions of life that are meant to clarify some of the logic of life's dilemmas, just as people everywhere use stories to develop new perspectives on important social problems.

And although our methodological approach proposes solutions to economic problems pertaining to any and *all geographical* locales, we submit you may discover this approach addresses the false and sandy[2] economic assumptions which are especially vexing to those who inhabit islands and other relatively insular regions.[3] But if this story accomplishes nothing else, I hope that it will at least irrefutably demonstrate that *we are all islanders (all inextricably intertwined and engaged in a non-cooperative game)!*

The fundamental problem I had identified on Prince Edward Island was that its inhabitants were not willing to fight to protect their natural resources and were thus, not willing to fight to protect themselves: a 900% increase in the application of potato fungicide has turned the island into a very curious laboratory for the study of rare and exotic cancers (a 30% increase over the past five years). This set-up becomes even bewieldering when considering the fact that (1) potato farmers receive the same price for their crop which they received 17 years ago, (2) these famers are only able to continue to pollute the island with their money-losing enterprises with financial

1 Myerson 2007a, p 4.

2 Keynes 1936.

3 My first visits to the developing world in 1967, and a more extensive stay in Kenya in 1969, made an indelible impression on me. Models of perfect markets, as badly flawed as they might seem for Europe or America, seemed truly inappropriate for these countries (Stiglitz 2001, p 473).

assistance gained through democratic vote, and (3) the agricultural secotor makes up only 5% of the island's voting population; yet the island continues to vote to, essentially, kill themselves and kill their economy (pesticide externalities are destroying the other two leading sectors of the economy: the in-shore fisheries and tourism).

So, with this problem in mind, I travelled to Iceland[1] twice last summer, in search of the indefatigable and unconquerable spirit Halldór Laxness captured in *Independent People:*[2] I wanted to come to understand people who were willing to fight to protect their natural resources (I was thinking primarily of the cod-wars) and fight to protect themselves (I was thinking of the Vikings), as I was beginning to suspect the lesson of Icelandic independence and Icelandic *Struggle for Life* may offer viable and valuable solutions to fundamental, relatively significant sociological, political, economical, and ecological (hereafter SPEE) problems on and Prince Edward Island and, more generally, in Atlantic Canada, including Newfoundland.[3] Several notable writers echo this conjecture,[4] and, as Francios Doumenge[5] noted while reflecting upon the 1992 North Atlantic island conference on

1 (a) Iceland is an island of some 103 100 km^2 located in the North Atlantic just south of the Arctic Circle. Iceland's central point is approximately 65 North and 19 West. The country's exclusive economic zone (EEZ) is 758 000 km^2 or more than seven times the surface area of the mainland. Shortest distances to neighbouring countries are: to Greenland 290 km, to the Faroe Islands 435 km, to Scotland 812 km and to Norway 970 km (Arnason 1995, p 5).
(b) Settled by Norwegian and Celtic (Scottish and Irish) immigrants during the late 9th and 10th centuries A.D., Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated, mostly to Canada and the US. Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. *Literacy, longevity, income, and social cohesion are first-rate by world standards* [italics mine, *CIA World Factbook*, updated 1 November 2007].

2 Laxness 1946.

3 The fishery in Newfoundland, and in other parts of Atlantic Canada is part industry, part social-welfare program, in contrast to Iceland where the fishery is organized almost exclusively as an industry.…Iceland lands slightly more fish than all of Atlantic Canada with one-tenth the number of people fishing. It uses about 60 per cent fewer people to process the fish (Simpson 1995).

4 The relative success of the Icelandic fisheries suggests that other fishing nations may have something to learn from the Icelandic experience (Arnason 1995, p x).

5 I worked in the fisheries and aquaculture in Micronesia, Polynesia, and melanesia for fourteen years (1960-1973), th elast two years as Project Manager for th eSouth Pacific Islands Fisheries Development Agency (FAO/UNDP). During this perikod my investigations also concerned coral reef conservation for the French National Research Council and small islands socio-economic development for the South Pacific Commission. Next, I was for three years (1976-1979) head of the educational system for the three American overseas French departments (Martinique, Guadaloupe, and French Guiana) as Rector of the University of Antilles-Guyane. Lastly, I served from 1987 to 1988 as President of the University of Antilles-Guyane. Lastly, Iserved from 1987 to 1988 as President of the Council of Administration of the French Overseas Scientific and Technical Research Institute for Cooperation and Development (ORSTOM).

Along the way, I have compiled extensive reports and written books on these experiences…, plus the report commissioned by UNCTAD on the "Viability of small island states"… for the Belgrade conference.
More than thirty years of familiarity with the Mediterranean and tropical islands world, where I visited and surveyed more than a

PEI which "sought to understand the critical problems currently facing small islands":[1]

> Looking back at all the different island problems, my understanding is that most of these could be best solved if the island community develops and sustains a sense of unity, which may manifest itself in civic mobilization. Iceland won the cod war because all the Icelanders were prepared to fight against the British fishing fleet and thus conserve their basic resource. Had there been any disagreement on this within the Icelandic population, they would never have won, and they would never have reached their present envious economic situtaion.[2]

This consensus also reverberates throughout *The North Atlantic Fisheries: Success, Failures & Challenges*:

> While Iceland is probably better poised to respond to the future, it has the distinction of being the only fully sovereign state amongst those societies discussed in this volume. Could this be mere circumstance? If not, what are the connections between full political independence and successful fisheries development?
>
> We think there is a link, for two reasons. The first relates to the concrete advantages nation states have over societies politically subordinate to larger nation states in pursuing economic development….
>
> There is no doubt that full control over the relevant levers of national policy can be an enormous advantage to a small, geographically isolated society. One obvious advantage is that priorities that directly address concerns at the local level need not compete with other concerns and priorities from regions more populous and politically dominant in the larger society. In the case of both Newfoundland and Prince Edward Island, fisheries concerns typically receive little attention on the national Canadian scene.[3]

Moreover, however, I submit the lesson of Icelandic independence and Icelandic *Struggle for Life* may offer viable and valuable solutions to the inestimably complex and vastly uncertain socio-economic *Problem of Global Warming,*[4] and that

> it is possible that political *independence engenders a certain resolve to make the most of available resources and opportunities*. Such resolve might manifest itself in concrete ways such as programs and policies, and in less obvious forms such as its effect upon collective attitudes. There is some suggestion that Iceland was able to pursue a *highly rationalized* strategy of fisheries modernization, *at least in part because of the collective realization that the society's future well-being was linked to a prosperous, efficient fisheries. The collective sentiment that there was no larger political unit to fall back on might very well have been instrumental in the pursuit of such a strategy*.[5]

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hundred entities related to eleven independent statees and twenty dependent or associated territories with Australia, France, New Zealand, Portugal, Spain, the United Kingdom, and the USA…, have enabled me to develop personal views integrating ecology, natural resources, and ethno-hestory…, as well as politics and socio-economy (Doumenge 1998, pp 227-339).

1 Doumenge 1998, p 337.

2 Ibid p 342.

3 Arnason and Felt 1995, p 300.

4 See Funk 2007a.

5 Italics mine: Arnason & Felt 1995, p 301.

We'll begin by opening *The Penguin Historical Atlas of the Vikings*:[1]

> Recent years have seen great changes in our historical understanding of the Vikings.[2] The traditional image of the Vikings as nothing more than axe-yielding pirates bent on rape and pillage or conquest has been balanced by a new appreciation of peaceful Viking enterprise in the fields of trade, crafts, exploration and settlement.... Some may feel that my approach has over-emphasized the Vikings' warlike activities at the expense of their more constructive enterprises. This... reflects my own unease at the extent to which the importance of violence in the Viking Age has been played down in many recent studies of the period. The Vikings could be a pretty rough crew when it suited them, and it suited many of them very often in the period *c.* 800-1100.

Now, the *dilemma* this historical exposition presents is the implication that we must first *interpret* what it *means* to be 'warlike', and we must thus dive head-first into the murky waters of *social norms.*[3] Is warfighting a rational pursuit? *We submit that it is.*[4] And what about the Vikings' victims? Were they 'warlike'? *We submit they were* (consider the crusades). Were these 'victims' more or less rational? *We submit they were hyperirrational.*[5] We also submit their descendants inherited this irrationality through genetics and centuries of institutionalized[6] social learning:

> The Vikings' victims had little difficulty explaining the raids: they were God's punishment on a sinful

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1 Haywood 1995, *Foreword*.

2 The term "Viking" has come to be applied to all Scandinavians of the period, but in the Viking age itself the term *vikingr* applied only to someone who went *i viking,* that is plundering (Haywood 1995, p 8).

3 The existence of social norms is one of the big unsolved problems in social cognitive science. Although no other concept is invoked more frequently in the social sciences, we still know little about how social norms are formed, the forces determining their content, and the cognitive and emotional requirements that enable species to establish and enforce social norms.... Human societies represent a spectacular outlier with respect to all other animal species because they are based on large-scale cooperation among genetically unrelated individuals. In most animal societies, cooperation is either orders of magnitude less developed compared with humans, or it is based on substantial genetic relatedness (Fehr & Fischbacher 2004, p 1).

4 Aumann 2005, p 351.

5 It is customary to suppose that the bulk of our beliefs are derived from some rational ground, and that desire is only an occasional disturbing force. The exact opposite of this would be nearer the truth: the great mass of beliefs by which we are supported in our daily life is merely the bodying forth of desire, corrected here and there, at isolated points, by the rude shock of fact. Man is essentially a dreamer, wakened sometimes for a moment by some peculiarly obtrusive element in the outer world, but lapsing again quickly into the happy somnolence of imagination (Russell 1928, p 14).

6 A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason (Russell 1928, pp 6-7).

people. Archbishop Wulfstan of York expressed this view eloquently in his *Sermon of the Wolf to the English,*[1] written after Svein Forkbeard's victory over the English in 1014.[2]

For example, last year[3] I considered the conjecture that the *rationalized Icelandic fishery management* is an evolutionary result of *rationalized Viking survival strategies.*

> Modern historians have found the Viking age harder to explain. Land-hunger caused by a growing population has often been proposed as a cause of the Viking expansion. The population in Scandinavia certainly was rising in the centuries before the first raids, and it continued to do so during and after the Viking age.... Scandinavia has relatively little good arable land and it might be expected that the pressure of a rising population would soon be felt.[4]

Since our anthropocentric tendencies marginalize (or, most often than not, completely ignore) the fact that we are mammals more *like* than *unlike* other mammals. We do not raise morality issues, evoke the improbable existence of God,[5] or engage in debate regarding what it means to be 'war-like' when a hungry lion takes a gazelle from another hungry lion, or, for that matter, when any other species on earth engages in warfighting for survival —with the exception of *man.*[6]

This illusive truth is so critical, I will offer one final anecdote I know rather well.

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1 Things have not gone well now for a long time at home or abroad, but there has been devastation and persecution in every district again and again, and the English have been for a long time now completely defeated and too greatly disheartened through God's anger; and the pirates so strong with God's consent that often in battle one puts to flight ten, and sometimes less, sometimes more, all because of our sins... what else is there in all these events except God's anger clear and visible over his people? (Haywood 1995, p 9).

2 Ibid, p 9.

3 Funk 2007a.

4 Ibid.

5 The belief in God has often been advanced as not only the greatest but the most complete of all the distinctions between man and the lower animals. It is however impossible, as we have seen, to maintain that this belief is innate or instinctive in man. On the other hand a belief in all-pervading spiritual agencies seems to be universal, and apparently follows from a considerable advance in man's reason, and from a still greater advance in his faculties of imagination, curiosity and wonder. I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument, as we should thus be compelled to believe in the existence of many cruel and malignant spirits, only a little more powerful than man; for the belief in them is far more general than in a beneficent Deity. The idea of a universal and beneficent Creator does not seem to arise in the mind of man, until he has been elevated by long-continued culture (Darwin 1883, p 7).

6 (a) Those whom we called brutes had their revenge when Darwin showed us that they are our cousins (Shaw 1903, ln 129.
(b) Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future. But we are not here concerned with hopes or fears, only with the truth as far as our reason permits us to discover it; and I have given the evidence to the best of my ability. We must, however, acknowledge, as it seems to me, that man with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his god-like intellect which has penetrated into the movements and constitution of the solar system -with all these exalted powers- Man still bears in his bodily frame the indelible stamp of his lowly origin (Darwin 1883).

The story is told of a young boy who learnt to hunt and learnt to fish. The boy's grandfathers were both great fishermen, one of which was an avid hunter as well. The boy's father was, and remains to this very day, a great hunter and a great fisher (in fact, it is widely agreed he is simply a great father). At the age of six or sseven, while hunting with his grandfather on a cold Thanksgiving day along a hedgerow in Newton county, Indiana, the young boy aligned his lever-action BB-gun at his first live target: a very large barn owl, resting peacefully on a fencepost at midday. The boy struck the owl square in the impenetrable tuft feathers in the centre of his chest. The brass BB dropped to the ground below the owl's roost. The owl blinked and stared at the boy. The boy sized up the situation before firing two more rounds--each shot yielding the same result.

On July 4th, 1977, the eight-year old boy shot 31 *.22 calibre rounds* from a single-shot, bolt-action Winchester model 67; 27 rounds tore through a small white paper plate posted fifty feet way, with one round less than a centimeter from a small, hand-drawn black bull's-eye. At the age of nine the young boy took a ruffled-grouse with a *.22 calibre* Browning, a feat many men would find difficult to duplicate, to say the least. The next summer, from forty paces over flowing water the young boy drew a bronze aluminium arrow on a slim mink and skewered it to the opposite bank of the stream. This fortunate boy also spent summers fishing on a lake with his father, the same lake his father had fished with his own father. He was twelve years old when he first sailed the Canadian waters of northern Ontario, on a fly-in fishing expedition, once again, with his father. In short, the young boy was as in-tune with his *natural* instincts as a songbird.[1] He was, so to speak, *a natural borne killer*.

How, when, where, why, and for what reason one looses touch with his or her natural instincts is, of course, a matter of inestimable speculation. But it may be worth noting that, at this juncture in his life, our young, natural borne killer entered into a Catholic elementary school which accelerated the course of the Christian tradition into which he had been baptised and borne. Yes, our attendant alter boy accepted what he was taught to be "good," and although, once again, we must not jump to conclusions, it may at least strike us as somewhat curious

1 See page 6: S*truggle for Life*.

that the boy put down his bow and put down his gun and no longer hunted with his father. We must also admit that it seems odd that the boy spent the next summer on Lake Gogebic with his father and brother, reading quietly in the bow of the boat, *secretly sparing the lives of as many minnows as he could!* Is it possible *that the boy had lost touch with his natural instincts?* What would Jesus do for the that little minnow—wriggling with a hook through its mouth and out of the top of its bloody head?

Naturally, like most other boys and girls (*and most men and women living well-above the poverty line*), at lunch-time, the boy would enjoy the walleye, fried in his father's famous batter recipe without considering, without *understanding,* the meaning of it all; without *truly understanding* what had *had* to occur in order for that golden fillet of fish to have arrived upon his plate. Seems like a fairly decent recipe for cognitive dissonance,[1] doesn't it?

Years later, when the privileges of youth had passed like a summer butterfly, the young boy who had become a man yet had not yet become an *independent man*, found himself ill-equipped for *The Struggle for Life.*

In fact he discovered that the *struggles for life* were far more difficult than he had *imagined.* And he failed. In fact he failed more times than most would imagine possible without transpiring with untimely death.

But there is nothing like necessity to rekindle even the coolest, ashen remains of the embers of natural instinct. At last the young man found himself on the Nak Nak River in South-western Alaska, drifting over the largest wild salmon run remaining on earth, ripping salmon out of a gill-net as fast and as furiously as he could, *for life was on the line*, and not only his life, for his very own son had begun that earliest stage of *The Struggle for Life,* yet within his mother's womb; and his fishing father, aware that the *inestimable*, *invaluable* nutrients from the bright-orange flesh of fresh, wild, sockeye salmon, may be one of the greatest gifts he may have to offer his unbourne son.

So he fished and filleted without a second thought. His killer instincts had begun to re-emerge.

A few years later, fishing in *The Gulf of Magdalene*, off the north shore of Prince Edward Island, when his young son was three years old, and they fished on the sea together for the first time, the man, the relatively

1 Festinger 1957.

independent man, celebrated each and every mackerel raised over the washboard, and as they sailed back to the harbour, he sat at the helm with his son and a summer smile, for he would soon provide a meal fit for a king, queen, and young prince. But as he filleted the fish onshore, with no small shame he recalled the days of his youth spent idly reading while his father and brother fished by his side. Moreover, he began to *understand* that

> *unless it be thoroughly engrained in the mind… the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood.*

Do you not find it curious that empirical studies consistently report that happiness and income rise in correlation up to the poverty-line, at which point every incremental rise in income yields less happiness? Is it not possible that happiness *and* rationality are in-synch when engaged in *The Struggle for Life*? Is it not worth considering the possibility that many driven individuals, whom have achieved levels of monetary success above and beyond the ability to provide food, water, and shelter for *the next two or three generations* may be drawn to hunting and fishing leisure pursuits by an instinctual drive to maintain a strong connection with *The Struggle for Life*?

In any case, now that our story of the young boy who struggled to become an independent man has been told, a *rational* interpretation of Viking history may present itself more clearly: Once upon a time, a pack of hungry, *independent*, and often genetically related mammals, fully engaged in the TSL, went foraging for food. On these foraging excursions, they engaged in highly rationalized problem solving endeavours, *learnt,*[1] corrected errors, and recorded these highly rationalized trials and errors which *served and continue to serve as a conduit for highly rationalized social learning and evolution.* As Fehr & Gachter noted in *Fairness and Retaliation: The Economics of Reciprocity:*

> The Edda, a 13th century collection of Norse epic verses, gives a succinct description of reciprocity: "A man ought to be a friend to his fiend and repay gift with gift. People should meet smiles with smiles and lies with treachery." There is considerable evidence that a substantial fraction of people behave according to

1 Learning from history does not come naturally to us humans…. It is a platitude that children learn only from their own mistakes; they will cease to touch a burning stove only when they are themselves burned; no possible warning by others can lead to developing the smallest form of cautiousness. Adults, too, suffer from such a condition. This point has been examined by behavioural economics pioneers Daniel Kahneman and Amos Tvesrsky…. In some respects we do not learn from our own history. Several branches of research have been examining our inability to learn from our own reactions to past events: For example, people fail to learn that their emotional reactions to past experiences (positive or negative) were short-lived—yet they continuously retain the bias of thinking that the purchase of an object will bring long-lasting, possibly permanent happiness or that a setback will cause severe and prolonged distress (when in the past similar setbacks did not affect them for very long and the joy of the purchase was short-lived) (Taleb 2001).

this dictum.[1]

And how does the wisdom of the *Edda* compare to the Christian dictum: *to turn your other cheek?*[2]

Over time, a *Viking Theory of Value* rooted in the *Struggle for Life* (as opposed to Christian values, Nationalistic values, Academic values, Corporate values, etc.) evolved which encouraged literacy for all and fostered independent-minded, rational individuals.[3]

Yes, the Vikings did eventually accept Christianity, but they do not appear orthodox in this acceptance; it seems they generally heed Shaw's advice: "Do not give your children moral and religious instruction unless you are quite sure they will not take it too seriously."[4] Helgi the Lean claimed to be a Christian, "but invoked Thor in matters of seafaring and dire necessity."[5] In 1946, Halldór Laxness summed up Icelandic rationalism, healthy scepticism, independence, and their general position on Christianity in *Independent People*:

> You should beware of believing things you see in books. I never regard books as the truth, and least of all the Bible, because there's no check on what they can write in them. They can spin lies as big as they like, and you never know, if you haven't been on the spot.....
>
> "The story can say what it likes for me," said Bjartur sceptically, "but what I'd like to know is this: Who saw Jesus rise on a Sunday?"[6]

Our analysis of Viking history concludes with the *simple, logical, rational,* observation that, on many of their

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1 2000, p 159.

2 In game theory, this strategy is referred to as "always cooperate."

3 (a) In Iceland there were no conditions for the rise of the class society elsewhere so characteristic of the Middle Ages, with its sharp contrast between Church and people, between the learned and the peasants. There books were not, as in other lands, the privilege of a few priests versed in Latin. Even in the Middle Ages literacy was far more widespread among the common people in Iceland than in other parts of Europe (Wessén 1995, *The Nobel Prize in Literature Presentation Speech*).
(b) I know many examples of success or failure of island life all over the world. Each time the "success story" involves educated populations, while the "failure story" involves the uneducated, illiterate islanders. The basic requirement of island life is a consciousness of group identity, history, and destiny. Group consciousness is the key either to destruction or to liberation (Doumenge 1988, p 342).
(c) Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated, mostly to Canada and the US. Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. *Literacy, longevity, income, and social cohesion are first-rate by world standards* [italics mine, *CIA World Factbook*, updated 1 November 2007].
(d) Also see, for example, Magnússon & Pálsson, *c.* 1000 A.D.a, *c.* 1000A.D.b.

4 1903, ln 42.

5 Haywood 1995, p 33.

6 Laxness 1946, p 64.

foraging quests, *these natural borne killers* encountered confused, weak, dependent people who, through *institutionalized irrationality,* were less able to defend their food and unable to understand the world in which they lived. They simply could not fathom a *human being* (note the disconnect from the animal kingdom) *evil* enough to take a gazelle from God (or a gold chalice from an unlocked church). *Rational* explanations for these *devilish* deeds were simply *outside* the scope of their religious-based value system, and thus, they were not able to comprehend what was happening in the world around them, much in the same way I am suggesting that you, Professor Dasgupta, do not understand what is happening in the world around you.[1]

By this juncture, your great mistake should be apparent to you, but if the nature of your error has not already begun to reveal itself, I trust it will in due course; as you may surmise from the narrative thus far, this error may be deeply entrenched in your mind, in your *unconscious mind*, and may take some time to untangle it all.

Let's return to *Nature in Economics*:

> Nature has been ill-served by 20th century economics. When asked, economists acknowledge nature's existence, but most would appear to deny that she is worth much. If ecologists worry about the contemporary nexus between population size (and growth), the standard of living, and the natural environment, we economists point to the accumulation of capital and technological progress and say Malthus got it wrong. In this paper I show by an appeal to theory that economics has been so badly misused, that it has deflected attention from deep problems at the nexus that are faced both regionally and globally.

From this *abstract* alone, it becomes immediately apparent that you neither understand (1) the *derivative nature of economics* nor (2) the *whole economy of nature*, because if you did, you would understand that, "economics has been so *effectively* deployed, that it has deflected *undue* attention upon *uncertain* and *inestimable* problems at the nexus that are faced both regionally and globally." Failure to grasp these two fundamentals is nothing to ashamed of, however, as I have already noted, your colleagues have committed the same errors, and I have discovered very few

1 History shows that our theories have been wrong more often than right, resulting in the demise of whole civilizations when we have misinterpreted what is happening to us.…

It would be comforting to believe that humans have been prescient enough to understand what is happening to themselves and act accordingly. But… the way the mind understands the external environment—the beliefs humans construct to explain the external world are frequently incorrect, particularly if the changes are creating really novel situations. And clearly, humans have evolved environments radically different from anything that existed before (North 2007, p1).

economists in possession of this knowledge. Political thinkers like Morgenthau have had a general understanding of the problem, and Mearsheimer understands it completely. Robert Aumann gets it: his 2005 Prize Lecture, *War and Peace*, is right on the mark. In fact, from von Neumann and Morgenstern to the present, it seems that with the possible exception of practitioners of *Mechanism Design Theory* (MDT), *most* game theorists, especially practitioners of evolutionary game theory (indeed, evolutionary biologists in general) grasp the nature of *nature*. I have merely noted this exception to MDT since, in light of your collaboration[1] with game theorist Eric Maskin, your first instinct might be to turn to him for his wisdom. Although *Evolution, Cooperation, and Repeated Games*[2] is a curious short meditation on the *Prisoner's Dilemma* and the *Battle-of-the-Sexes* in repeated games,[3] his normative[4] assumptions are as mistaken as yours (indeed MDT was founded upon a normative foundation). Case in point: *Mechanism Design: How to Implement Social Goals.*[5] Although we will not be blown off course with a lengthy, unnecessary, and

1 Dasgupta & Maskin 2005.

2 Maskin 2007.

3 The theory of repeated games has been an important tool in the behavioral and biological sciences. Indeed, it provides the central model for explaining how agents with selfish objectives might nevertheless behave cooperatively and efficiently in a long-term relationship. For that reason, it has been invoked often by economists, political scientists, ecologists, anthropologists and others interested in human cooperation (Maskin 2008, p 1).

4 These days, one commonly asserted imperfection in the science-policy interface is that some so-called "science" is imbued with policy preferences. Such science may be labeled as normative and it is potentially an insidious kind of scientific corruption. By normative science, I mean "information that is developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices." In some forms, normative science is not obviously normative to policy makers or even to many scientists. Such "science" has become a serious problem. I believe that use of normative science is stealth policy advocacy. Science, of course, is not value free because it is a human enterprise, but this fact does not make all science normative. Policy-neutral science is a way of learning about the world and it is characterized by transparency, reproducibility, and independence. Consider the simple but fundamental difference between scientific "is" and the policy "ought." Science deals with the "is" world (and the "was" and "will be" states of the world) as does the policy world, but the policy world also deals with the "oughts" and "shoulds." Science is, or should be, bounded in the "is" world (Lackey 2004, p 2).

5 The intellectual history of mechanism design theory goes back at least to nineteenth-century utopian socialists such as Robert Owen and Charles Fourier. Repulsed by what they viewed as the evils of the burgeoning capitalist system, these thinkers argued that socialism offered a more humane alternative and sometimes became involved in setting up experimental communities such as New Harmony, Indiana.

A more direct influence on the modern theory was the Planning Controversy, which reached its greatest intensity in the 1930s. The principal antagonists on one side were Oskar Lange and Abba Lerner, who argued forcefully that, done right, central planning could replicate the performance of free markets (Lange 1936 and Lerner 1944). Indeed, they suggested, planning could correct serious "market failures"—notably those on display in the Great Depression—and thereby potentially surpass markets. On the other side, Friedrich von Hayek and Ludwig von Mises staunchly denied the possibility that a planned system could ever approach the success of the free market (von Hayek 1944 and von Mises 1920).

The controversy was important and fascinating, but for certain onlookers such as Leonid Hurwicz, it was also rather frustrating. This was because it lacked conceptual precision: critical terms such as "decentralization" were left undefined. Moreover, the arguments adduced on either side often were often highly incomplete. In part, this was because they simply lacked the technical apparatus—in particular, game theory and mathematical programming—to generate truly persuasive conclusions.

largely useless discourse on the merits and demerits of MDT (we will, however, return to the very critical normative issue in due course), I will note, for example, although you *could* discover the solution to *The Problem of Sustainable Economic Development* is *not* implementable through a "social choice" mechanism because it is not *monotonic,*[1] employing this theorem is unnecessary, as it is much more readily understood that the solution is not implementable through social choice due to *The Problem of Induction*. If you are able to understand the Seven Axioms in this discourse, you will also be able to understand that the foundation of MDT is as inherently cracked and unstable as ecological economics, because, as you will see, *The Problem of Induction* falsifies the final conjecture in footnote 3 on the previous page.

In any case, if you seek to understand TSL through the social sciences, I'd turn to Aumann (or Schelling or Mearsheimer, for that matter), not Maskin. But the easiest, most straight-forward and unquestionably the best introduction to TSL, is, of course, to begin in the beginning, as Stephen Jay Gould noted in his 1433 page Magnum Opus, *The Structure of Evolutionary Theory:*

> The logical structure of the Darwinian foundation remains remarkably intact—a fascinating historical observation in itself, and a stunning tribute to the intellectual power of our profession's founder. Thus… I believe that the best way to exemplify our modern understanding lies in an extensive analysis of Darwin's basic logical commitments, the reasons for his choices, and the subsequent manner in which these aspects of "the structure of evolutionary theory" have established and motivated all our major debates and substantial changes since Darwin's original publication in 1859. I regard such analysis not as an antiquarian indulgence, but as an optimal path to proper understanding of our current commitments, and the underlying reasons for our decisions about them.[2]

Naturally you must weigh the value of Gould's advice on your own, but I believe you may easily see that,

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This is where Leo Hurwicz entered the picture. Inspired by the debate, he attempted to provide unambiguous definitions of the central concepts, and this effort culminated in his two great papers, Hurwicz (1960) and (1972), where he also introduced the critical notion of incentive compatibility.

The work inspired by Hurwicz and others has produced a broad consensus among economists that von Hayek and von Mises were, in fact, correct—the market *is* the "best" mechanism—in settings where (i) there are large numbers of buyers and sellers, so that no single agent has significant market power; and (ii) there are no significant externalities, that is, an agent's consumption, production, and information does not affect others' production or consumption. However, mechanisms improving the market are generally possible if either assumption is violated (Maskin 2008 pp 9-10).

1 Maskin 1977, 2008.

2 2002, p 12.

although I remain undecided on his punctuated equilibrium,[1] I believe his assertion of the contemporary significance of Darwin's original works is absolutely correct. Dawkins understands this point even better than Gould.

In APPENDIX VI: THE PROBLEM OF ECOLOGICAL ECONOMICS, you will find colour-coded highlights outlining your mistake, but I believe this outline may be unnecessary: if your error is not already clear to you, perhaps a high definition image of your error will snap into focus in the following review, a detailed treatment of the Seven Axioms which we previewed at the beginning of discourse. I believe now that I have properly framed the nature of your great mistake, you will, perhaps, more readily come to understand that you have failed to grasp the significance of Axioms IV through VII, which, once again, not only properly frame *The Problem of Sustainable Economic Development, but also serve as an independent proof of the Funk-Zweikampf solution*.[2] Again, if this is not already clear, I believe this, the initial criticisms I outlined on the first page of this letter, and the points I've detailed throughout this discourse will resonate and assimilate in your mind.

We'll move on to RIIS and GEMS strategies in their non-cooperative game after the review of our assumptions.

Ever since Menger's *Grundsätze der Volkswirtschaftslehre* (*Principles of Economics*),[3] conscientious economists have understood the implications of *The Problem of Value*; ever since the *Silent Spring* of 1962,[4] conscientious people

1 Gould 2002, ch 9.

2 See page 8: footnote 1.

3 1871.

4 (a) HEADLINES IN THE New York Times in July 1962 captured the national sentiment: "Silent Spring is now noisy summer." In the few months between the New Yorker's serialization of Silent Spring in June and its publication in book form that September, Rachel Carson's alarm touched off a national debate on the use of chemical pesticides, the responsibility of science, and the limits of technological progress. When Carson died barely eighteen months later in the spring of 1964, at the age of fifty-six, she had set in motion a course of events that would result in a ban on the domestic production of DDT and the creation of a grass-roots movement demanding protection of the environment through state and federal regulation. Carson's writing initiated a transformation in th relationship between humans and the natural world and stirred an awakening of public environmental consciousness (Lear 2002 in Carson 1962, p x).

(b) *It is often outsiders who see a problem first.* This may be because an inventor is rightly keen to have his invention applied, and may therefore overlook its possibly undesirable consequences. Thus, certain chemical inventions proved very successful against mosquitoes and other insects, but with the undesirable result that songbirds died of starvation. The American naturalist Rachel Carson reported all this in her excellent book *Silent Spring* (Popper 1999, p 101).

everywhere have understood the implications of *The Problem of Value*. Since our radical solution to this age-old problem is rather counter-intuitive, we shall review again in greater detail…

A UNIFIED THEORY OF VALUE FOR THE BIOLOGICAL AND SOCIAL SCIENCES[1]
&
SOLUTION TO THE PROBLEM OF SUSTAINABLE ECONOMIC DEVELOPMENT

AXIOM I: The Ground Zero Premise[2]

Survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a survival enterprise. It follows that survival is the… "problem" for human societies as well; it is a prerequisite for any other, more exalted objectives. Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely.…Our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern

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1 These 7 Axioms rest upon the fundamental physical laws of science (and, naturally all established sub-sets of these laws), but naturally acknowledge the well-established conclusion that, although both Einstein's and Newton's theories have been verified consistently, both cannot be valid. This footnote merely acknowledges our solution adheres to and does not conflict with the Physical Laws of Science: (i) *Fluid Mechanics* (Archimedes' Principle), (ii) *Force, Mass, and Inertia* (Kepler's Three Laws of Planetary Motion, Newton's Three Laws of Motion, Newton's Law of Universal Gravitation), (iii) *Heat, Energy, and Temperature* (Newton's Law of Cooling, Boyle's Law, Law of Conservation of Energy, Joule's First and Second Law, The Four Laws of Thermodynamics), and (iv) *Quantum Mechanics* (Heisenberg's Uncertainty Principle). Furthermore, we hereby submit our unified theory of the biological and social sciences maps the range of scientific knowledge: (1) lower limit of what must be known, and (2) the upper limit of what may be known.

2 Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.

An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements.

We can see that life–even at the level of the unicellular organism–brings something completely new into the world, something that did not previously exist: problems and active attempts to solve them; assessments, values: trial and error.

It may be supposed that, under the influence of Darwin's natural selection, it is the most active problem solvers, the seekers and the finders, the discoverers of new worlds and new forms of live, that undergo the greatest development.

Each organism also strives to stabilize its internal conditions of life and to maintain it's individuality – an activity whose results biologists call 'homoeostasis'. Yet this too is an internal agitation, an internal activity: an activity that attempts to restrict the internal agitation, a feedback mechanism, a correction of errors. The homoeostasis must be incomplete. It must restrict itself. Were it completely successful, it would mean the death of the organism, or, at the very least, the temporary cessation of all its vital functions. Activity, agitation, search are essential for life, for perpetual restlessness, perpetual imperfection; for perpetual seeking, hoping, evaluation, finding, discovering, improving, for learning and for the creation of values; but also for perpetual error…

Darwinism teaches that organisms become adapted to the environment through natural selection. And it teaches that they are passive throughout this process. But it seems to me far more important to stress that the organisms find, invent and reorganize new environments in the course of their search for a better world…

All organisms are fully occupied with problem-solving. *Their first problem is survival.* But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.

According to this optimistic interpretation, it is through natural selection and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche.

This pressure from within results in a choice of niches; that is, in forms of behavior that may be regarded as a choice of lifestyles and of surrounding. This must be taken to include choice of friends, symbiosis, and above all, perhaps most importantly… the choice of a mate… [all italics mine, Popper 1992].

governments… [is] either directly or indirectly related to the meeting of our basic survival needs.[1]

(i) Kin selection
(ii) Direct reciprocity
(iii) Indirect reciprocity
(iv) Graph selection

AXIOM II: The R-3[2] Premise

(i) *The Problem of Sustainable Economic Development*:
Global natural Resource consumption is approximately three times (3x) the earthly replenishing rate. In light of *The Tragedy of the Commons,*[3] though this problem may be soluble on local, municipal, regional, or even on national levels, it is insoluble on a global scale.

AXIOM III: The Ecological Uncertainty Premise

The Problem of Bounded Rationality
Axiom II threatens Axiom I.

AXIOM IV: The Political Uncertainty Premise

(i) *The Problem of Warfighting.*[4,5]
War is a violent clash of interests between or among organized groups characterized by the use of military force. These groups have traditionally been established nation-states, but they may also include any nonstate group—such as an international coalition or a faction within or outside of an existing state—with its own political interests and the ability to generate organized violence on a scale sufficient to have significant political consequences. The essence of war is a violent struggle between two hostile, independent, and irreconcilable wills, each trying to impose itself on the other. War is fundamentally an interactive social process.

1 Corning 2000, abstract.

2 Resource Replenishing Rate.

3 Lloyd 1832 ; Hardin 1968. Also see Ludwig et. al 1993.

4 See Aumann 2005, p 351.

5 (a) All actions in war take place in an atmosphere of uncertainty, or the "fog of war." Uncertainty pervades battle in the form of unknowns about the enemy, about the environment, and even about the friendly situation. While we try to reduce these unknowns by gathering information, we must realize that we cannot eliminate them—or even come close. The very nature of war makes certainty impossible; all actions in war will be based on incomplete, inaccurate, or even contradictory information (Gray 1989, foreword).

(b)
והיה באחרית הימים, נכון יהיה הר בית יי בראש ההרים, ונישא מגבעות, ונהרו אליו כל הגוים.
והלכו עמים רבים ואמרו, לכו ונעלה אל הר יי, אל בית אלהי יעקב, ויורנו מדרכיו, ונלכה באורחותיו; כי
מציון תצא תורה, ודבר יי מירושלם. ושפט בין הגוים, והוכיח לעמים רבים; וכיתתו חרבותם לאיתים,
וחניתותיהם למזמרות; לא ישא גוי אל גוי חרב, ולא ילמדו עוד מלחמה.

"And it shall come to pass … that … many people shall go and say, … let us go up to the mountain of the Lord, … and He will teach us of His ways, and we will walk in His paths. … And He shall judge among the nations, and shall rebuke many people; and they shall beat their swords into ploughshares, and their spears into pruning hooks; nation shall not lift up sword against nation, neither shall they learn war any more."

Isaiah is saying that the nations can beat their swords into ploughshares when there is a central government – a Lord, recognized by all. In the absence of that, one *can* perhaps have peace – no nation lifting up its sword against another. But the swords must continue to be there – they cannot be beaten into ploughshares – and the nations must continue to *learn* war, in order *not* to fight! (Aumann 2005, p 357)

Clausewitz called it a *Zweikampf* [*The Struggle for Life*]…and suggested the image of a pair of wrestlers locked in a hold, each exerting force and counterforce to try to throw the other. War is thus a process of continuous mutual adaptation, of give and take, move and countermove. It is critical to keep in mind that the enemy is not an inanimate object to be acted upon but an independent and animate force with its own objectives and plans. While we try to impose our will on the enemy, he resists us and seeks to impose his own will on us. *Appreciating this dynamic interplay between opposing human wills is essential to understanding the fundamental nature of war. The object in war is to impose our will on our enemy*. The means to this end is the organized application or threat of violence by military force. The target of that violence may be limited to hostile combatant forces, or it may extend to the enemy population at large. War may range from intense clashes between large military forces—sometimes backed by an official declaration of war—to subtler, unconventional hostilities that barely reach the threshold of violence.[1]

AXIOM V: The Planetary Uncertainty Premise

(i) *The Problem of Supernovas*:
Given Axiom I, an alternative inhabitable planet must be discovered, and immigration must occur within an unknowable time-frame, ostensibly as soon this year, but no later 99,000 yr from present (see vi, below).

(ii) *The Problem of Ohmic Decay:*
The mechanism by which the Earth and other planets maintain their magnetic fields against ohmic decay is among the longest standing problems in planetary science. Although it is widely acknowledged that these fields are maintained by dynamo action, the mechanism by which the dynamo operates is in large part not understood. Numerical simulations of the dynamo process in the Earth's core have produced magnetic fields that resemble the Earth's field, but it is unclear whether these models accurately represent the extremely low values of viscosity believed to be appropriate to the core.[2]

(iii). *The Problem of Meteorites:*
It is widely believed that meteorites originate in the asteroid belt, but the precise dynamical mechanism whereby material is transported to Earth has eluded discovery. The observational data for the ordinary chondrites, the most common meteorites, impose severe constraints on any proposed mechanism. The ordinary chondrites are not strongly shocked, their cosmic ray exposure ages are typically <20 Myr, their radiants are concentrated near the antapex of Earth's motion and they show a pronounced 'afternoon excess' (for every meteorite which falls in the morning two fall in the afternoon). Wetherill concluded that these data could only be explained by an "unobserved source" of material… His subsequent, more sophisticated investigations have not changed this basic conclusion. Recently I have shown that there is a large chaotic zone in the phase space near the 3/1 mean motion commensurability with Jupiter and that the chaotic trajectories within this zone have particularly large variations in

1 Italics mine, Gray 1989, pp 3-4

2 Kuang & Bloxham 1997, abstract.

orbital eccentricity. Since asteroidal debris is quite easily injected into this chaotic zone, it could provide Wetherill's 'unobserved source' if chaotic trajectories which begin at asteroidal eccentricities (e<0.2) reach such large eccentricities that Earth's orbit is crossed (e>0.57)… At least some of these chaotic trajectories do have the properties required to transport meteoritic material from the asteroid belt to Earth. Combined with the Monte Carlo calculations which show that the resulting meteorites are consistent with all the observational constraints, *the case for this chaotic route to Earth is fairly strong* [italics mine].[1]

(iv) *The Problem of Chaotic Behaviour:*
There are several physical situations in the solar system where chaotic behavior plays an important role. Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behavior also seems to be an essential ingredient in the explanation of certain non-uniformities in the distribution of asteroids. The long-term motion of Pluto is suspiciously complicated.[2]

(v) *The Problem of Super-Eruptions:*
In the past 2 Myr, there have been, on average, two eruptions every hundred millennia, the last of which shattered the crust of New Zealand's north island 26,500 years ago. To date, no mechanisms have been discovered for predicting these events; thus an eruption of this magnitude (VE8)[3] is possible within this decade and likely within 100,000 years Human survival is unlikely; even smaller eruptions (VE4, VE5, VE6) present significant problems.

(vi) *The Problem of Solar Flux:*
There has been life on Earth for at least 3,500 Myr but the assumption that a comparable future lies ahead may not be justified. Main sequence stars appear to increase their burning rate as they age. Thus the Sun, if a typical star, can be predicted to have increased its output by 30% since the Earth's origin 4,500 Myr ago. The maintenance of an equable climate since life began probably required some means of planetary thermo-stasis. The Gaia hypothesis proposed by Lovelock and Margulis included an unspecified biological means for climate control. Walker… suggests an abiological automatic thermostasis in which the atmospheric abundance of CO2, a greenhouse gas, adjusts to resist the warming tendency of the increased solar flux. It is clear that whatever the mechanism, atmospheric CO2 is now close to its lower limit of partial pressure, so the biosphere may soon, in geological terms, be exposed without protection to the predicted progressive increase of solar luminosity.[4]

AXIOM VI: The Deductive Premise

I suspect *The Problem of Induction* (in contradistinction with *deduction*) may be the most significant, least

1 Wisdom 1985, abstract.
2 Wisdom 1987, abstract.
3 Self 1982
4 All italics mine, Lovelock & Whitfield 1982, abstract.

understood problem on Earth today, not too mention the primary hindrance to TPSED. I have already noted, Dr Dasgupta, that your works demonstrate that you are insufficiently versed in this problem, and again, you will find several examples highlighted in APPENDIX VI. In your *Collapse* review, for example, you also noted that

> The Brundtland Commission Report of 1987 defined it as 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. In other words, sustainable development requires that each generation bequeath to its successor at least as large a productive base as it inherited.

You see, TPI is simply a philosophical acknowledgement that time machines have not and do not exist, that we are unable to *infer* anything with any assigned degree of *probability* about the *future*. You will discover that you are the rule rather than the exception in this state of philosophical ineptitute: although you have cited the Brundland Commission Report properly, the problem here is that the members of the Brundtland Commission do not understand TPI, either:

> The work of the Brundland [sic.] Commission suffers from continual references to sustainability that is to be achieved in an unspecified way. Recently some of the world's leading ecologists have claimed that the key to a sustainable biosphere is research on a long list of standard research topics in ecology. Such a claim that basic research will (in an unspecified way) lead to sustainable use of resources in the face of a growing human population may lead to a false complacency: instead of addressing the problems of population growth and excessive use of resources, we may avoid such difficult issues by spending money on basic ecological research.[1]

I will also note your *Collapse* review illustrates your normative approach to science, which is a common ailment amongst those who have failed to grasp TPI;[2] as Popper noted long ago, this problem is at least as old as

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1 Ludwig et. al. 1993.

2 Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management, and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's '*Nobody knows anything*' theory and advance our replacement theory: *George Lucas knows something* (Funk 2007b, abstract).

Plato:[1] Consider, for example, your claim that

> what I have sketched here *is* [italics mine] the correct way to determine whether contemporary economic development has been sustainable. It *is* [italics mine] also the correct way to evaluate public policy, for it tells me that a policy *should* [italics mine] be accepted if and only if it is expected to lead to an increase in wealth per capita.

I regret the complexities surrounding TPI are too expansive to address in what has already become a fairly long letter,[2] but the following passage may contextualize the problem for our purpose herewith, especially in regards to your dubious claim to be a contributer in "these are early days in the *quantitative* study of sustainable development;"[3] it would have been more accurate to refer to your endeavours as the *stone age* rather than the "early days" of the *quantitative* study of sustainable development," because, once again, since the time of Hume[4] and Cournot,[5] it has been self-evident that hope for a *quantitative* study of sustainable development is as dead as the dinosaurs (unless, of course Michael Crichton discovers a time-machine preserved in fine piece of Jurassic amber):

> We shall never attain scientific consensus concerning the systems that are being exploited. There have been a number of spectacular failures to exploit resources sustainably, but to date there is no agreement about the causes of these failures.…
>
> The great difficulty in achieving consensus concerning past events and a fortiori in prediction of future events is that controlled and replicated experiments are impossible to perform in large-scale systems. Therefore there is ample scope for differing interpretations. There are great obstacles to any sort of experimental approach to management because experiments involve reduction in yield (at least for the short term) without any guarantee of increased yields in the future. Even in the case of Pacific salmon stocks that have been extensively monitored for many years, one cannot assert with any confidence that present levels of exploitation are anywhere near optimal because the requisite experiments would involve short-term losses for the industry.…
>
> Scientific certainty and consensus in itself would not prevent overexploitation and destruction of resources. Many practices continue even in cases where there is abundant scientific evidence that they are ultimately destructive. An outstanding example is the use of irrigation in arid lands. Approximately 3000 years ago in Sumer, the once highly productive wheat crop had to be replaced by barley because barley was more salt-resistant. The salty soil was the result of irrigation. E. W. Hilgard pointed out in 1899 that the consequences of planned irrigation in California would be similar. His warnings were not heeded. Thus 3,000 years of experience and a good scientific understanding of the phenomena, their causes, and the appropriate prophylactic measures are not sufficient to prevent the misuse and consequent destruction of

1 1945.

2 Popper's 513 page treatise (1959) offers the best introduction.

3 2005, italics mine.

4 1739

5 1838

resources….

Once we free ourselves from the illusion that science or technology (if lavishly funded) can provide a solution to resource or conservation problems, appropriate action becomes possible. Effective policies are possible under conditions of uncertainty, but they must take uncertainty into account. There is a well developed theory of decision-making under uncertainty (18). In the present context, theoretical niceties are not required. *Most principles of decision-making under uncertainty are simply common sense*. [Note, however, on this single, italicized conjecture, I whole-heartedly disagree]. One must consider a variety of plausible hypotheses about the world; consider a variety of possible strategies; favour actions that are robust to uncertainties; hedge; favour actions that are informative; probe and experiment; monitor results; update assessments and modify policy accordingly; and favour actions that are reversible.[1]

AXIOM VII: The Insularity Premise

Value (V) *is a derivative function of relative insularity* (I_R): $V=f'(I_R)$

Strategic solutions[2] to threats posed by Axioms IV and V may be optimally addressed through biogephraphical and politico-economic mechanisms and institutions such as the U.S. Industrial Military Complex, NASA, etc. These mechanims in turn develop through consumption intensive, globalized consumer economies, and thus presents TPD's hold[3] on TPSED![4] By simultaneously accelerating Axiom II and driving solutions to Axioms IV and V.[5] Furthermore, given Axiom VI, a perfect Nash Equilibrium[6] (hereafter NE), the *precise* optimal strategic balance between natural resource consumption and natural resource preservation is unknowable and thus merely

1 Ludwig et. al. 1993.

2 Extraterrestrial immigration facilitated by arduous, long-term, capital and technological intensive space exploration, and meteorite/national defence through missile R&D, etc.

3 It may be laid down as a general rule to which there are few exceptions that, when people are mistaken as to what is to their own interest, the course that they believe to be wise is more harmful to others than the course that really is wise. Therefore anything that makes people better judges of their own interest does good. There are innumerable examples of men making fortunes because, on moral grounds, they did something which they believed to be contrary to their own interests. For instance, among early Quakers there were a number of shopkeepers who adopted the practice of asking no more for their goods than they were willing to accept, instead of bargaining with each customer, as everybody else did. They adopted this practice because they held it to be a lie to ask more than they would take. But the convenience to customers was so great that everybody came to their shops, and they grew rich (Russell 1928, p 10).

4 The "Prisoners" with whom we are unablel to communicate and thus cooperate with in our non-cooperative game are *unknowable future events, such as wars, volcanic eruptions, meteorite impacts, ohmic decay, solar flux, and any other "instances, of which we have had no experience*."

5 We note the solutions threats posed by Axiom V are, at present, ceteris paribus, essentially identical.

6 A Nash equilibrium is defined as a strategy combination with the property that every player's strategy is a *best reply* to the other players' strategies. This of course is true also for Nash equilibria in *mixed* strategies. But in the latter case, besides his mixed *equilibrium strategy,* each player will also have infinitely many *alternative* strategies that are his *best replies* to the other players' strategies. This will make such equilibria potentially unstable (Harsanyi 1994, p 167).

imperfectly soluble: we find a solution through a subjective, correlated, core,[1] strategic[2] NE/ESS. I will illustrate with a single example (but of course examples are limited only to the extent of one's imagination): *If* global natural resource consumption should result in trophic cascades and result in human extinction, the last man or woman (or last several hundred thousand, let's say) on Earth could exclaim, "Dr Dasgupta, were right! Resource consumption was too high!" Alternatively: *If*, let's say, fifty years from now, our chaotic meteorite generator[3] should lob a 200 km wide soft-ball our way, and, despite our best efforts, we were just a few years shy of developing a missile defense network capable of diverting or destroying this meteorite, then, just before the lights go out, we could all collectively curse, "Dr Dasgupta, you were wrong! We should have consumed natural resources *faster!*" (thereby accelerating space/NASA funding, defence R&D, etc.). This, Dr Dasgupta is exactly why I have suggested that you are not familiar enough with TPI! And *this* is the Prisoner's Dilemma in *The Problem of Sustainable Economic Development*: The "prisoner," in this game, is *The Problem of Induction. We do not an can not know what the other prisoner will do, because the other prisoner is the unknowable future!*[4] Given the depth of your body of work, however, I recognize that you are heavily invested in your fundamentally and fatally flawed positions, and that you may not be easily moved, so I'll offer one more example of this Prisoner's Dilemma. Consider Albert Einstein, perhaps one of the

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1 An outcome *x* of a game is said to be in its "core" if no set *S* of players can *improve* upon it – i.e., assure to each player in *S* an outcome that is better for him than what he gets at *x*. Inter alia, the concept of core plays a central role in applications of game theory to economics; specifically, the core outcomes of an economy with many individually insignificant agents are the same as the competitive (a.k.a. Walrasian) outcomes – those defined by a system of prices for which the supply of each good matches its demand (see, e.g., Debreu and Scarf 1963, Aumann 1964) (Aumann 2005, pp 356-357).

2 What do I mean by "strategic equilibrium"? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior*. Sharing that Prize were John Harsanyi, for formulating and developing the concept of *Bayesian* equilibrium, i.e., strategic equilibrium in games of incomplete information; and Reinhard Selten, for formulating and developing the concept of *perfect* equilibrium, a refinement of Nash's concept, on which we will say more below. Along with the concepts of *correlated* equilibrium (Aumann 1974, 1987), and *strong* equilibrium (Aumann 1959), both of which were cited in the 2005 Prize announcement, the above three fundamental concepts constitute the theoretical cornerstones of noncooperative game theory [all italics Aumann's 2005, p 352].

3 Wisdom 1985.

4 Planetary uncertainty, political uncertainty, etc.

greatest humanists,[1] and no doubt endowed with a very capable, analytical, rational and fiercely independent mind.[2] Why do you suppose he wrote those four fateful letters to Roosevelt?[3] Quite simply, because he came to the same conclusion I have arrived at (it wasn't until I considered both Einstein and von Neumann's roles in the Manhattan Project that this iteration of TPD became clear to me).

Struggle with it awhile, it certainly wasn't an easy conclusion for me to accept, and it wasn't easy for Einstein, either.[4] But if you accept this unified theory of the biological and social sciences, and understand the greater extent of TPSED, and, furthermore, if you begin to wonder, "Then what is the optimal strategy?, then that is where a TVAL based upon relative insularity comes into play. Again, a mixed but counter-balancing NE/ESS is reached when continental and insular biogeographies pursue their respective, antithetical, optimal economic development strategies.

And at this juncture, I trust that I have single-handedly and rather exhaustively falsified both *Nature in Economics* and, thus, so-called "Ecological Economics." And although at last we are set to begin to explore the intricacies of our *Theory of Value*, RIIS and GEMS economic development strategies, and play our non-cooperative game, I imagine, Professor Dasgupta, you have long-since determined whether or not you find this discourse of use; in the event that my teaching skills may be lacking,[5] or in the event that cognitive dissonance may prove too

1 I am by heritage a Jew, by citizenship a Swiss, and by makeup a human being, and only [italics Einstein's] a human being, without any special attachment to any state or national entity whatsoever (Einstein 1918, doc 560).

2 Einstein's genius reminds us that a society's competitive advantage comes not from teaching the multiplication or periodic tables but from nurturing rebels.... And, as recent research into Einstein's personal papers shows, there's no better glimpse into his offbeat creativity than the way he puzzled out the special theory of relativity.... *Einstein alienated so many professors that he was unable to earn a doctorate, much less land an academic job* [italics mine]. At the age of 26, he was working as a third-class examiner at the Swiss patent office in Bern.... *Other scientists had come close to his insight, but they were too confined by the dogmas of the day* [italics mine]. Einstein alone was impertinent enough to discard the notion of absolute time, one of the sacred tenets of classical physics since Newton. "Imagination is more important than knowledge," Einstein later said. Indeed, if we are ever going to unravel the further mysteries of dark matter, come up with a unified theory, or discover the true nature of energy, we should carve that proclamation above all of our blackboards (Isaacson 2007, pp35-36).

3 See APPENDIX V: EINSTEIN'S DILEMMA.

4 In fact, late in life, Einstein expressed regret over the letters, stating he had made a mistake. The absolute truth, of course, is unknowable even to Einstein. Did he make a mistake or was his mistake stating that he had made a mistake? Naturally, we must each decide what to accept as true.

5 Many of the views which have been advanced are highly speculative, and some no doubt will prove erroneous; but I have in every case given the reasons which have led me to one view rather than to another. It seemed worth while to try how far the principle of evolution would throw light on some of the more complex problems in the natural history of man. False facts are highly injurious to

vexing,[1] I will bring this long letter to close. However, I will have the great fortune to prepare the remainder of this discourse on the derivative value of relative insularity in a paper which I will deliver with a seminar in June, at a (fortunately) *independent*[2] island research institute[3] in Mariehamn, Åland,[4] and I would be happy to send this paper along, and if you would like to attend the conference I will forward details.

Before signing off, however, I will make a valedictory offering by relieving you of some unnecessary anxiety and concern regarding the future of *humanity*. I am pleased to report that on this first day of May, 2008, at eleven

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the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for every one takes a salutary pleasure in proving their falseness: and when this is done, one path towards error is closed and the road to truth is often at the same time opened (Darwin 1883, p 1236).

1 Festinger 1957.

2 Åland, a tiny archipelago in the Gulf of Bothnia is an unsuspecting place, a small province of neighbouring Finland. Home to 26,000 Swedish-speaking islanders, the island functions uniquely as an autonomous, self-governing, demilitarised region…. Its 26,000 islanders have the power to shape the future of Europe. As the national parliament in Helsinki prepares to ratify the Lisbon Treaty, the politicians of Åland are quietly in control of the final decision. The autonomy act that grants them their unique status also allows them to veto any treaty that affects their lands. And they may well exercise this right….

The situation arises from a complicated history. In 1921 a decision by the League of Nations placed the islands under Finnish sovereignty following centuries of Swedish rule and intermittent Russian takeovers. Since that date the islanders have lived in relative peace with this decision. The Finns have left them to propagate, educate and legislate with minimal interference.

Åland has never shared the pro-European sentiment of mainland Finns. The referendum that secured Finland's accession in 1995 was initially rejected by the islanders when concerns over their on board duty-free sales were called into question. The Finnish government finally negotiated an opt-out clause in the new EU tax directives for the islands. Following the 'yes' vote to succession in Sweden, Åland voted to join the EU on 20 November 1994 with a 74% majority.

'I don't define myself as Finnish or Swedish,' smiles Susanne Eriksson. The assistant director of the Aland Parliament stands in the shadow of the red Scandinavian cross that covers the blue Aland flag. 'I am an Ålander' (Steen 2008, p1).

3 Åland International Institute of Comparative Island Studies (AICIS) is an Åland based, international and *independent*, research institute which explores the economic and institutional aspects of insular entities - mainly from a comparative point of view. It operates, on a network basis, in close cooperation with other island institutes and academic institutions, as well as with a variety of economic and policy milieus, all over the world. AICIS…. is an independent foundation, set up by a number of leading Ålandic companies: Åland Mutual, Alandia Corporations, Bank of Åland, and Åland Investment Ltd. The core operations of AICIS are physically located to Statistics and Research Åland (ÅSUB), which also provides AICIS with the necessary facilities and IT-systems [italics mine AICIS 2008].

4 (a) Åland, an autonomous province of Finland. Åland functions in many ways similar to an independent state with its own legislation and administration. Its health statistics are good. The average life expectancy is 2–3 years higher than in the rest of Finland. For women it is the highest in the Nordic countries… The unemployment rate is low at about 2% (2003) compared with rates for the rest of Finland (9%), Sweden (5.6%) and Denmark (5.6%). In 2003, the gross domestic product per person was €34 193 (£22 556, US$44 423), the highest in the Nordic countries (Finland €23 500, £15 500, $30 500; Sweden €24 600, £16 250, $32 000). Furthermore, there is considerable municipal autonomy. The prerequisites for good subjective health development seem to be present in Åland (Eriksson et. al. 2007, p 684).

(b) The Åland Islands (60°00' to 60°30'N, 19°30' to 20°30'E)… [are] situated on the SW coast of Finland in the northern Baltic Sea… The Åland Islands are made up of some 6500 islands, thus forming a pattern of zonation ranging from inner sheltered bays to open sea areas. Average water depth is 20 to 25 m, with a shoreline of over 8000 km, emphasising [sic.] the importance of littoral, nearshore shallow areas for the functioning of the ecosystem. Due to land uplift (50–60 cm 100 a 1) after the last glaciation, new littoral areas are continuously forming. The brackish Baltic Sea has a restricted exchange of saline waters due to the shallow thresholds of the narrow Danish straits, and a large riverine input of freshwater results in low salinities in the northern archipelago… The sea is non-tidal but influenced by strong seasonality in hydrography, including ice cover during winter (Åland Islands: generally less than 40 days), and high temperatures (18 to 20°C) during summer months (Perus & Bonsdorff 2004, p 46).

hundred hours, temperature is 2°C at Covehead Harbour, light rain is falling, wind force 2 West-Northwest, and barometric pressure is holding steady at 101.46 kPa. My father-in-law, brother-in-law, and I set 300 baited traps on the sandy bottom off the north shore of Prince Edward Island, and, *regardless of what misfortune might or might not befall economic markets between now and o'five hundred tomorrow*, it is likely our traps will be full of North Atlantic lobster, and, again, no matter what Fortune[1] may have on her mind, these edible, feisty crustaceans will yield some *value*, and this value is a derivative function of our relative insularity here on Prince Edward Island![2] I thought knowing this might help alleviate some apparent anxiety and concern you expressed in a statement which, coincidentally, most clearly revealed the *true nature* of your great mistake, your most revealing *tell*,[3] if you will. In your most unnatural and nature-less *Nature in Economics,*[4] you will recall that you suggested that *"humanity would cease to exist if world [economic] output were zero."* That was a very interesting statement. *Humanity* would cease to exist, would it? After dreaming for more than a decade about my very own volumes of *The Oxford English Dictionary*, I discovered a set for sale in Montreal last December, so let's take a look and see what the *OED* has to say about *humanity*: *"The human race; human beings collectively."* Well, I believe that I have sufficiently refuted this theory, but I will note that, although *humanity* may very well cease to exist for someone such as yourself, Sir, if Fortune should indeed push her tiller hard: I can fish and I can hunt and I can sail.

And I will be in my Skíðblaðnir[5] with my wife and my son and nets and knives and guns and *we* will fight for

1 [The wise] will start each day with the thought… Fortune gives us nothing which we can really own. Nothing, whether public or private, is stable; the destinies of men, no less than those of cities, are in a whirl. Whatever structure has been reared by a long sequence of years, at the cost of great toil and through the great kindness of the gods, is scattered and dispersed in a single day. No, he who has said 'a day' has granted too long a postponement to swift misfortune; an hour, an instant of time, suffices for the overthrow of empires. How often have cities in Asia, how often in Achaia, been laid low by a single shock of earthquake? How many towns in Syria, how many in Macedonia, have been swallowed up? How often has this kind of devastation laid Cyprus in ruins? We live in the middle of things which have all been destined to die. Mortal have you been born, to mortals have you given birth. Reckon on everything, expect everything (Botton 2001, p 91).

2 Funk, forthcoming.

3 A tell in poker is a detectable change in a player's behavior or demeanor that gives clues to that player's assessment of his hand. A player gains an advantage if he observes and understands the meaning of another player's tell, particularly if the tell is unconscious and reliable (Wikipedia 2008).

4 Dasgupta 2007, p 3.

5 In Norse mythology, the god Frey counted among his greatest treasures a magic ship called Skíðblaðnir which had been built by those consummate craftsmen of legend, the dwarves; according to Snorri Sturluson it always had a following wind, and it was so ingeniously

survival.

And although *humanity* may very well cease to exist for *people like you*,[1] it will *never* cease to exist for *people like us, because we are rational enough to understand that it doesn't exist in the first place!*

> THE MAIN CONCLUSION arrived at in this work, namely that man is descended from some lowly-organised form, will, I regret to think, be highly distasteful to many persons. But there can hardly be a doubt that we are descended from barbarians….
>
> Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future. *But we are not here concerned with hopes or fears, only with the truth* as far as our reason permits us to discover it; and I have given the evidence to the best of my ability. We must, however, acknowledge, as it seems to me, that man with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his god-like intellect which has penetrated into the movements and constitution of the solar system -with all these exalted powers - *Man still bears in his bodily frame the indelible stamp of his lowly origin*.[2]

As the Icelandic say, may a whole whale wash up upon your shore (I suspect you may need it),

(Matt Funk)

PS: It is possible that psychological discomfort has made it impossible for you to read the entirety of this letter, and it is perhaps not likely that you will read as far as this postscript. Thus, I have elected to save 96 pages of paper, and have not enclosed the extensive, annotated, SELECTED BIBLIOGRAPHY. If my judgement was poor in this regard, and if you would in fact appreciate a copy of this bibliography, please contact me and I will send it.

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constructed that it was large enough to carry the entire pantheon of the gods…, yet could be folded up and tucked into a pouch when not in use (Magnusson 1980, p 21).

1 One of the longest standing controversies in evolutionary game theory is the group selection controversy. The group selection idea, which traces its origins all the way back to Darwin, essentially says that groups with internal cooperation will be more successful than other groups, and that this may cause altruistic behaviours—individual sacrifices for the common good of the group—to survive and in some circumstances thrive:

> *There can be no doubt that a tribe including many members who, from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over most other tribes, and this would be natural selection*. (Darwin, 1871, p. 166) [italics mine, Weibull & Salomonsson 2005, p 1].

2 Italics mine, Darwin 1888, p 1248.

APPENDIX I: TUCKER 1950

5 June 2005 Eric Rasmusen notes, erasmuse@indiana.edu:

> *Chapter 1. Albert Tucker, ``A Two- Person Dilemma,'' unpublished notes (May 1950)*
>
> When I was writing the first edition of *Games and Information* back in the 1980's I was confused by the varying citations give for The Prisoner's Dilemma. I asked Lloyd Shapley about it, since he was there at the founding, and he referred me to Albert Tucker. Professor Tucker replied with this letter [see next page] telling me about his Stanford handout [see third page] and the article by Straffin that tells the story, Philip Straffin, ``The Prisoner's Dilemma,'' *UMAP Journal*. 1: 101-103 (1980). I republished both in *Readings in Games and Information*[1]

1 (Rasmusen 2005).

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2/25/87

Dear Professor Rasmusen,

Here is a copy of the mimeo which was published in 1980 UMAP, page 101, along with a copy of the accompanying article by Philip Straffin. In 1949-50 I was at Stanford on sabbatical leave, and became a consultant at Rand.

I expect Lloyd Shapley did not want to become involved because Merrill Flood, a mutual friend, seems to feel that he and Rand colleagues did not get the credit they deserved. Lloyd was a Princeton graduate student at this time and became my Ph.D. student when I returned.

Anyhow, I claim no active part in the matter except inventing the prisoner story. I have always tried for catchy examples in my talks.

Excuse this rough reply, but I am 81 and hobbled by arthritis.

Sincerely,

A W Tucker

See UMAP Journal 1 (1980) 101-103.

A TWO*PERSON DILEMMA

Two men, charged with a joint violation of law, are held separately by the police. Each is told that

(1) if one confesses and the other does not, the former will be given a reward of one unit and the latter will be fined two units,

(2) if both confess, each will be fined one unit.

At the same time each has good reason to believe that

(3) if neither confesses, both will go clear.

This situation gives rise to a simple symmetric two-person game (not zero-sum) with the following table of payoffs, in which each ordered pair represents the payoffs to I and II, in that order:

		II	
		confess	not confess
I	confess	(-1, -1)	(1, -2)
	not confess	(-2, 1)	(0, 0)

Clearly, for each man the pure strategy "confess" dominates the pure strategy "not confess." Hence, there is a unique equilibrium point* given by the two pure strategies "confess." In contrast with this non-cooperative solution one sees that both men would profit if they could form a coalition binding each other to "not confess."

The game becomes zero-sum three-person by introducing the State as a third player. The State exercises no choice (that is, has a single pure strategy) but receives payoffs as follows:

		II	
		confess	not confess
I	confess	2	1
	not confess	1	0

*see J. Nash, PROC. NAT. ACAD. SCI. 36 (1950) 48-49.

Stanford, May 1950

A. W. Tucker

APPENDIX II:THE PROBLEM OF RELIGION

Godfrey Baldacchino wrote:

I should be there on Monday… but, if you wish, I can arrange something more 'formal' - with an invitation issued to all members of the Faculty… Even later on during next week - say, Thursday, 2 to 3.30pm - so we don't have to listen to two presentations back to back…

I have asked Matt to consider a presentation comparing development policy in Barbados and Mustique…

Some more good news: we may have a MAIS grad course in island biogeography on offer as from next September. Courtesy of Dr Marina Silva (Dept of Biology).

G

Matt Funk wrote:

A formal invite to the department would be great; I'd be happy to deliver a Barbados/Mustique/Sustainable Economic Development seminar.

And if there is still interest in an informal coffee talk after Ariana's defence, I'm still up for that (Colin, are you still onboard?)

And very exciting news about the Biogeography course, by the way, as the more I read on this topic, the more I concur with Bowman (1994): "Since biogeography holds the key to the survival of life, it deserves more attention." I have also become more acutely aware, however, that "Biogeography" does not exist. And it is in fact unfortunate that there are many who mistakenly believe that it (and every other subject matter) exists. I'm sure you will all recall my emphasis on Popper's (1956) notion that subject matters do not exist; please consider this notion yet again in this light:

It is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialities that perhaps should not have been separated in the first place? Early in this century the specialities of biology and chemistry were joined to form biochemistry; similarly, economics and ecology are now in the process of being combined into ecological economics.

My first attempt at interdisciplinary analysis led to an essay, "The Tragedy of the Commons." Since it first appeared in Science 25 years ago, it has been included in anthologies on ecology, environmentalism, health care, economics, population studies, law, political science, philosophy, ethics, geography, psychology, and sociology. It became required reading for a generation of students and teachers seeking to meld multiple disciplines in order to come up with better ways to live in balance with the environment.

I did not start out intending to forge an interdisciplinary link, but rather to present a retiring president's address to the Pacific division of the American Association for the Advancement of Science. But even after six revisions, each quite different from the one before, my summary of an ecologist's view of the human overpopulation problem would not crystallize. Repeatedly, I found fault

with my own conclusions (Hardin 1998).

The reason I say that it is unfortunate that "Biogeography" exists, is because its methods are absolutely *essential* to understanding "island studies," and it is very easy to see how many scholars may never dig into this "specialty". It is rather ironic that Spellerberg & Sawyer's (1999) "An Introduction to Applied Biogeography (the best introduction I have been able to discover) reaches the same conclusion (Indeed, it was rather lucky that I stumbled into it. I've attached Hardin 1998 (which contains the citation above) and Hardin 1968.

Again, *there are only problems, and our urge to solve them*. If we must insist on subject matters, there is only one subject and it is called "Nature" or perhaps "Biology," and all other problems fit into these laws, as even art and even the laws of physics must be held within the biological realm, since biological organisms form, evaluate, and utilize both the laws of physics and works of art.

Remember, Darwin was not a "evolutionary biologist" or even a "biologist," he was a *Naturalist*. One of the most influential books he read while onboard *The Beagle* was a work by a so-called economist (Malthus, whom also happened to influence Lloyd, of which more to follow). How many "economists" today take time to seek out relevant works in "evolutionary biology"? How many biologist read economics? Although I believe it is fair to say that the answer to both questions is "more than ten years ago," as Hardin noted above, perhaps these "subjects" *should not have been separated in the first place?* I will also suggest that it is no coincidence that, although "The Tragedy of the Commons" is cited by economists more often than any other specialist, Hardin was in fact a biologist.

Another important element I will briefly share is this: If a scholar does not completely understand and accept the fundamentals of what we refer to as evolutionary biology, very close to nothing else will be understood, and his or her analysis is likely to demonstrate this deficit. I would like you all to carefully consider the six pages which make up Hardin 1968: I submit that if, for example, we had (1) read and discussed these six pages, and (2) agreed to accept the central thesis, (which I realize may not have occurred) then (3) we would have systematically provided solutions for very close to 100% of the problems which we had grappled with for two full semester's in Dr Nagarajan's seminars. Yes, it is true that one may formulate developmental arguments based upon what are essentially religious grounds (such as a belief in the redistribution of wealth and so-called "inalienable, global human" rights - just who or how the wealth is to be redistributed and how these "global" rights are to be insured is another story), but the burden of proof will be heavy on their hands, as the empirical evidence in favour of evolutionary biology is far greater than the empirical evidence in favour of the existence of god/s.

If you decide to accept and utilize the arguments I'm submitting herewith, and should find yourself criticized for being a "Social Darwinist," kindly thank your critique for essentially calling you a "biologist," because what he or she has unwittingly stated is that you are *logical* and *rational*.

Finally, please consider the following, for I have found that the deep roots of religion[1], nationalism, and "social norms" may combine to make *nothing more difficult* than to always bear the following in mind:

---

1 (a) The belief in God has often been advanced as not only the greatest but the most complete of all the distinctions between man and the lower animals. It is however impossible, as we have seen, to maintain that this belief is innate or instinctive in man. On the other hand a belief in all-pervading spiritual agencies seems to be universal, and apparently follows from a considerable advance in man's reason, and from a still greater advance in his faculties of imagination, curiosity and wonder. I am aware that the assumed instinctive belief in God has been used by many persons as an argument for His existence. But this is a rash argument, as we should thus be compelled to believe in the existence of many cruel and malignant spirits, only a little more powerful than man; for the belief in them is far more general than in a beneficent Deity. The idea of a universal and beneficent Creator does not seem to arise in the mind of man, until he has been elevated by long-continued culture (Darwin 1883, p 1242).

(b) Beware of the man whose god is in the skies (Shaw 1903, ln 83).

> Nothing is easier than to admit in words the truth of the universal S*truggle for Life*, or more difficult--at least I have found it so--than constantly to bear this conclusion in mind. Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood. We behold the face of nature bright with gladness, we often see superabundance of food; we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year (Darwin 1859, p 62).

Think about this carefully, for in this light you will find *cooperative behaviour*, *kin selection*, *reciprocity*, etc, but you will not find *social justice*.[1] For, once again, who do you propose would administer this "social justice"? The wise owl? The noble, just lion? Ah, but some will say, "but we are *different*!" Somehow, one single species on Earth (humans) is somehow different than all of the rest. Well, I'm afraid, once again, the burden of proof in this argument is, once again, in their hands,[2] for, again, the argument is essentially religious/irrational.[3] When Nietzsche said "God is dead," what he was trying to say was "God will not protect your nest, God will not collect insects for you, money does not grow on trees, etc. - you must *fight* for your own survival (including your family's survival, your community's survival, your nation's survival, etc.). And yes, more organisms will perish than will survive (and this holds true for *every* species, including ants, bees, birds, humans, hogs, fish, dragonflies, etc.). In evolutionary biology, this is referred to (and, moreover, accepted) as *The Ground Zero Premise*. Even Bertrand Russell, perhaps the greatest logician of the past century, was not able to fully grasp the true nature of this premise.[4]

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1 It may well appear deplorable to a lover of mankind that possession of capital or a piece of land often provides the owner a higher income for a given period of time than the income received by a laborer for the most strenuous activity during the same period. Yet the cause of this is not immoral, but simply that the satisfaction of more important human needs depends upon the services of the given amount of capital or piece of land than upon the services of the laborer. The agitation of those who would like to see society allot a larger share of the available consumption goods to laborers than at present really constitutes, therefore, a demand for nothing else than paying labor above its value. For if the demand for higher wages is not coupled with a program for the more thorough training of workers, or if it is not confined to advocacy of freer competition, it requires that workers be paid not in accordance with the value of their services to society, but rather with a view to providing them with a more comfortable standard of living, and achieving a more equal distribution of consumption goods and of the burdens of life. A solution of the problem on this basis, however, would undoubtedly require a complete transformation of our social order (Menger 1871, p 174).

2 I am aware that the conclusions arrived at in this work will be denounced by some as highly irreligious; but he who denounces them is bound to shew why it is more irreligious to explain the origin of man as a distinct species by descent from some lower form, through the laws of variation and natural selection, than to explain the birth of the individual through the laws of ordinary reproduction (Darwin 1883, p 1242).

3 (a) Those whom we called brutes had their revenge when Darwin shewed us that they are our cousins (Shaw 1903, ln 129).
(b) The search for happiness based upon untrue beliefs is neither very noble nor very glorious. There is a stark joy in the unflinching perception of our true place in the world, and a more vivid drama than any that is possible to those who hide behind the enclosing walls of myth (Russell 1928, p 21).
(b) Evolutionary game theory provides a framework for explaining social interactions, including those between males and females. In a recent article, Roughgarden et al. discuss a new approach to sexual selection based on cooperative game theory and argue that cooperation rather than competition is fundamental in interactions between the sexes. However, compelling reasons for adopting this approach are not given and the authors do not adopt it consistently. We argue that non-cooperative game theory provides an adequate basis for understanding sexual selection, but that further work is needed to produce realistic models. We agree with Roughgarden and colleagues that bargaining is an important aspect of social interactions, but this is not a novel claim. Bargaining does not require the assumption of cooperation and does not necessarily lead to it (McNamara & Binmore 2006, abstract).

4 Our instinctive apparatus consists of two parts -- the one tending to further our own life and that of our descendants, the other tending to thwart the lives of supposed rivals. The first includes the joy of life, and love, and art, which is psychologically an offshoot of

I would also like to suggest that Hardin's "Tragedy of the Commons" serve as a required text for the Introduction to Island Studies course, as this phrase serves as useful shorthand when it is fully understood, and may help accelerate the learning process when it comes to understanding islands, and thus, understanding the world in which we live.

Hope you all find this more interesting than tedious; I'm interested and open to any comments and criticisms you may have to offer (including comments or criticisms from Dr Silva and/or other members of the biology department!). I've also CC'd Faiz since I value his criticism and suspect he may strongly disagree; if someone is brave enough to forward to Ariana (I do not have her email), I suspect she may disagree even more adamantly…

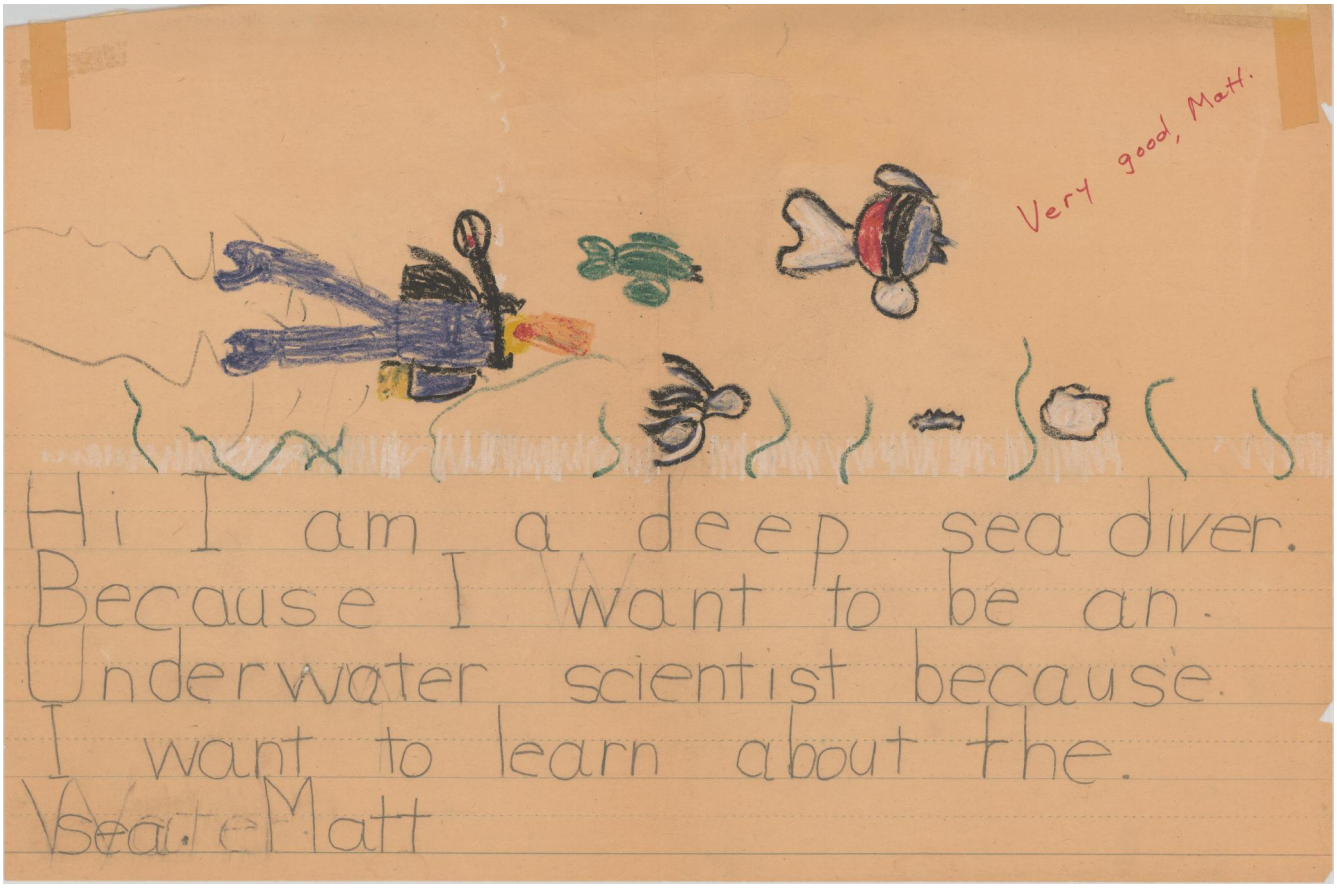
Hope to see you all on Monday…Matt

PS: I have attached a third Hardin paper (1974) which may also brew interesting discussions over coffee, as well as an excellent PNAS paper(which I have found to be the single best source for my research purposes) from last week, which, I believe demonstrates how relevant Hardin is yet today. Note the first citation in this PNAS paper is Hardin 1968. I will also add that this citation is *incorrect*, or, at the very least, inadequate, since Hardin did *not* in fact first formulate "The Tragedy of the Commons." - Hardin's work was based upon a much earlier finding by Oxford economist, WF Lloyd (1833), whose work I have also attached; Lloyd's promethean vision was extraordinary. This citation error is extremely common - even one of my favourite economist-philosopher-kings, Ragnar Arnason, makes the same mistake in our very own Island Studies volume: *North Atlantic Fisheries!*

love. The second includes competition, patriotism, and war. Conventional morality does everything to suppress the first and encourage the second. True morality would do the exact opposite. Our dealings with those whom we love may be safely left to instinct; it is our dealings with those whom we hate that ought to be brought under the dominion of reason. In the modern world, those whom we effectively hate are distant groups, especially foreign nations. We conceive them abstractly, and deceive ourselves into the belief that acts which are really embodiments of hatred are done from love of justice or some such lofty motive(Russell 1928, p 13).

APPENDIX III: WHY I WANT TO LEARN ABOUT THE SEA

Matt Funk *c.* 1974



Matt,
I think Henry didn't show this to you, because he didn't necessarily agree w/ what Eric was saying here. I thought you might want to see it though.
Best,
Jessica

9/28/2004

Dear Henry,

This letter is a response to Matt Funk's Song of the Dragonfly. As we have discussed, I think Matt has tremendous talent, and Song of the Dragonfly has the potential to be great first novel. I am very much interested in working with Funk, but in order to further consider it for publication I think I need to get a few concerns addressed. I was very confused as to what kind of story I was reading as this has all sorts of elements that make for a hodgepodge of genres. Its one part of each: fantasy, action/adventure, romance, mystery, and I was often blown away by his science. I can honestly say that I learned a lot from this book.

But the most important issue for a story like this to work is that the reader must be able to suspend disbelief, and that seems to be the hardest thing for me to do. The mass migration seems pretty implausible, even fantastical. But this happens within a very real environment---a very reality based world in which something bizarre has surfaced---filled with relationship troubles and such, and that has the reader back and forth between a fantastical underwater revolution and two people battling their personal and relationship problems. It's like a tug-of-war, with all the tension on the reader. And this tears me in two. Funk's strengths seem to be very much in the reality-based world. He has a great anecdotal style that fleshes out very real characters and offers real-life "lessons" (so to say). But I feel that for a story like this (a man coming to terms with the interconnected Earth, and learning valuable environmental lessons from abizzare gathering of marine mammals), it is best told with many fantastical twists, and would require more elements of the surreal and fantastic.

You brought up the comparison of the early Jonathan Lethem books we did here and they offer up a great example. They suck you into a world where the real has been twisted into a satirical fantasy of dreams and visions, allow you suspend disbelief (as anything in this world is possible), and drag you through philosophical wanderings. But also Funk may be carving out something entirely fresh and needed, the environmental novel. But I think in order for this to work he might need to create some very real environmental situations rather than more fantastical ones.

So I ask you this, do you think that Funk will consider revisiting the book in either a more science-based / reality-based way or maybe a more surreal, fantastic way? I'd be happy to discuss this with Funk if you want me to. I realize that this is more than I alluded to prior, but I feel it is very much necessary. Let me know what you think.

Sincerely,

Eric Raab
Assistant Editor

P.S. I'm going to try and catch up on some reading over the long weekend. Maybe we can talk next week after I read your book.

TOTAL P.01

APPENDIX V: THE EARTH[1]

The drawing above represents the theoretical framework of "ecological economics."
The blue represents the Earth, the biosphere and all of its inter-connected systems,
which are, naturally, beholden to the second law of thermodynamics.
Although this framework is referred to as a "whole-systems"
approach, as you can see, it "forgot" two systems.
This framework is represented in Axioms I-III.[2]

The drawing above represents the theoretical framework of *The Zweikampf Solution*.
Note that, in addition to the axioms represented in the drawing above (in blue),
this framework also recognizes two additional, fundamental assumptions:
(1) *political uncertainty* (white), and (2) *planetary uncertainty* (red).
As you can see, this is the "bigger picture," so to speak.
This framework is represented in Axioms I-VII.[3]

1 Artwork courtesy of William Matthew Funk © 2008.

2 See page 9.

3 See page 9.

APPENDIX VI: THE PROBLEM OF ECOLOGICAL ECONOMICS

Colour-coded Critical Highlights:

(1) You do not understand *The Problem of Induction*,
(2) you do not understand that economics is a *derivative science*, and thus, essentially
(3) you have failed to comprehend, essentially, *the whole economy of nature*;
(4) you do not understand that subject matters do not exist.

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Nature in Economics

Partha Dasgupta

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Abstract Nature has been ill-served by 20th century economics. When asked, economists acknowledge nature's existence, but most would appear to deny that she is worth much. If ecologists worry about the contemporary nexus between population size (and growth), the standard of living, and the natural environment, we economists point to the accumulation of capital and technological progress and say Malthus got it wrong. In this paper I show by an appeal to theory that economics has been so badly misused, that it has deflected attention from deep problems at the nexus that are faced both regionally and globally.

1 Nature's Absence from Growth Theories

Nature did not appear much in twentieth century economics, and it doesn't do so in current economic modelling. When asked, economists acknowledge nature's existence, but most deny that she is worth much. I have professional colleagues who believe that the services nature provides amount at best to 2–3% of an economy's output, which is the share of agriculture in the GDP of the United States. Why, they ask, should one incorporate a capital asset of negligible importance inmacro-economic models of growth and distribution? Growth modellers note that investment in knowledge enjoy cumulative returns because the benefits are durable and can be shared collectively. So they stress that new ideas are the main source

Text of the President's introductory remarks at the proceedings of Section F (Economics) of the BA (British Association for the Advancement of Science) Festival of Science 2006, at the University of East Anglia,

September 2006.

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of material progress and imagine that the growth of ideas is capable of circumventing any constraint nature may impose on the ability of economies to grow indefinitely.[1]

One class of growth models assumes that technological progress can be expected to be of such a character that, in alliance with the accumulation of reproducible and human capital it will be able to substitute for a vanishing natural resource base—we will call the latter, *natural capital*—and generate indefinite growth in output, both in the form of material goods and services. I find it hard to give credence to such models, because a vanishing resource base would mean a dwindling supply of the multitude of ecosystem services upon which life depends. More commonly, growth models assume nature to be a fixed, indestructible factor

of production (Ricardo's "land"), implying that in the face of technological progress, the shadow price of natural capital will remain small. The problem with that assumption is that it is simply wrong: nature consists of degradable resources (soil, watersheds, fisheries, fresh water, the atmosphere—ecosystems generally). It would have been reasonable to make that wrong assumption when natural-resource constraints didn't bite, but it isn't reasonable when studying development possibilities open to the world today. Recent concerns over global climate change are perhaps the first acknowledgement among economists that at the scales at which the world economy has been operating for some time, nature is in many aspects, fragile. Moreover, property rights to natural capital are often either vaguely defined or weakly enforced, meaning that nature's services are underpriced in the market. Official statistics on national income certainly give the impression that natural capital is of small importance; but official statistics reflect market prices, not shadow prices. Applied case studies of local ecosystems suggest that if shadowprices were to be used in national and international statistics (as they ought ideally to be), the decomposition of national income into its various factors would look quite different.[2] Moreover, as nature's services are underpriced in themarket, new technologies would be expected to remain rapacious in their use of natural capital: inventors and innovators would have little reason to economize on their use.

In any event, we should be sceptical of a theory that places such enormous burden on an experience that is not much more than 250 years old. Extrapolation into the past is a sobering exercise: over the long haul of history (a 5000 years stretch, say, upto about 250 years ago), economic growth even in the currently-rich countries was for most of the time not much above zero. The study of possible feedback loops between poverty, population growth, and the character and performance of both human institutions and natural capital is not yet on the research agenda of modern growth economists. Which is probably why environmental and resource economics—let us call the subject, *ecological economics*—remains somewhat isolated from the main body of contemporary economics, especially as the discipline is presented in textbooks and journals.

The focus in international discussions on the world's economic outlook is, justly, on economic growth and distributive justice; but a common afterthought to those discussions, that "the environment must be protected", reflects a widespread belief that nature is a luxury and not an essential factor of production. For example, *The Economist* (25 September 1999) carried a 38-page Survey of the World Economy in which natural capital made no appearance in the authors' assessment of what lies ahead. I doubt though that many readers will have noticed this. Even today natural capital has not entered our common economic language.

1 Barro and Sala-i-Martin (2003) and Helpman (2004) provide excellent examples.
2 For example, it can be argued that in view of the deep uncertainties that we harbour about the economic effects of global climate change, the shadow price of a ton of carbon dioxide in the atmosphere is currently in the order of 100 US dollars.

Ecosystems are capital assets. Like reproducible capital assets (roads, buildings, and machinery), ecosystems depreciate if they are misused or are overused. But they differ from reproducible capital assets in three ways: (1) depreciation of natural capital is frequently irreversible (or at best the systems take a long time to recover), (2) except in a very limited sense, it isn't possible to replace a depleted or degraded ecosystem by a new one, and (3) ecosystems can collapse abruptly, without much prior warning. To illustrate problems facing the world's poorest regions today, imagine what would happen to a city's inhabitants if the infrastructure connecting it to the outside world was to break down without notice. Vanishing water holes, deteriorating grazing fields, barren slopes, and wasting mangroves and coral reefs are spatially confined instances of corresponding breakdowns among the rural poor. It can even be argued that ecological collapse, such as the one that has been experienced in recent years in the Horn of Africa and the Darfur region of Sudan, trigger rapid socio-economic decline.

2 Deficiencies in Economic Reasoning

Matters haven't been helped by the misuse of economics by prominent economic journalists, who see economic progress mostly in terms of growth in GDP. It is even today commonly thought that ". . . trade improves the environment, because it raises incomes, and the richer people are, the more willing they are to devote resources to cleaning up their living space." (*The Economist*, 4 December, 1999, p. 17.) The problem with this viewpoint is that it assumes environmental destruction to be always reversible, flatly contradicting points (1) and (2) above. Moreover, even now the problems the world can expect to face under "business as usual" are set aside by an application of high social discount rates. Once again, here is *The Economist* (26 June 1999: 128) on social cost-benefit analysis:

> "Suppose a long-term discount rate of 7% (after inflation) is used . . . Suppose also that the project's benefits arrive 200 years from now . . . If global GDP grows by 3% a year during those two centuries, the value of the world's output in 2200 will be 8 quadrillion US dollars (a 16-figure number). But in present-value terms, that stupendous sum would be worth just 10 billion US dollars. *In other words, it would not make sense for the world to spend any more than 10billion US dollars (under 2 US dollars a person) today on a measure that would prevent the loss of the planet's entire output 200 years from now.*" (Italics mine.)

Humanity would cease to exist if world output were zero; so, the scenario we are asked to consider does not remotely resemble a normal investment project. We should therefore be cautious before using the language of standard cost-benefit theory when discussing the choice problem posed by the author. Where the author gets things wrong, even after framing the problem wrongly, is in assuming that the rates to be used for discounting future income losses are independent of the economic forecast. The underlying picture in the passage is that of a Doomsday Project (zero world output in year 2200). Accepting the project would involve a sharp decline in output from some point in time in the future and it can be shown that if consumption were to decline, social discount rates would be negative (Dasgupta 2001 [2004], 2007a). So, where does the 7% a year discount rate come from? Discounting future incomes produces paradoxes only when it isn't recognized that, as social discount rates are themselves shadowprices, they should be determined on the basis of analysis and not plucked from air.

I admit to experiencing some pleasure in exposing *The Economist*'s faulty economic reasoning when it comes to environmental matters, not only because the newspaper has for many years been supercilious about matters of the greatest importance and has repeatedly written sermons on how environmental scientists ought to practise their craft,[3] but also because its writers are (i) highly intelligent, (ii) hugely influential, and (iii) never in doubt. There are, however, deep psychological reasons why people are often ambivalent about environmental matters. The various causes behind contemporary environmental degradation pull in different directions and are together not unrelated to an intellectual tension between the concerns people share about global climate change and international fisheries that sweep across the globe, and about those matters (such as the decline in firewood or water sources in rural areas in the world' poorest regions) that are specific to the needs and concerns of village communities. Environmental problems present themselves differently to different people. In part, it is a reflection of the tension I have just noted and is a source of misunderstanding of people's attitudes. Some people identify environmental problems with population growth, while others identify them with wrong sorts of economic growth. Then there are others who view them through the spectacle of poverty. Each of these visions is correct. There is no single environmental problem; rather, there is an innumerable collection of them. Thus, growth in industrial wastes has been allied to increased economic activity; and in industrialized countries (especially those in the former Soviet Union) and industrializing countries (e.g. India and China), neither preventive nor curative measures have kept pace with their production. Moreover, as noted earlier, the scale of the human enterprise, both by virtue of unprecedented

increases in the size of the world's population and the extent of economic activity, has so stretched the capabilities of ecosystems, that humankind can today rightly be characterized as the earth's dominant species. These observations loom large not only in ecological economics, but also in the more general writings of environmentalists and in the professional writings of ecologists in the West. For example, Vitousek et al. (1986) have estimated that 40% of the net energy created by terrestrial photosynthesis (i.e. net primary production of the biosphere) is currently being appropriated for human use. To be sure, this is a rough estimate. Moreover, net terrestrial primary production isn't exogenously given and fixed; it depends in part on human activity. Nevertheless, the figure does put the scale of the human presence on the planet in perspective.

On the other hand, economic growth itself has brought with it improvements in the quality of a number of environmental resources. The large-scale availability of potable water, and the increased protection of human populations against both water- and air-borne diseases in industrial countries, have in great measure come in the wake of growth in national income these countries have enjoyed over the past 200 years or so. Moreover, the physical environment inside the home has improved beyond measure with economic growth (cooking in SouthAsia continues to be a central route to respiratory illnesses among women). Such positive links between economic growth and environmental quality often go unnoted by environmentalists in theWest. I would guess that this lacuna is yet another reflection of the fact that it is all too easy to overlook the enormous heterogeneity of natural capital, ranging as it does from the atmosphere, oceans, and landscapes, to water-holes, grazing fields, and sources of fuelwood. This heterogeneity needs to be kept in mind.

3 See, for example, "Environmental Scares: Plenty of Gloom", *The Economist* (20 December 1997). The journal *Environment and Development Economics* reprinted that article in 1998 (Vol. 3, Part 4, pp. 493–499) and published critical comments on it by a number of economists and environmental scientists.

3 Economic Progress as Sustainable Development

It can be shown that the right way to judge the economic performance of a country (or for that matter of any economic unit: household, village, district, state, country, the world as a whole) is to study movements in its *productive base*. By an economy's productive base I mean its *institutions* and its *capital assets*. Institutions are different from capital assets, in that the former comprise a social infrastructure (e.g., laws, property rights, beliefs, and the extent of trust among people) for guiding the allocation of resources, including the capital assets themselves. By the latter I mean not only reproducible capital (roads, building, machines), human capital (education, skills, and health), and publicly available knowledge (science and technology), but also natural capital (minerals, oil and natural gas; fisheries, forests, soil; more generally, ecosystems). Let us call the social worth of an economy's productive base its *inclusive wealth*. An economy enjoys sustainable development if and only if, relative to its population, its inclusive wealth (at constant prices) does not decline.4 We call a change in inclusive wealth over time (at constant prices), *inclusive investment*. The result I amappealing to says that an economy would enjoy sustainable development if and only if, relative to its population, inclusive investment is not negative.5 So, by an economy's inclusive wealth we mean the shadow value of its productive base and by inclusive investment we mean the shadow value of the net change in its productive base. Of course, even if some assets have decumulated, inclusive wealth would increase if there were a compensatory accumulation of other assets in the economy. By the same token, even if some assets (e.g. manufactured and human capital) have accumulated, inclusive wealth would decrease if there were a serious decumulation of other assets in the economy (e.g. ecosystem services). Inclusive investment is to be contrasted from recorded investment. Because a wide range of services obtained from natural capital are missing from standard economic accounts, recorded investment could be positive even if inclusive investment were negative. On the other hand, current accounting practice does not recognise that nutrition, health care, and potable water are not merely consumption goods, they are simultaneously investment goods. So, there is a corresponding undercount in recorded investment.

The notion of inclusive investment I am advocating here is not only inclusive of various types of capital assets, but is also sensitive to individual and locational differences. For example, a pond in one location is a different asset from a pond in another, because their ecological characteristics are likely to differ and because the communities making use of them are likely to face different economic circumstances. It follows that seemingly identical ponds should have different shadow prices. Of course, in practice such refinements may not be attainable. But it is always salutary to be reminded that macroeconomic reasoning glosses over the heterogeneity of Earth's resources and the diverse uses to which they are put—by people residing at the site and by those elsewhere. Shadow prices depend not only technology and consumer preferences, but also on institutions, and their combined effect on people's lives. The one powerful message the Millennium Ecosystem Assessment

4 See Dasgupta et al. (2000), Dasgupta (2001 [2004]), and Arrow et al. (2003a, b).

5 Those familiar with the Brundtland Commission Report will recognise this as a precise formulation of the definition of sustainable development it adopted, namely, ". . . development that meets the needs of the present without compromising the ability of future generations to meet their own needs." In this reckoning sustainable development requires that relative to their populations each generation should bequeath to its successor at least as large a productive base as it had itself inherited. Notice that the requirement is derived from a relatively weak notion of intergenerational justice. Sustainable development demands that future generations have no less of the means to meet their needs than we do ourselves; it demands nothing more.

(see Reid et al. 2005) has given to us economists is that estimating shadow prices of natural capital assets is now of central importance.

Even if an economy satisfies the sustainablity criterion (viz., that, relative to population, inclusive investment is not negative) today, or has satisfied the criterion in the recent past, it might not continue to do so in the future. Whether it is able to do so depends on the scale of the economy (as measured by, say, GDP), among other things. If the scale becomes too large relative to the natural capital base of the economy, the economy will be unable to maintain its inclusive wealth. As an economy's scale increases, natural capital (e.g. ecosystems) becomes more scarce relative to the size of the economy. Consequently, the amount of other types of capital needed to substitute for natural capital—that is, the shadow prices of natural capital—may rise. The extent to which those shadow prices rise depends on a number of factors, including the rate of technological progress. There can even come a point where no amount of feasible investment in manufactured capital or human capital can offset further declines in natural capital (Ehrlich and Goulder 2007).

It is easy to see why GDP won't do as an index of sustainable development. An economy's productive base will shrink if its stock of capital assets depreciates and its institutions aren't able to improve sufficiently to compensate for that depreciation. GDP is an acronym for *gross* domestic product. The word "gross" means that GDP ignores the depreciation of capital assets. It is certainly possible for a country's productive base to grow while its GDP increases, which is no doubt a path of economic development we all would like to follow; but it is also possible for a country's productive base to *shrink* during a period when GDP grows. (For illustrations of such possibilities from recent economic history, see Dasgupta 2007a,b.) The problem is that no one would notice the shrinking if everyone's eyes were rivetted on GDP. If the productive base continues to shrink, economic growth will sooner or later stop and reverse sign. The standard of living will then decline, but no one would have suspected that a fall was in store. So, growth in GDP per head can encourage us to think that all is well, when it isn't. Similarly, it is possible for a country's Human Development Index (HDI) to increase even while its productive base shrinks (Dasgupta 2007a,b). This means that HDI too can mislead. The moral is telling: GDP (or for that matter, the HDI) is not a measure of long run human well-being, meaning that movements in GDP (or for that matter, HDI) are a poor basis for judging economic progress.

4 Collaboration Among Environmental Scientists and Economists

The advances that have taken place in ecological economics in recent years have owed much to collaboration between ecologists and economists.[6] Among those advances is a heightened awareness of the ubiquity of non-linearities in ecological processes and the inability of the price mechanism—even a complete specification of property rights—to allocate resources efficiently.

The good news is that climate change is at last on the international agenda, but there is a danger that such other critical issues as habitat destruction, biodiversity loss, and population growth will remain on the sideline. Which is why, as President of Section F (Economics) of the BA (British Association for the Advancement of Science) Festival of Science 2006, held at the University of East Anglia, I thought it desirable to invite economists and environmental scientists to the Section's customary day-long session to add to the public understanding of

6 See Arrow et al. (1995, 2000, 2004), Perrings (1995), Daily et al. (1998, 1999), Levin et al. (1998), Dasgupta et al. (2000), Heal et al. (2004), and Ehrlich and Goulder (2007).

ecological economics. The papers that follow are based on the lectures that were delivered on that occasion. The lectures and the discussions that followed them were stimulating and informative. Above all, the day's events illustrated the point that in order that the public is informed of environmental problems and their possible solutions, it is necessary to bring environmental scientists and economists together.

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APPENDIX VII: EINSTEIN'S DILEMMA

from: http://hypertextbook.com/eworld/einstein.shtml

Einstein's First Letter to Roosevelt

Notes:

The letter that launched the arms race. A warning to President Roosevelt of the possibility of constructing "extremely powerful bombs of a new type" with hints that the German government might be doing just that. Addressed and dated Peconic, Long Island, August 2nd 1939, it was most likely written by Leo Szilard, the scientist who invented the chain reaction. Nevertheless, Einstein took full responsibility for its consequences, calling it "the greatest mistake" of his life. I have tried to reproduce the formatting as it appeared in the original. This is the only letter for which I have done this.

Source:

Public Domain.

Albert Einstein
Old Grove Rd.
Nassau Point
Peconic, Long Island

August 2nd 1939

F.D. Roosevelt
President of the United States
White House
Washington, D.C.

Sir:

Some recent work by E.Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations:

In the course of the last four months it has been made probable - through the work of Joliot in France as well as Fermi and Szilard in America - that it may become possible to set up a nuclear chain reaction

in a large mass of uranium,by which vast amounts of power and large quantities of new radium-like elements would be generated. Now it appears almost certain that this could be achieved in the immediate future.

This new phenomenon would also lead to the construction of bombs, and it is conceivable - though much less certain - that extremely powerful bombs of a new type may thus be constructed. A single bomb of this type, carried by boat and exploded in a port, might very well destroy the whole port together with some of the surrounding territory. However, such bombs might very well prove to be too heavy for transportation by air.

The United States has only very poor ores of uranium in moderate quantities. There is some good ore in Canada and the former Czechoslovakia. while the most important source of uranium is Belgian Congo.

In view of the situation you may think it desirable to have more permanent contact maintained between the Administration and the group of physicists working on chain reactions in America. One possible way of achieving this might be for you to entrust with this task a person who has your confidence and who could perhaps serve in an inofficial capacity. His task might comprise the following:

a) to approach Government Departments, keep them informed of the further development, and put forward recommendations for Government action, giving particular attention to the problem of securing a supply of uranium ore for the United States;

b) to speed up the experimental work,which is at present being carried on within the limits of the budgets of University laboratories, by providing funds, if such funds be required, through his contacts with y

private persons who are willing to make contributions for this cause, and perhaps also by obtaining the co-operation of industrial laboratories which have the necessary equipment.

I understand that Germany has actually stopped the sale of uranium from the Czechoslovakian mines which she has taken over. That she should have taken such early action might perhaps be understood on the ground that the son of the German Under-Secretary of State, von Weizsäcker, is attached to the Kaiser-Wilhelm-Institut in Berlin where some of the American work on uranium is now being repeated.

Yours very truly,
A. Einstein
(Albert Einstein)

Einstein's Second Letter to Roosevelt

Source:
Ronald W. Clark. *Einstein: The Life and Times*. New York: Avon Books, 1970: 678-679.

March 7, 1940

I wish to draw your attention to the development which has taken place since the conference that was arranged through your good offices in October last year between scientists engaged in this work and governmental representatives.

Last year, when I realized that results of national importance might arise out of research on uranium, I thought it my duty to inform the administration of this possibility. You will perhaps remember that in the letter which I addressed to the President I also mentioned the fact that C. F. von Weizsäcker, son of the German Undersecretary of State, was collaborating with a group of chemists working upon uranium at one of the Kaiser Wilhelm Institutes - namely, the Institute of Chemistry.

Since the outbreak of the war, interest in uranium has intensified in Germany. I have now learnt that research there is carried out in great secrecy and that it has been extended to another of the Kaiser Wilhelm Institutes, the Institute of Physics. The latter has been taken over by the government and a group of physicists, under the leadership of C. F. von Weizsäcker, who is now working there on uranium in collaboration with the Institute of

Chemistry. The former director was sent away on leave of absence, apparently for the duration of the war.

Should you think it advisable to relay this information to the President, please consider yourself free to do so. Will you be kind enough to let me know if you are taking action in this direction?

Dr. Szilard has shown me the manuscript which he is sending to the Physics Review in which he describes in detail a method of setting up a chain reaction in uranium. The papers will appear in print unless they are held up, and the question arises whether something ought to be done to withhold publication.

I have discussed with professor Wigner of Princeton University the situation in the light of the information available. Dr. Szilard will let you have a memorandum informing you of the progress made since October last year so that you will be able to take such action as you think in the circumstances advisable. You will see that the line he has pursued is different and apparently more promising than the line pursued by M. Joliot in France, about whose work you may have seen reports in the papers.

Einstein's Third Letter to Roosevelt

Notes:

This is only a fragment of the letter's body.

Source:

Ronald W. Clark. *Einstein: The Life and Times*. New York: Avon Books, 1970: 681.

April 25, 1940

I am convinced as to the wisdom and the urgency of creating the conditions under which that and related work can be carried out with greater speed and on a larger scale than hitherto. I was interested in a suggestion made by Dr. Sachs that the Special Advisory Committee supply names of persons to serve as a board of trustees for a nonprofit organization which, with the approval of the government committee, could secure from governmental or private sources or both, the necessary funds for carrying out the work. Given such a framework and the necessary funds, it (the large-scale experiments and exploration of practical applications) could be carried out much faster than through a loose cooperation of university laboratories and government departments.

Einstein's Fourth Letter to Roosevelt

Notes:

Subject: Fourth Einstein Letter
Date: Mon, 08 Dec 97 16:07:03 EST
From: William Lanouette <lanouettew.rced@gao.gov>
To: Glenn Elert <gae4@columbia.edu>

This fourth letter to FDR was [also drafted] by Leo Szilard. In it Einstein proposed that the President hear

Szilard's views about setting policies for the A-bomb. Einstein told FDR that it was Szilard who first raised the possibility of nuclear weapons and that this had led Einstein to write the first letter in August 1939. Einstein said that Szilard and other scientists were interested in communicating their views about policy to members of FDR's cabinet and that it was worth the President's time to hear what Szilard had to say. The letter failed to reach President Roosevelt before his death on April 12th 1945.

Source:

William Lanouette with Bela Silard. *Genius in the Shadows: A Biography of Leo Szilard, The Man Behind the Bomb.* Chicago: University of Chicago Press, 1994: 261-2.

112 Mercer Street
Princeton, New Jersey
March 25, 1945

The Honorable Franklin Delano Roosevelt
President of the United States
The White House
Washington, D.C.

Sir:

I am writing to introduce Dr. L. Szilard who proposes to submit to you certain consideration and recommendation. Unusual circumstances which I shall describe further below introduce me to take this action in spite of the fact that I do not know the substance of the considerations and recommendations which Dr. Szilard proposes to submit to you.

In the summer of 1939 Dr. Szilard put before me his views concerning the potential importance of uranium for national defense. He was greatly disturbed by the potentialities involved and anxious that the United States Government be advised of them as soon as possible. Dr. Szilard, who is one of the discoverers of the neutron emission of uranium on which all present work on uranium is based, described to me a specific system which he devised and which he thought would make it possible to set up a chain reaction in un-separated uranium in the immediate future. Having known him for over twenty years both from his scientific work and personally, I have much confidence in his judgment and it was on the basis of his judgment as well as my own that I took the liberty to approach you in connection with this subject. You responded to my letter dated August 2, 1939 by the appointment of a committee under the chairmanship of Dr. Briggs and thus started the Government's activity in this field.

The terms of secrecy under which Dr. Szilard is working at present do not permit him to give me information about his work; however, I understand that he now is greatly concerned about the lack of adequate contact between scientist who are doing this work and those members of your Cabinet who are responsible for formulating policy. In the circumstances I consider it my duty to give Dr. Szilard this introduction and I wish to express the hope that you will be able to give his presentation of the case your personal attention.

Very truly yours,

(A. Einstein)

THE END

Notes:[1]

1 All comments, criticisms, corrections, and questions will be gratefully accepted and considered. Thank you!

On the Problem of Dependent People: hyperbolic discounting in Atlantic Canadian island jurisdictions

Funk, Matt
University of prince edward island

20. November 2007

On the Problem of Dependent People:

Hyperbolic Discounting in Atlantic

Canadian

island
jurisdictions

In celebration of the life of an independent woman!
For my grandmother,[1] Frieda Holley
December 28th, 1917 - November 20th, 2007

20 November 2007

Matt Funk
Department of Island Studies
The University of Prince Edward Island
46.3° N, 63.1° W

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ABSTRACT

Prince Edward Island's Economics, Statistics and Federal Fiscal Relations Division's *33rd Annual Statistical Review* reports the total value of 2006 fish landings was CAD 166.6 MM. This paper discloses a preliminary finding that the *actual* total value of fish landings for 2006 was approximately CAD 416.5 MM. Furthermore, this discourse submits that this entrenched systemic error has been consistently generated for all 33 years that the *Annual Statistical Review* has been published. Moreover, this systemic error creates a ripple-effect and promotes bias through all relative natural resource valuations. This significant conjecture is presented within an institutional context which serves as the foundation for this error generation, including other errors associated with *The Problem of Induction*. Within this broad context, this paper focuses upon deficient resource valuation methods, especially as they relate to (1) *The Problem of Continental Economics* and (2) *The Problem of Dependent People*. Solutions are presented by contrasting the failure of fishery management methodology and practice amongst dependent Canadian islanders, and the relative success of fishery management amongst independent Icelandic islanders. The possibilities that independent people enjoy higher levels of rationality, efficiency, happiness[2], economic sustainability, general well-being, and are thus, ceteris paribus, less likely to commit errors associated with *The Problem of Induction* are taken into consideration. Likewise, consideration is given to the notion that dependent people are more likely to exhibit irrational behaviour, develop deeper dependencies[3], foster totalitarian governments, and to contribute to a wide-array of systemic errors, such as those which exacerbate *The Problem of Global Warming*.

ABBREVIATIONS:

CAD	Canadian Dollar
EU	European Union
GNP	Gross National Product
GDP	Gross Domestic Product
M	1,000
PEI	Prince Edward Island
SNIJ	Sub-National Island Jurisdiction/Canadian Island Jurisdictions
TPI	The Problem of Induction
TPGW	The Problem of Global Warming
UN	United Nations

FOREWORD

The particular quality of the reflections cast by historical expositions, especially *political* and *economic* expositions, are dependent upon which stones or which seas the searcher elects to illuminate[4]; thus I endeavour to bear in mind that "our knowledge, as well as our ignorance, at any time and on every issue, tends to be opportunistically conditioned, and thus brought to deviate from full truth[5];" or, as an independent man who understands the true value of insularity once observed, "when we chase the shore for treasures the ones we discover are the ones we carry there with us[6]".

We must also endeavour to heed the call of Randall Wallace's (1995) *selective re-creation*[7] of the life of another independent man, and the essence of Scottish independence:

> EXT. MACANDREWS FARM - DAY
> A farmhouse and a large barn lie nestled in a Scottish valley. Riding down the roads that lead in from opposite sides are Scottish noblemen in full regalia...
>
> VOICE OVER (CONT'D)
> Historians from England will say I am a liar. *But history is written by those who have hung heroes* [italics mine].

Yes, all histories are heavily skewed by survivorship-bias as well. *People's histories*[8] are, afterall, quite few and very far between, and this is, of course, because they do not serve institutional needs.

Bearing these disclaimers in mind, the following exposition of Icelandic independence and selected aspects of Canadian dependence is no doubt equally biased; in fact, it may be moreso. I would be remiss to fail to disclose that I have accumulated considerable anecdotal evidence that Babe Ruth spoke a profound truth when, as legend has it, he once noted: "*You'll never meet a rich kid in the majors*." This has been said many times, in many ways: it is an idiom found in every language, in every culture. *Necessity is the mother of Invention* may be the most common iteration, but my favourite is the proverbial Chinese iteration: *Give a man a fish and you feed him for a day. Teach a man to fish and you feed him for a lifetime.* Given my personal experience, however, I would be inclined to rewrite this proverb: *Give a man a fish and you take away the instinctual ability to fish he would have discovered on his own accord.*

You see, my life has been one of rather extraordinary privilege, and I remain ever grateful for this privilege. I believe I may benefit from an independent-minded, global perspective, which I may humbly suggest, would not have been possible without the benefit of this life of privilege.

But the costs have been substantial.

I further submit my greatest gains, most worthy insights, most sensible problem solving endeavours, and happiest[9] moments have been achieved over the past three years, fishing in the North Atlantic, fully engaged in the *Struggle for Life* (Darwin 1859), without the extraordinary benefits *and* extraordinary costs associated with a *dependent* life of privilege.

What I'm attempting to acknowledge here, is that, although this research is submitted herewith in earnest, it may in fact also carry the added bias of a subconscious endeavour (though, upon this reflection, naturally, it becomes quite conscious) to correct *personal errors*. I will leave it to the reader to decide whether my personal bias helps or hinders the following discourse. If there is any truth that "ontogeny begets phylogeny[10]", then my personal bias may prove rather useful.

In any case, (1) conjectures and refutations herewith may be ridden with error[11], (2) they are open to criticism, and (3) my aim is not to convince or even to sway.[12]

I will add one more point before introducing our feature presentation. If this paper should strike you as rather odd or even unorthodox, I suggest that it may be due to the fact that my approach may be unusual and, by design, necessarily unorthodox:

> Since I have neither interest nor intent of adding to the compost heap of refereed journals[13], I believe I may be better positioned to focus on problems (rather than puzzles), and thus possess more latitude to address issues relating to the antithetical *Problems of Complexity* & *Compression*. The BIBLIOGRAPHY, an appendix hybrid, is a product of this liberal degree of stylistic latitude. You may find the sketch of *The Problem of Induction* (Hume 1739) and the solution in (Popper 1959) of use; I will also recommend an overview of the inter-related problems of media production, consumption, and toxicity in Frey, Benesch & Stutzer (2005). Finally, Jarvie & Pralong (1999) provide a key to a significant mystery. I will not digress further, but if you have questions relating to this method, I am happy to forward Funk (2007c), *The Problem of Compression: Logical Errors and Bad Advice from the APA Publication Manual* (Funk 2007f).
>
> You will find copious footnotes, and if you find them useful I may suggest they serve two functions: one

for the reader, the other for the writer. The footnotes provide a map to the logical framework of this discourse: If I have made an error, you may be able to help me by digging into the related footnotes. If I have forwarded an interesting or original idea of merit, the footnotes may be of assistance in the event you have interest in inspecting or following a few of my steps (and if you pause for a moment to inspect the contents of this footnote[14], I believe my modus operandi will be quite clear). I will briefly relate that these stylistic choices are the result of what is essentially an Austrian[15] approach to addressing faulty foundational issues in economics[16](and the social sciences in general), and these stylistic elements evolved through form-following-intended-function: my target audience is academic, but my over-riding objective is to appeal to a wider audience, especially researchers in other so-called 'fields'[17], but also my wife, family members, friends, fellow islanders, fellow fishermen, et cetera). As Mead (1928) related in her preface to the 1961 edition of *Coming of Age in Samoa*:

> My father, who was an unflagging though friendly critic, once told me that I would never again write so good a book as this my first one because, as I grew older and wiser, I would "know too much" and the books would inevitably be harder to read.

If any passages in the following discourse prove difficult to follow, as Montaigne advised[18], blame the writer, not the reader.[19] Again, all criticism is welcome.

INTRODUCTION

> HISTORY SHOWS THAT OUR THEORIES HAVE BEEN WRONG MORE OFTEN THAN RIGHT, resulting in the demise of whole civilizations when we have misinterpreted what is happening to us.…
>
> It would be comforting to believe that humans have been prescient enough to understand what is happening to themselves and act accordingly. But… the way the mind understands the external environment—the beliefs humans construct to explain the external world are frequently incorrect, particularly if the changes are creating really novel situations. And clearly, humans have evolved environments radically different from anything that existed before.
>
> —Douglass C. North, *Corporate Leadership in an Uncertain World,* 2007

As noted in the abstract, the PEI *Annual Statistical Review* reported 2006 fish landings of CAD 166.6 MM, but I submit the *actual* total value for 2006 was approximately CAD 416.5 MM. Although there are two fundamental economic principles[20] in question here, these principles lag far behind even the *second-most* important lesson this analysis has to offer, and we will thus tend to the more pressing matters. Agnarsson and Arnason (2003) offer two key points regarding this lesson of secondary importance in *The Role of the Fishing Industry in the Icelandic Economy. A historical Examination:*

> (1) Expansion and development of the fisheries was the driving force behind Iceland's economic transformation during the 20th century. Yet, the overriding importance of this sector fails to show up in national accounts – such as contribution to GDP and employment statistics –because they do not take into consideration the various ways economic activity in the maritime sectors affects other branches of the economy.… *This ignorance of the true contribution of the fisheries can lead policy makers to underestimate the effects shocks to the fisheries will have on the economy* [italics mine, Abstract].
>
> (2) A misconception concerning the economic importance (in terms of GDP generation) of the various sectors may have seriously detrimental consequences. Global warming, pollution accidents, stock collapses, the erection of tariff barriers and so on may lead to substantial shocks to the fishing industry. If the macro-economic role of the fishing industry is underestimated when shocks of this kind happen—and they will—then it may well be that this underestimate will lead to the adoption of incorrect, probably inadequate, economic policy responses. Clearly, a more complete understanding of the true economic significance of the fisheries will help policy makers in anticipating the economic impacts of fisheries shocks and, thus, increase the chances that the appropriate economic policies be implemented (Ibid, p 14).

Agnarsson & Arnason (2003) propose that their "measurements of the economic importance of the fishing industry in Iceland are also indicative of the importance of the fishing industries in similar fish-based economies across the North Atlantic," (p 14) and that they "expect similar multipliers to apply" (Ibid). I concur.

My PEI 2006 fish landings approximation of CAD 416.5 MM is based upon their generic multipliers; and if the PEI provincial treasury consents to my *Freedom of Information Act* request for 33 years of economic data, then I intend to conduct a more thorough analysis and deliver it in the form of a Master's thesis in Island Studies at The University of Prince Edward Island. And as this discourse unfolds, I trust you may concur that the *relative* importance of the Prince Edward Island fishery (that is, relative to agriculture and tourism) may in fact exert an even *greater* multiplier effect on the PEI economy:

New York food critic Frank Bruni made a trip to PEI this fall, and an article relating this journey appeared in the travel section of the *New York Times* a few days ago. Note that the article was titled *Prince Edward Island: Beckoned by Bivalves* (Bruni 2007), not *Prince Edward Island: Beckoned by French Fries*, also note the article's sole photograph was a lobster fishing boat in Neaufrage Harbour, not an Potato truck parked in the middle of a field. Visitors to PEI go deep sea diving, not deep potato digging, and then head for a bite to eat at *New Glasgow Lobster Suppers*, not *New Glasgow Tator Tots*. Understanding the significance of this *New York Times* article is essential to grasping the essence of *The Problem of Prince Edward Island Economics*: An *increase* in agricultural production translates to *decreases* for both the fishery and tourism (when *The Globe and Mail* headlines *PEI's Killing Fields,* it's bad for business, see Mittelsteadt 2006 ; also see Delaney 2006). A *decrease* in *industrial* agricultural production, however, would result in *increases* for both tourism and the fishery (no to mention lower health-care costs, tastier water, and higher standards of living!

Setting the relevant strength of the multiplier effect aside, however, the actual figure, this 2006 sub-national (provincial) account balance entry, is largely irrelevant, and the basis for this irrelevancy is two-fold. Presently, I will address half of this issue; I trust the second-half will be self-evident by the end of section 3.1.

First of all, what *is* relevant is the value of the fishery *relative* to other economic sectors. David Cairns illuminates this issue perfectly:

> [1] Prince Edward Island's economic mainstay is agriculture, followed by tourism and fishing. Although the fisheries industry annually contributes some US$150 million to the economy…, [2] *it was relatively late in developing and has never gripped Islanders' culture and consciousness in the way that farming has* [italics mine,

Arnason & Felt, 1995, p 98].

Indeed, position [1] appears to be held universally on Prince Edward Island without exception. I have not found a single piece of economic analysis that uncovers Cairn's erroneous conclusion (That is, point [1], above. Point [2], however, is right on the mark). I trust the gravity of this relative mis-ranking will become evident in this discourse, but for now I will merely offer a relevant analogy and offer a quick sketch: the gross miscalculation of the fishery resource (utility) has resulted in a disastrous economic inversion on Prince Edward Island: *The tail (agriculture) is wagging the dog (fishing), and it is wagging it so hard that the dog and its owner (the islanders) are not well.*

Although I do largely concur with Agnarsson & Arnason's (2003) position that *a more complete understanding of the true economic significance of the fisheries* will help policy makers *in Iceland,* I do not believe this position is applicable here in Canada. Although I suppose it is remotely possible that this paper could be of some very limited use to a provincial or federal politician[21], my aim is not (as noted in the introduction) to influence anyone, much less a politician, and this is largely because (1) I believe this effort would be futile, and (2) I have surrendered my *personal* interests in Prince Edward Island (but I do retain substantial research interests). Although I realize I'm giving away the ending, this paper concludes *the deeply entrenched problems facing Prince Edward Island*[22] (and Newfoundland, for that matter) are insoluble, and thus ~~my wife and I have decided to emigrate as soon possible~~[23].

In any case, I trust that you will likewise discover in the discourse that follows, that the island does offer a tremendous, perhaps unsurpassable, opportunity for problem solving. No, this paper was not written for the aid of policy makers or politicians, and although Tom Cruise's *"Who's coming with me?"* monologue from Cameron Crowe's (1996) *Jerry McGuire* does come to mind[24], this paper was written simply for fellow *islanders,* and, if this paper accomplishes nothing else, I hope that it will irrefutably demonstrate that *we are all islanders*.

MF
Stanhope, Prince Edward Island
November 20th, 2007

ON THE PROBLEM OF DEPENDENT PEOPLE

1.0 On the Problem of Fishery Dependence

Arnason (1995) wisely noted that "*the relative success of the Icelandic fisheries suggests that other fishing nations may have something to learn from the Icelandic experience*," (p x), and it is beginning to appear that perhaps even the Icelandic may have something to learn from the Icelandic experience: Conspicuous consumption (Veblen 1899) is spreading over Iceland as quickly as the ice caps are melting, the prospect of EU entrance and, (arguably) EU *dependence* is gaining strength, and the Icelandic people are beginning to adopt the Canadian and American practices of ignoring the warnings of fishermen and fisheries scientists: this year's cod harvest plummeted 45% (Iceland Review 2007). But make no mistake about it: the Icelandic fisheries have perhaps been managed more conservatively, more effectively, and more *rationally* than any other fishery on Earth.

And there is much more to learn from the Icelandic experience: The author of this paper travelled to Iceland[25] twice last summer, in search of the indefatigable spirit Halldor Laxness[26] captured in *Independent People:*[27] it is alive and well, and we submit, the lesson of Icelandic independence offers viable and valuable solutions to three fundamental, relatively significant problems on Prince Edward Island, and, moreover, offers valuable and viable solutions to the inestimably complex and vastly uncertain *Problem of Global Warming*[28].

Arnason and Felt (1995) may be inclined to agree; in the final pages of *The North Atlantic Fisheries: Success, Failures & Challenges*, they

> alluded to a second, more subjective, potential benefit of sovereignty. It is possible that political *independence engenders a certain resolve to make the most of available resources and opportunities*. Such resolve might manifest itself in concrete ways such as programs and policies, and in less obvious forms such as its effect upon collective attitudes. There is some suggestion that Iceland was able to pursue a *highly rationalized* strategy of fisheries modernization, *at least in part because of the collective realization that the society's future well-being was linked to a prosperous, efficient fisheries*. The collective sentiment that there was no larger political unit to fall back on might very well have been instrumental in the pursuit of such a strategy (p 301).

This brings us to a sneak-peak of the conclusion, the weighty first 'end' of our book-ending, the single-most important lesson this analysis has to offer is this: The *collective realization* that the planet's future well-being is linked

to a prosperous, efficient natural resource management, including, of course, the single-largest component: the fisheries.

To place this conjecture in context, consider the following two declarations:

> (1) The major point was that *Iceland depends on its fishing industry more than any other state in the world*.... Its economy is *uniquely dependent on fishing for survival* [italics mine, TED 1997, p 1].
>
> (2) [Iceland is] the *only developed nation* in the world... *dependent on fisheries*" [italics mine, Gissurarson 2000, vol 60].

Icelandic independence offers valuable solutions to the inestimably complex and vastly uncertain problem of human survival on earth largely because these two very widely held assumptions are *false*.

There is not a single economy on earth that is *uniquely dependent on fisheries for survival*, every single inhabitant on earth is dependent upon the fisheries, and the fitness of all other *inter-related* natural resources for survival! In a world of bounded rationality (as opposed to *our* world of bounded irrationality[29]), this lesson would be quite unnecessary, these words mere platitudes, but, unfortunately, *nationalism*[30] is a much greater problem than we seem able to imagine...

3.0 On The Problem of Nationalism

The crux of this discourse may lie in the following assertion from Funk (2007e) *On the Problems of Beauty and Vulnerability: Introducing ~~Island Bioeconomics~~ Problem Solving in an Open Letter to Godfrey Baldacchino:*

> It seems far too many are either unwilling or unable to understand that economics is a *derivative* science, not a *primary* science: Economics does not exist *on* its own accord or *for* its own purpose. 'Economics' was created and is perpetuated to forward subjective, *national interests*, not the search for truth[31] (p 7).

Baldacchino was curious about this assertion and requested clarification: Did Funk (2007e) intend to infer that economics was created and is perpetuated *only* to forward subjective, *national interests?* The answer to this question, for all intents and purposes (in 2007e, and herewith), is *yes*:

> The very nature of economics is rooted in nationalism.... *It would never have been developed except in the hope of throwing light upon questions of policy, but policy means nothing unless there is authority to carry it out, and authorities are national* [italics mine, Robinson 1962].

In its *most* original form (from its origin in ancient Greece through its emergence in the English language in 1530),

economics was what we refer to today as 'home economics'. Here, we are relatively safe to say, national interests were at bay. National interests, however took a firm hold (strangle-hold?) with Adam Smith[32], and this is reflected in 'economics' 1804 etymological evolution as *political economy*[33], but before spinning this thread any further, we should clarify the context of our declaration that economics is a *derivative* science, as this fundamental seems illusive. *Derivative*, in this sense, is not a reference to the relatively well-known (in finance, anyway) financial weapons of mass destruction[34], but rather to Russell's (1928) *Theory of Economic Power*[35].

It seems prudent to bring this to your attention, because few economists are in possession of a complete comprehension of this thoroughly derivative, nationalistic, army-driven nature of economics. Of course this translates to far less comprehension in the other social sciences, and, for all practical purposes, virtually none of the general population. Yes, this generalization is very broad, but the overwhelming continental deployment of nationalistic, free-trade doctrine on small islands, SNIJ's, and small, developing economies may justify this sweeping generalization. I have searched far and wide (see BIBLIOGRAPHY), and I have not been able to find a single working paper or journal article[36] that does *not* prescribe insular economic development remedies *as if these small islands and poor nation states had the continental resources and warfighting capabilities necessary for the successful deployment of such economic agendas!*

Many of these free-trade development plans were put into play on islands (especially the Caribbean) and in other small, developing economies during the late 60's (such as the PEI development plan) and early 70's, popularized by popular advice from the likes of William G. Demas. This continental approach is great for short-term growth, but disastrous for long-term sustainability. Nearly without exception, UN economic working papers directed to the economic development of insular economies continue to exhibit dysfunctional ignorance of this issue. The free-trade continental economic development plan is beginning to take a serious toll on the Caribbean ecology, and, the problem is, there's no turning back; these economies are now *dependent* upon the economic activities which may reduce many, if not most, to ecological (and then, of course, economical) ruin.

Take for example, the following passage, which we have sampled nearly at random (it was the first hit from a

Google query: "small island economic development"). It is, rather ironically, a paper delivered as the third William G. Demas Memorial Lecture at the Caribbean Development Bank by José Antonio Ocampo, Executive Secretary, Economic Commission for Latin American and the Caribbean in the Cayman Islands, on 14 May 2002:

> *These trends suggest that very small developing states are able to strive and compete internationally on the basis of a narrow specialisation*, based on their natural advantages. For developed countries, the size of the domestic market is no longer an obstacle for building up a modern economy and successfully competing in international trade, as the example of small European countries indicates (p 6).

Yes, mathematicians are able to find *trends* to support quite literally anything, including the correlation between sunspots and corn prices[37], and film revenues and sub-atomic particles[38]! This Demas Memorial lecture is no different, and, embodies perhaps the most common misguided mantra: given diseconomies of scope and scale, *you must find your niche*, or simply, *specialize*. I've got some very important news here: That is very bad advice. For every success story there are a thousand failures, and what few success stories there are are typically *over* not long after they're discovered. *A Taste of Small-Island Success: A Case from Prince Edward Island* captures the essence of this problem:

> Smallness and insularity have been traditional markers for the absence of economies of scale, viable markets, labour power and expertise, and business know-how. Loaded with such structural handicaps, small-island societies often are seen as clearly doomed by the accident of geography to eke their way as bastions of protectionism and as targets of interventionist bale-out and hand-out programs (Baldacchino 2002, p 254).

The spirit in this paper is on track, but the logic and methods of the economic analysis rests on a *false and sandy foundation*. *Small-island societies often are seen as clearly doomed by the accident of geography.* This notion is widely held because, from a *Continental Economics* perspective, it is doomed! Baldacchino (2002) falls into the *Demas' Error* trap as well: *Look, they found their niche! It can be done!* Demas' Error plays a role in nearly every Continental economic application to islands and small economies. And yes, quite naturally, The *PEI Preserve Company*, that savvy, successful, resourceful firm that, against all odds, *found its niche…* filed for bankruptcy in May of 2007. All it had actually *found* was yet another provincial employee (whom, if memory serves me correctly, studied economics at UPEI) gullible enough to fall for *Demas' Error (*or *The Error of Continental Economics* or whatever term you'd prefer to

use to refer to pure economic folly). In any case Prince Edward Island (Ottawa) wound up with the two million dollar bill for this *economic development* loan.

However, from an *Island Economics* perspective, the small-island societies are clearly *saved* by the *miracle* of geography. How are they saved? By realizing it may be better *not* to find your niche! Islands must face the nature of their cost/benefit structure: Less violent crime, fewer toxic externalities, cooperative, other-regarding behaviour, and, ceteris paribus, *less monetary gain, fewer employment opportunities, and less significant economic development*. That's the deal, take it or leave it! When islands chase continental economic mirages, such as the pursuit of commercial agriculture (see CBC 2007a, CBC 2007c), sooner or later, they lose money *and* the benefits their pristine islands once offered: through amplification-by-compression,[39] they experience significantly greater pollution-related effects than continental counterparts. The largest bankruptcy in PEI history was a welfare-funded (Ottawa) fish-plant which was built, of course, with the mad delusion of *stimulating economic growth*. *Delusional* really may not even be a strong enough word for it, because what kind of institution would build a plant to process a fishery resource it was working even much harder to destroy? Then PEI built a meat packing plant, which also went belly-up. Unnaturally, they recently bailed it out as well, and although I refuse to commit the prosaic *Economists' Error* of issuing predictions,[40] I will not be surprised if these doors soon close yet again.

I draw your attention to these extraordinary popular delusions for two reasons. First, since I have suggested that the province is so fundamentally confused that it actually believes the *least* important industry is in fact their *most* important industry, I ought to demonstrate the type of systemic dysfunction required in order to hold such an absurd position. Secondly, I demonstrate this error in order to fully demonstrate the effective solution.

The solution is this: Do as little as possible, disturb as little as possible, foster the healthiest environment possible, for that *is* and *should always* be an island's greatest asset. This prescription is not a call to return to the dark ages, but a call to scrutinize, very carefully, what industries, what *imported goods*, are required for a relatively high standard of living. In certain situations, island governments are able to provide protection and benefits that their continental analogues can not. For example: what are the costs and benefits cigarette consumption? The strain on

the healthcare system alone is onerous, and every additional export carries high externality costs. Simply outlaw cigarette sales and smoking and in one fell swoop you protect the environment, protect the islanders, reduce transportation related externalities, and lowered your Irrationality-per-capita rate (smokers, who are by definition irrational agents, will either emigrate or become more rational as they *learn* to adopt rational behaviour). This is but one small example, but, by doing less, you'll actually contribute more to the economy by *sustaining and developing valuable natural resource assets over the long run*. People will emigrate; that will actually *help*. With very little assistance (but a great deal more environmental protection) the island will reach its bio-equilibrium (for all species, including humans). Of course, we do not believe a welfare state would ever request *less* welfare, but, ironically, the province would perform better with less, and, moreover, scaling down instead of up inhibits financial shocks.

Consider the fact that

> the 17th century saw several attempts to develop the Prince Edward Island fisheries through grants made by the French crown for monopoly fishing or sealing rights… *Because of Prince Edward Island's remoteness, its poor north shore harbours*, and political squabbling, *none of these projects was ever realized*. (Arnason & Felt 1995, p 101).

Do you get the picture? From an *Island Economics* perspective, this was an economic *miracle*. The relative access and relative deep water harbours on PEI's south shore have helped turn the Northumberland Strait into a lifeless sewer, but the *poor north shore harbours* have *preserved* the north shore's ecology *and* its economy!

The world-class, protected, deep-water harbour in St. John's served as a fantastic port to facilitate all kinds of economic development, including a manufacturing facility for factory trawlers. The harbour was so economically stimulating, in fact, that they were able to fish the most productive cod fishery on earth to commercial extinction. The inverse situation, meanwhile, played out to the north:

> Compared to Newfoundland, Iceland's domestic fisheries remained at very low levels of effort and catches until the early 20th century… In the period 1905-1909, Icelandic groundfish landings averaged only 48.4 thousand metric tonnes, or about a quarter of those of Newfoundland (Arnason & Felt 1995, p 271).

Once you accept the self-evident reality that man is irrational, doesn't understand his world, despises the sea, and utilizes self-destructive, inductive logic, then the realization that *being behind the development curve has distinct*

economic advantages becomes very clear.

And since this nationalistic element inherent to neoclassical economics is so critical, so debilitating, so counter-productive, and so destructive, we shall paint this picture on a larger canvas with the assistance from a woman who understood the derivative nature of economics perhaps better than any economist, past or present…

3.1 On The Problem of Being a Woman

> ICELANDIC WOMEN ARE STRONG-WILLED AND SELF-SUFFICIENT, BOTH QUALITIES DATING from the fishing tradition, when women organised the home and farm and managed everything while waiting for the men to return; often the men did not….
>
> Since they have maintained their strength and independence, feminism is seen as a backward step, for why accept equality when you have superiority?
>
> —Richard Sale, *Xenophobe's Guide to the Icelanders*, 1994

Joan Robinson was J.M. Keynes' star pupil, taught at Cambridge in the 1930's, became the first female fellow of King's College in 1979, and was one of the most prominent economists of the twentieth century[41]. "Her lack of a Nobel prize has been considered one of the saddest "oversights" of the modern economics profession - or one of the most outrageous cases of deliberate neglect" (Cepa 2007, p 1).

And nowhere is this sadness more apparent than in the clarity of her final chapter, *What are the Rules of the Game?,* in her 1962 publication of *Economic Philosophy*. If this chapter were published today, it would be heralded as 'a brilliant *new* insight!', but of course she was in part marginalized because she was a woman, but also because her *highly rationalized* approach to economics (in a similar fashion that the great 'Austrians'[42] from Menger to Hayek were marginalized) did not serve *academic* and *nationalistic* machinations. The Austrian economists were marginalized by the *Austrian Economics* label in the same manner in which *Ecological Economics* is marginalized from mainstream economics today. The inevitable loss of knowledge is a peculiar, sysiphisian[43] feature of economics, and thus we must briefly turn back time to 1962; without further ado[44],

> Behind the facade of laisser-faire theory the governments of all capitalist nations have boosted trade and production, conquered territories and adopted institutions to help their own citizens to gain advantage. *Free-Trade doctrine itself, as Marshall shrewdly observed, was really a projection of British national interests*.
>
> Never before has so great a proportion of economic energy and scientific study been devoted to means of destruction. We combine doctrines of universal benevolence with the same patriotism that inspired the horsemen of Ghengis Khan….

Internal neighbourliness is won by projecting aggression outside. Many things that would be considered disgraceful at home are justified in the name of national interest. As Dr Johnson said: *'Patriotism is the last refuge of scoundrel'*.

As individuals, we value people for what they give to the world not for what they get out of it. We see clearly enough in each other (though not always each in himself) that outward prestige is a poor substitue for inward content. We see that aggression is a sign of weakness and boasting of a lack of self-confidence. Yet greed, vainglory and oppression are quite acceptable in national terms.

The neo-classical heritage still has a great influence, not only on the teaching of economics but in forming publc opinion generally, or at least in providing public opinion with its slogans. But when it comes to an actual issue, it has nothing concrete to say. Its latter-day practioners take refuge in building up more and more elaborate mathematical manipulations and get more and more annoyed at anyone asking them what it is that they are supposed to be manipulating.…

The very fallacies that economics is supposed to guard against, economists are the first to fall into. Their central concept, National Income, is a mass of contradictions. Consumption, for instance, is customarily identified with sale of consumers' goods, and a high rate of 'consumption' is identified with a high standard of life.…

The fight that has to be put up, for instance, to keep wild country from being explolited for… profit is made more difficult because its defenders can be represented as standing up for 'non-economic' values (which is considered soft-headed, foolish and unpatriotic) *the the economists should have been the first to point out that utility, not money, is economic value and that the utility of goods is not measured by their prices*.

All the same we must not abandon the hope that economics can make an advance towards science, or the faith that enlightenment is not useless. *It is necessary to clear the decaying remnants of obsolete metaphysics out of the way before we can go forward*.

The first essential for economists, arguing among themselves, is to 'try very seriously', as Professor Popper says that natural scientists do, 'to avoid talking at cross purposes' and, addressing the world, reading their own doctrines aright, to combat, not foster, the ideology which pretends that values which can be measured in terms of money are the only ones that ought to count [all italics mine, Robinson 1962, p 117 - 137].

During his acceptance speech for his 1982 Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel, George Stigler noted that the most fundamental problem in economics was the fact that it did not have a *theory of value*[45]. Of course this was both true and false. Economics *could* have a theory of value if it wanted one: a theory of value based upon the *Laws of Thermodynamics,* which has been readily available since the 1880's, but economics did not (and still does not) really want one, because it was founded upon an *antithetical* theory of value: a theory of value based upon the *Laws of Warfighting.* Thermodynamics have been consistently rejected ever since, starting with Menger's (1883) *Investigations into the Method of the Social Sciences with Special Reference to Economics.* However, this and all subsequent objections were readily marginalized and are but hazily remembered as minor 'methods squabbles' footnotes in the history of economics, due to the fact that warfighting nations have always exerted and continue to exert control over the *direction of economics.* I certainly do not mean to infer there is any

kind of conspiracy going on here, as that effort would be quite unneccearry. You see, the dominating interests are *already* perfectly aligned: Warfighting nations exert hegemonic control over economics with the same power principles they use to exert control over everything else: education[46], religion, and the *manufacture of consent*[47].

For example, consider the following news release which came over the wire on Monday, April 16, 2007 at 3:56 PM:

> WASHINGTON (Reuters) - The Environmental Protection Agency said on Monday U.S. greenhouse gas emissions linked to global warming increased 16 percent over a 15-year period. President George W. Bush pulled the United States out of the subsequent Kyoto global warming treaty, *arguing the accord's limit on annual emissions would hurt the U.S. economy* [italics mine].

You see, we can't have a reporter lunge to his feet up and object, "But Mister President, that's not true! According to the *Laws of Thermodynamics,* the Kyoto Protocol will actually *help* our economy," because then the President's job becomes more difficult, and when things get difficult, the government becomes *unstable*.

That's why it is very important for Universities to help the President and leave economics curriculums alone. I asked an economics Professor at The University of Prince Edward Island (we'll keep this relatively confidential) why the undergraduate coursework remained steeped in neoclassical theory while our graduate course falsified the foundations of the entire undergraduate curriculum. He said, quite naturally, so those undergraduates will be well-prepared for graduate school!

May we recall that the 2006 provincial fisheries landing figure was largely irrelevant, and that the basis for this irrelevancy is two-fold? The first reason, we will recall, was due to the fact that the *relative ranking* (industry priority) was more critical than the actual figure. The second reason, we noted, should be self-evident by the end of section 3.1 (we're there), because by now we trust it is understood that the actual figure doesn't really *mean* very much; it has no *value*. If someone offers you $100 'to do something', does that *mean* very much? Of course not, because you don't know what 'something' is. If it's $100 to take the day off and read a good book, well, then that means something. If it's $100 to munch cyanide tablets, well, then, that means something quite different. You see, national/provincial accounts don't reflect the manner in which the revenue was generated, and thus its primary use

is of political nature (a marketing device for nationalistic pursuits). I serves no purpose for social scientists interested in the much less common, *primary* science of economics, those significant-but-marginalized scientists engaged in true economic problem solving.

By the way, the President's statement was, quite sadly, *true*, because economic theory is *false!* Again: *The very nature of economics is rooted in nationalism!*

3.2 On the Problem of Continental Economics

> We cannot immunize the continents and the oceans against our contempt for small places and small streams. Small destructions add up, and finally they are understood collectively as large destructions. *Excessive nutrient runoff from farms and animal factories in the Mississippi watershed has caused, in the Gulf of Mexico, a hypoxic or "dead zone" of five or six thousand square miles* [italics mine, Berry 2005, p 7].

In what we have referred to as *Continental Economics,* (which is, for all practical purposes, derivative, nationalistic, neoclassical economics) the "dead zone" Berry is referring to is a classic example of an 'externality', one of the many 'incidental' items national accounts (such as GNP) cannot be bothered with. It's relatively easy to get away with this on Continents, especially one as large as North America, especially when these externalities generally flow to Mexico, and especially when you are able to ignore and dispel complaints (on this and other minor issues, such as the Kyoto Protocol) with a large army, subjectivism, and manufactured consent[48].

But things are quite different with *Island Economics*, because externalities are more difficult to ignore and less easily flushed down foreigners' throats. When island externalities kill 10,000 fish and cancer rates jump 26% in four years, it's just not that easy to ignore (yet it is amazing to witness to what great lengths people will go to do so, Festinger[49] was definitely on to something). As noted, a good number of very silly economics papers advise small island sovereign nations and SNIJ's to *find their niches* through the lens of *Continental Economics*, but, what they all fail to grasp, *nearly all* of these ill-conceived economic pursuits simply will not succeed *in the long run* (such as commercial agriculture or--simply taking the elementary principles of *location theory* into consideration--manufacturing almost *anything*) unless you happen to possess the means (a standing army or an *extraordinary* competitive advantage, such as Icelandic geothermal resources) to slash your cost-base to third-world rates or

administer economic sanctions to non-cooperative nation states. Funk (forthcoming) presents a theory of value (*Island Bioeconomic*[50] *Theory of Value)* based upon *relative insularity*, and further synthesizes this natural resource valuation effort within a much broader, macro-economic scope in *On the Problem of Continental Economics: Economic Principles for People Who Live on Islands, Including Inhabitants of Earth*.

4.0 On the Problem of Social Norms

With this rudimentary *Island Bioeconomic* foundation poured, we may now return to explore Agnarsson and Arnason's (2003) suggestion *that political independence may engender a certain resolve to make the most of available resources* and to pursue *a highly rationalized strategy*, and, in doing so, consider the quagmire of social norms. Consider the following dilemma presented in the Foreword to Haywood's 1995 *Penguin Historical Atlas of the Vikings*:

> Recent years have seen great changes in our historical understanding of the Vikings[51]. The traditional image of the Vikings as nothing more than axe-yielding pirates bent on rape and pillage or conquest has been balanced by a new appreciation of peaceful Viking enterprise in the fields of trade, crafts, exploration and settlement.... Some may feel that my approach has over-emphasized the Vikings' warlike activities at the expense of their more constructive enterprises. This... reflects my own unease at the extent to which the importance of violence in the Viking Age has been played down in many recent studies of the period. The Vikings could be a pretty rough crew when it suited them, and it suited many of them very often in the period *c.* 800-1100.

Now, the dilemma this historical exposition presents is the implication that we must first *interpret* what it *means* to be 'warlike', and we must thus dive head-first into the murky waters of *social norms*[52]. Is warfighting a rational pursuit? *We submit that it is.* And what about the Vikings' victims? Were they 'warlike'? *We submit they were* (consider the crusades). Were these 'victims' more or less rational? *We submit they were hyperirrational.*[53]

> We also submit their descendants have inherited this irrationality through genetics and social learning.

4.1 On the Problem of Religion

> The Vikings' victims had little difficulty explaining the raids: they were God's punishment on a sinful people. Archbishop Wulfstan of York expressed this view eloquently in his *Sermon of the Wolf to the English*, written after Svein Forkbeard's victory over the English in 1014:
>
> > Things have not gone well now for a long time at home or abroad, but there has been devastation and persecution in every district again and again, and the English have been for a long time now completely defeated and too greatly disheartened through God's anger; and the pirates so strong with God's consent that often in battle one puts to flight ten, and sometimes less, sometimes more,

> all because of our sins… what else is there in all these events except God's anger clear and visible over his people (Ibid, p 9)?

And we submit the more *highly rationalized contemporary Icelandic fishing strategy* is an evolutionary result of more *highly rationalized Viking survival strategies.*

4.2 On the Problems of Hunting and Gathering

> Modern historians have found the Viking age harder to explain. Land-hunger caused by a growing population has often been proposed as a cause of the Viking expansion. The population in Scandinavia certainly was rising in the centuries before the first raids, and it continued to do so during and after the Viking age.… Scandinavia has relatively little good arable land and it might be expected that the pressure of a rising population would soon be felt (Ibid).

These conjectures may be rather bold, perhaps even controversial, so we should inject an analogy which further illustrates the logical basis for these conjectures. We submit our anthropocentric tendencies marginalize the fact that we are mammals more *like* than *unlike* other mammals. As a result, we tend to neglect the importance and very essence of the *Struggle for Life*[54] (Darwin 1859) with which every single organism on Earth is chiefly occupied. We do not raise morality issues, evoke the questionable existence of God, or engage in debate regarding what it means to be 'war-like' when a hungry lion takes a gazelle from another hungry lion, or, for that matter, when any other species on earth engages in warfighting for survival—with the exception of *man.*

Our interpretation of the Viking history is rather simple: Once upon a time, a pack of hungry, *independent*, and often genetically related mammals, fully engaged in the *Struggle for Life*, went foraging for food. On these foraging excursions, they engaged in highly rationalized problem solving endeavours, *learned*[55] *from their mistakes*, corrected their errors, and recorded these highly rationalized trials and errors which *served as a conduit for highly rationalized social learning and evolution*. (see Magnússon & Pálsson, *c.* 1000 A.D.a, 1000A.D.b). Over time, a *theory of value* evolved which encourage literacy for all, which fostered independent-minded, rational individuals. The Vikings did eventually accept Christianity, but they have never taken it too seriously. Helgi the Lean claimed to be a Christian, "but invoked Thor in matters of seafaring and dire necessity" (Haywood 1995, p 33). Laxness (1946) sums up Icelandic rationalism, healthy scepticism, independence, and position on Christianity all in one fell swoop:

> You should beware of believing things you see in books. I never regard books as the truth, and least of all the Bible, because there's no check on what they can write in them. They can spin lies as big as they like, and you never know, if you haven't been on the spot.....
>
> "The story can say what it likes for me," said Bjartur sceptically, "but what I'd like to know is this: Who saw Jesus rise on a Sunday? (p 64).

On many foraging quests, Vikings also encountered dependent, irrational people who were less able to defend their food and less able to understand the world in which they lived due to *institutionalized irrationality* which rendered them disconnected from the essence of *Struggle for Life*. They simply could not fathom a *human being* (note the disconnect from the animal kingdom) evil enough to take a gazelle from God (or a solid gold chalice from an unlocked church). *Rational* explanations for these *devilish* deeds were simply beyond their cognitive limits.

How, we may wonder, did these people become irrational?

5.0 On The Problem of Dependent People

> WHEN IN THE COURSE OF HUMAN EVENTS, IT BECOMES NECESSARY FOR ONE PEOPLE TO dissolve the political bands which have connected them with another, and to assume among the powers of the earth, the separate and equal station to which the Laws of Nature and of Nature's God entitle them, a decent respect to the opinions of mankind requires that they should declare the causes which impel them to the separation.
>
> We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness -- That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, --*That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness.*... When a long train of abuses and usurpations, pursuing invariably the same Object evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security.
>
> —*Thomas Jefferson, The Declaration of Independence, 1776*

Professor Chomsky explains this phenomenon quite clearly: We become irrational and dependent through the surrender of intellectual independence. We foster, maintain, and perhaps even recover rationality through the critical process of *developing an independent mind*[56]. For example, imagine that you are a fisherman, and that you've noticed, over the past several years, that the fish stocks are dwindling. A week or two later, you read in the newspaper that a famous English scientist has assured your government that, despite the grumblings of foolish fishermen, the fish stocks are as healthy as they've ever been. If you feel at ease, relieved to know that your

livelihood is not in danger afterall, and grateful for experts who have been able to discover certain knowledge, then you have surrendered your rationality and independence. If your well water has elevated nitrate levels and, once again, you feel relief when the provincial government informs you those levels *aren't high enough to do any harm,* then, once again, it's time to review Jefferson (1776) and write your own declaration.

How do organisms surrender intellectual independence?

I am unaware of examples outside of the human species, but it is quite common where social cohesion between genetically unrelated organisms is deemed beneficial, which, of course includes the entire human population. It began in earnest with the rise of authoritarian and totalitarian states between 500 B.C. and 350 B.C (Popper 1945), but for the present discourse I'm unable to pursue this issue with any depth, as "the problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright" (Popper 1945, Vol. II, p 9). I'll merely offer this snapshot:

> The greatest principle of all is that nobody, whether male or female, should be without a leader. Nor should the mind of anybody be habituated to letting him do anything at all on his own initiative ; neither out of zeal, nor even playfully. But in war and in the midst of peace—to his leader he shall direct his eye and follow him faithfully. And even in the smallest matter he should stand under leadership. For example, he should get up, or move, or wash, or take his meals… only if he has been told to do so. In a word, he should teach his soul, by long habit, never to dream of acting independently, and to become utterly incapable of it.
>
> —PLATO OF ATHENS, *c.* 360 B.C. (Ibid, p 7).

Today, however, the traps aren't as easy to see, but this dependence is primarily propagated through the three inter-related, viral ills (as in self-distributing, such as the word-of-mouth feedback loop phenomena regularly observed in the entertainment industry): (1) media production, (2) media consumption, and (3) media toxicity. And although government, education, and religion play the three primary roles, the media serves as a conduit for all three players. The dependent people living on the dependent SNIJ of PEI are especially prone to fall prey to Authoritarian dominance (especially since over 30% of the populations works for the federal and/or provincial governments), and they are likewise vulnerable to *The Problem of Induction* (hereafter TPI, see Hume, 1739), which

requires submission to the irrational belief in the existence of certain knowledge[57] and gives rise to a great number of *myths* or *systemic and collective cognitive dissonances* (Festinger 1957), such as *The Problems of Religion,* which, for example, held and continues to hold significant populations in the state of cognitive discomfort when faced with the conflicting truth[58] that the bible was metaphor, not natural history[59] (Darwin 1883). We submit the same flavour of discomfort also holds us back from rejecting similar *myths* and accepting truths pertaining to *The Problem of Global Warming.* Weale (2007) offers an excellent insight to the recent evolution (the past 200 years) of the hyperirrational religious delusions which have contributed to PEI's deep discounting of all natural resources, including the fishery.

Dominant and false philosophical (authoritarian) and methodological (inductive) notions which guide academic institutions, government institutions, and, thus, human life on earth, lead us to the ultimately false and irrational sense of certainty which may be rapidly driving us toward the penultimate lesson[60] of TPI.

6.0 On the Problems of Induction & Global Warming

You may be wondering how we propose the independent qualities of sovereignty relate to *The Problem of Global Warming,* so let's sketch an outline of this corollary relationship.

Funk's (2007a) conceptualization of this problem is significantly different than the prevailing conceptualization of the problem, and the detailed development of our theory may be discovered in Funk (2007f). The timeline of Weart's (2003) *The Discovery of Global Warming* begins in Sweden, with Arrhenius' first publication of his calculations of global warming from human emissions of CO_2, and ends in 1988, where Weart notes that "the period since 1988 is too recent to identify historical milestones" (p 206). This may have been marginally true in 2003, but the history of the past four years is surely enough to fill an encyclopaedia. But it is safe to say that the 2007 *Intergovernmental Panel on Climate Change* report (see UNIPCC 2007) represents a fairly unbiased representation of this theory *as it is generally accepted.* Funk (2007a) does not accept this theory. Funk (2007a) also does not accept Weart's assertion that "the [1896] discovery of global warming was…[very] clear" (p vii), because, we submit, that it is not only unclear, it is nearly impossible to discern.

Gillis (2004) detailed various aspects of the totalitarian Greek disdain for the sea[61] (which, we submit, serves as the root of our present disdain for the sea), and Funk (2007f) explored this relationhip between independent and dependent (or, open and closed) societies in *On the Problem of Global Warming: The Brief History of a New & Unpopular Theory in an Open Letter to John Gillis:*

> ***On the Problem of Closed Societies & the Sea***
> Several months ago I wrote to you regarding an essay I had tentatively titled *On the Problem of Closed Societies: Why We Turn Our Backs to the Sea*, and indicated my intent "to follow Popper's (1945) thread… and explore the possibility that gross disregard for marine resources may be rooted in Greek disdain for the chaotic sea."
>
> You were kind enough to reply:
>
> > *Dear Matt…I am not sure that it is just closed societies that turn their backs on the sea. There is certainly a long standing western ambivalence toward the sea that you will want to explore* [italics mine, Gillis 2007].
>
> Of course you're absolutely right about *the long standing western ambivalence toward the sea,* and again, thank you for shedding light on this problem and leading me to Steinberg [2001], because he charts this ambivalence with a master cartographer's precision and clarity. But it does not appear that your definition of 'open' and 'closed' resembles mine, becuase I have only been able to discover a single open society[62] left on Earth: *Iceland*. Steinberg has piqued my curiousity about micronesian societies, perhaps they may be relatively open as well. I'd also be willing to consider the societies of the Hawaiin Islands if we're willing to acknowledge that they represent a society that is seperate from The United States. Because, despite the fact that Popper (1945) traced the rise of closed societies (totalitarian states) from ancient Greece to Nazi Germany, I charge it is not possible to read *The Open Society and Its Enemies* today without being constantly reminded of post-Eisenhower U.S. foreign policy[63] presents a solid case that every nation that trades with the U.S. becomes a de facto closed society through complicity, submission, and co-dependence; thus there aren't many nations left to choose from. Bobby Fisher's personal end-game conflict, which culminated in a series of distress calls to rational sovereign nations for asylum, serves as a great example: Iceland was the only nation *independent* enough (from complicit, submissive, and dependent ties to The United States) to offer Fisher asylum. And speaking of games, are you familiar with the ultimatum game[64]? It's as if U.S. foreign policy consistently offers the world zero, and the rest of the world gladly accepts zero and goes quietly into the night as the U.S. walks away with ten [Note: see this recent recantation[65]]. I will not digress further with a critique of Albert Gore's position on global warming, but if you're interested in that, I will forward *On the Problem of Totalitarian Politicians: An Open Letter to the Nobel Peace Prize Committee concerning Henry Kissinger and Albert Gore* when I find time to finish it this winter. Presently I will only suggest that social change works its way from the bottom to the top (consider the civil rights movement in the United States or the Ghandi-era independence movement in India), not the top, down. By definition, politicians are antithetical to the problem solving process [recall footnote 17].

6.1 On the Problem of Global Illiteracy

> IT IS CUSTOMARY TO SUPPOSE THAT THE BULK OF OUR BELIEFS ARE DERIVED FROM SOME rational ground, and that desire is only an occasional disturbing force. The exact opposite of this would be nearer the truth: the great mass of beliefs by which we are supported in our daily life is merely the bodying

> forth of desire, corrected here and there, at isolated points, by the rude shock of fact. Man is essentially a dreamer, wakened sometimes for a moment by some peculiarly obtrusive element in the outer world, but lapsing again quickly into the happy somnolence of imagination.
>
> —Bertrand Russell, *Sceptical Essays*, 1928.

The Problem of Global Warming (hereafter TPGW) may be accurately described (framed) as the *systemic hyperirrational consumption of all natural resources*.

'Global warming' is *not* limited to the ecological distress induced through the consumption of superheating fossil fuels—this human induced superheating is merely *a single symptom* of far more significant problems which stem from TPI. In short, TPI has generated *attendant myths*[66] and *convenient myths*[67], which encourage men to act irrationally. Irrationality spawns and maintains irrational institutions which manufacture consent (see Herman & Chomsky 1988), drive irrational conspicuous consumption (Veblen 1899), and, moreover, foster hyperirrational resource consumption—which is certainly not limited to the consumption of superheating fossil fuels.

In essence, this problem stems from authoritarian-induced irrationality (which we will refer to as an 'illiteracy') regarding TPI. This general illiteracy in turn generates the three universal and inter-connected illiteracies of TPGW:

I. Land Illiteracy

II. Water Illiteracy

III. Air Illiteracy

Wendell Berry (2005) coined the term we use for the first of the three major facets of this hyperirrational resource consumption: ***Land Illiteracy***.

> The principle problem is that we are "land illiterate." When it comes to "reading" a landscape, we might as well be studying a foreign language. Too many of us don't know our perennials from our annuals, what the signs of poor water cycling are, what an incised channel means, or, simply by looking, whether a meadow is healthy or not (Berry 2005, pp 164-165).

Land Illiteracy leads to *The Problem of Commercial Agriculture*[68], which, to keep things simple for the time being, contributes one-third of TPGW. *Air Illiteracy (*representing another one-third), which leads to the *The Problem of Superheating Fossil Fuels*, is the most commonly understood and vaguely acknowledged component of

global warming, but, this discourse focuses on *Water Illiteracy,* which leads to *The Problem of Commercial Fishing*, we will briefly contextualize two Illiteracies in tandem with an illustration from Funk (2007f):

> ***On the Problem of Prince Edward Island Economics***
> In January of 2006 the Fraser Institute ranked Prince Edward Island the worse Province in Canada for business investment. Though I agree with this assessment, this is by far the least of Prince Edward Island's problems: Prince Edward Island has rapidly emerged as the worse place in Canada—perhaps all of North America—for human life. This gives me little comfort to report, as my wife was born and raised on this island, her respective families (MacDonalds and Campbells, descendants of island Scots from the Hebrides) have inhabited the island for five generations, and we presently call this fine island home.
>
> Toronto's *Globe and Mail* ran a cover-story last winter with a gigantic headline: CANCER: PEI'S KILLING FIELDS, and the article noted
>
> > Prince Edward Island would be a good place to shed more light on the health effects of agricultural chemicals because areas such as Kensington have some of the highest airborne concentrations of pesticides around farm fields in the world, and a sizeable rural population literally living on the doorstep of the spraying (Mittelsteadt 2006 p 1 ; also see Delaney 2006).
>
> Unless you're familiar with the institutional process of *manufacturing consent* (see Lippmann 1922), or were aware that this submissive dependent island state was a closed society and joined ranks with The United States in a long list of totalitarian, failed democratic states, you may be surprised that this in-depth, *Globe and Mail* cover-story headline made scant back-page news in the *The Guardian*. But I wasn't surprised. I didn't even expect the story would appear in *The Guardian* at all.
>
> As you know, Prince Edward Island is the smallest Canadian province with a population of just 130,000 people. However, due to the island's relatively small size, it is the most densely populated province in Canada, and it is *the* most densely populated commercial agricultural region in North America.
>
> And I'm afraid this problem gets worse: Prince Edward Island is also the only province in Canada that is 100% dependent on its groundwater resource, and, quite sadly, it is the only Province in Canada that does not have regulated municipal water oversight. Over one in five wells on this island pumps water into homes which fails to meet Canadian water safety guidelines (which are more liberal than FDA requirements for bottled water, in other words, you're able to drink water at home that would be illegal to sell!). More troubling is the fact that neither federal nor provincial governments test (the provincial water testing lab here on the island is the most limited provincial lab in Canada) or provide safety guidelines for pesticides[69]. It may be reasonable to conclude that PEI has the lowest quality ground-water source in Canada, with the possible exception of northern Alberta (see Dominion 2007).
>
> And thus we begin to see the inextricable relationship between *Land Illiteracy* (*The Problem of Commercial Agriculture*) and *Water Illiteracy* (in this iteration, *The Problem of Drinking Poison*). I will not delve too deeply into this relationship, but consider the fact that the entire south shore lobster fishery collapsed over five years ago, and to date, all focus is on the *economic consequences* of this collapse, not the infinitely more important *environmental implications* of this collapse (my conjecture, which I believe is a rather solitary position on the matter, is that this in-shore fishery was, *at the very least*, significantly weakened by run-off cased by both *Land Illiteracy* and *Water Illiteracy* in *The Problem of Commercial Agriculture*. All of the major fish kills were in south-shore watersheds, it is a very Western display of denial to believe that the pesticides' toxicity vanishes where the river meets the sea. Although the fishery is consistently ranked as the third-most important island industry (behind agriculture and tourism), in a world where rationality prevailed (I hope I am clearly submitting that it does not), it would be quite obvious that both the fishery and tourism

sectors will fail in a toxic environment. And in a sense, of course, residents use the same criteria tourists use when we choose a "vacation destination" to call home: Prince Edward Island also holds the distinction of the only province in Canada with a negative growth rate (negative 9.5%) for single family home sales in 2006. What, you may ask, are the people of Prince Edward Island doing about this grave situation?

The answer is, of course, quite naturally, nothing, because that is what submissive and dependent people do[70]. And that is, afterall, exactly what my fellow Americans do, too:

> We Americans are not usually thought to be a submissive people, but of course we are. Why else would we allow our country to be destroyed? Why else would we be rewarding its destroyers? Why else would we all—by proxies we have given to… corporations and… politicians—be participating in its destruction? Most of us are still too sane to piss in our own cistern, but we allow others to do so, and we reward them for it. We reward them so well, in fact, that those who piss in our cistern are wealthier than the rest of us.
>
> How do we submit? By not being radical enough (Berry 2005, p 21).

6.11 On the Problem of Water Illiteracy

The tremendously influential British scientific philosopher Thomas Henry Huxley.… was appointed to three British fishing commissions. He played a major role in an 1862 commission, which was to examine a complaint of driftnet fishermen, who said that longliners were responsible for their diminishing catches. The fishermen had asked for legislation restricting longlining. But Huxley's commission declared such complaints to be unscientific and prejudicial to more "productive modes of industry." The commission also established the tradition in government of ignoring the observations of fishermen. It reported "fishermen, as a class, are exceedingly unobservant of anything about fish which is not absolutely forced upon them by their daily avocations" (Kurlansky 1997, pp 121-122).

Kurlansky (1997) chronicles the Canadian governments religious faith (pun intended) in Huxley, and, furthermore, the modelling of their fisheries policies on Huxley's authoritarian, inductive logic to the very bitter end: the collapse of the great Newfoundland cod fishery.

> At the 1883 International Fisheries Exhibition in London, which was attended by most of the great fishing nations of the world, Huxley delivered an address explaining why overfishing was an unscientific and erroneous fear: "Any tendency to over-fishing will meet with its natural check in the diminution of the supply,… this check will always come into operation lon g before anything like permanent exhaustion has occurred."….
>
> For the next 100 years, Huxley's influence would be reflected in Canadian government policy. An 1885 report by L.Z. Joncas in the Canadian Ministry of Agriculture stated:
>
> > The question here arises: Would not the Canadian fisheries soon be exhausted if they were worked on much larger scale and would it be wise to sink a larger amount of capital in their improvement?…. As to those fishes which, like cod, mackerel, herring, etc. are the most important of our sea fishes, which form the largest quota of our fish exports and are generally called commercial fishes—with going so far as to pretend that protection would be useless to them —I say it is impossible, not merely to exhaust them, but even noticeabely to lessen their number… *For the last three hundred years fishing has gone on in the Gulf of St. Lawrence and along the coast of our Maritime Provinces, and although enormous quantities of fish have been caught, there are no*

indications of exhaustion [italics mine] (pp 121-123).

Note this final, authoritarian declaration by the Canadian Ministry of Agriculture (italicized above) offers a perfect example of TPI at work in *The Problem Commercial Fishing*. And what is astonishing, of course, is that these errors have not been acknowledged and are in fact being repeated as you read these words (such as the present Barry Group controversy in the Gulf of St. Lawrence).

7.0 On the Problem of Storytelling

> THE HAND-WRINGING LITARY OF WHAT WE HAVE DONE TO OUR HABITAT IS A LONG ONE, and, like most everyone else, I am tired of hearing about it.
>
> I also dislike the feelings of fatalism and powerlessness it sometimes evokes. But I am not without hope, and it's not because I believe in some new technological quick-fix that is just around the corner. Putting more and more sophisticated tools in the hands of deranged people, who are captive to *old stories* [convenient myths], is hardly a solution. *The reason I am not without hope is because I know what great storytellers we humans are, and because I believe we are capable of a new narrative that will get us off this blundering course.*
>
> —David Weale, *Chasing the Shore*, 2007

Are we *capable of a new narrative that will get us off this blundering course ?*

> John Maynard Keynes wrote that his friend Bertrand Russell 'held two ludicrously incompatible beliefs: on the one hand he believed that all the problems of the world stemmed from conducting human affairs in a most irrational way; on the other, that the solution was simple, since all we had to do was to behave rationally' (Russell 1935, Preface).

Thus Weale, Keynes, and Russell charge us toward the third act of this investigation, seeking remedies, elixirs, and conclusions in light of this possible dilemma. So, in this spirit, let us revisit the final moment of an interview first published in *Der Speigel* in April of 1992:

> *Spiegel* Herr Popper, you are nearly ninety years of age and have always described yourself as an optimist through and through. But this interview has struck some very pessimistic notes. Has new knowledge come in the evening of life?
>
> *Popper* Optimism is a duty. One must focus on the things that need to be done and for which one is responsible. *What I have said… is meant to make you and others vigilant. We must live so that our grandchildren have a better life than ours—and not just in an economic sense* [italics mine, Spiegel Verlag 1992].

The Introduction suggested that the lesson of Icelandic independence may offer valuable and viable solutions to the inestimably complex and vastly uncertain problem of the sustainability of life on earth. Do we have reason to be optimistic? To be hopeful? *Are we capable of a new narrative that will get us off this blundering course?*

We trust we are all wise enough to know that we are not wise enough to know. But of coursed we can and must try to do all that we are able to do.

On the Problem of Global Warming: a Brief History of a New & Unpopular Theory in an Open Letter to John Gillis & Ragnar Arnason (Funk 2007f), chronicles one man's ten-year search for such a narrative; this discourse distils modest gains and various aspects of that search over the past four months; and this discourse concludes that the study of islands is primary, paramount, perhaps even utterly necessary for human survival. Islands serve as lighthouses, as *synecdoches*[71], as economic models far more representative and descriptive than mathematical models[72] (and although our method does employ mathematics, it does so from the *opposite direction*[73] of those methods common to continental economic analysis). Darwin's powerful and effective, island-based analysis *and* storytelling enabled us to break through *attendant* and *convenient myths* and grasp global complexity and uncertainty that was beyond our reach.

Nagarajan's (2006) *Collapse of Easter Island: Lessons for Sustainability of Small Islands* illustrates that "islands represent a microcosm of the planet Earth" (abstract), echoing Von Bertallanfy… "the island microcosm can certainly help to simplify understanding but it still needs to be related to larger and more complex system dynamics" (Baldacchino 2007, p 84).

Many are surprised to discover that *The Theory of Evolution* had been published in several accounts by several authors *for over fifty years* prior to Darwin's 1859 *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life*, and eighty years before his 1883 publication of *The Descent of Man and Selection in Relation to Sex* (Larson 2004). "Although it is often said that the *Origin of Species* [finally] convinced people of evolution because it provided an easily-understood mechanism (natural selection) for evolution, the deluge of articles and books published in 1909, 50 years after the origin, *show clearly that it was principally the facts of geographical distribution that had convinced the majority"*[italics mine, Baldacchino 2007, p 202].

The Theory of Evolution by Means of Natural Selection was finally accepted because Darwin was able to *describe a very large complex, closed system* (earth) by modelling it with *much smaller, simplified, semi-closed systems* (islands).[74]

Moreover, island processes are amplified through compression[75] and thus, relative to continents, exhibit explosive rates of evolution[76]. *Thus islands enable us to model and observe alternative earthly socio-economic, political, and ecological futures.*

Funk (2007a) constructed a powerfully descriptive, living, whole-earth system model of TPGW utilizing just two relatively small islands, Prince Edward Island and Iceland. Although we may hold personal interests in these islands, and hunger to continue to learn *about* them, we may stand to gain far more by learning *from* them. "[Margaret] Mead didn't go to Samoa just to study Samoa. Rather she wanted to understand the whole human race" (Baldacchino 2007, p 49). Following closely in her footsteps, our "Einfühlung[77]" for these *islands in the stream* comes from our desire to understand the world in which we live, and our never ending search for a better world[78].

1 As I was sitting in my hotel room in Skåne, I asked myself: what can fame and success give to an author? A measure of material well-being brought about by money? Certainly. *But if an Icelandic poet should… ever lose his sense of belonging with the humble of the earth, whom my old grandmother taught me to revere, and his duty toward them, then what is the good of fame and prosperity to him?* [italics mine, Halldór Laxness, *Nobel Banquet Speech*, December 1955].

2 One can be independent, or one can be subject to decisions made by others… This difference, embodied in the institutional distinction between the decision-making procedures 'market' and 'hierarchy', affects individual wellbeing beyond outcomes. Taking self-employment as an important case of independence, it is shown that the self-employed derive higher satisfaction from work than those employed in organizations, irrespective of income gained or hours worked. This is evidence for procedural utility: people value not only outcomes, but also the processes leading to outcomes (Benz & Frey, pre-publication release, abstract).

3 (a) The perverse effects frequently attributed to the welfare state are easy to interpret from a behavioral perspective. If people overestimate the magnitude of immediate benefits relative to more distant ones, you can actually–on net–harm them by offering them additional immediate benefits. They already tend to under-invest. Making their present more livable with cash gifts only amplifies this tendency. Similarly, if individuals systematically overestimate their own abilities, you could easily harm a student by admitting him to a program for which he is under-qualified. Blinded by over-confidence, he would be likely to select the best school that accepted him, scarcely considering the possibility that he will be out of his league. Looking at the welfare state from a behavioral standpoint lays the groundwork for a stronger claim: Potential welfare recipients' deviations from neoclassical assumptions tend to be especially pronounced. If the average American falls short of the neoclassical ideal, the average recipient of government assistance does not even come close (Beaulier & Caplan 2007, p 487).

(b) Once you accept the idea that you can hurt people by giving them more choices, you cannot dismiss the idea that you can help them by taking some of their choices away. In practice, of course, the latter is much more costly and intrusive than the former (Ibid, p 503).

4 The situation can be best described by comparison with a searchlight (the 'searchlight theory of science', as I usually call it in contrasdistinction to the 'bucket theory of the mind'). What the searchlight makes visible will depend upon its position, upon our way of directing it, and upon its intensity, colour, etc. ' although it will, of course, also depend very largely upon the things illuminated by it. Similarly, a scientific description will depend, largely, upon our point of view, our interests, which are as a rule connected with the theory or hypothesis we wish to test ; although it will also depend upon the facts described. Indeed, the theory or hypothesis could be described as the crystallization of a point of view (Popper 1945, vol. II, p 260).

5 Myrdal, 1975, p1. Also see Descartes 1637.

6 Weale, 2007, p 11.

7 Art is a selective re-creation of reality according to an artist's metaphysical value-judgments. Man's profound need of art lies in the fact that his cognitive faculty is conceptual, i.e., that he acquires knowledge by means of abstractions, and needs the power to bring his widest metaphysical abstractions into his immediate, perceptual awareness. Art fulfills this need: by means of a selective re-creation, it concretizes man's fundamental view of himself and of existence. It tells man, in effect, which aspects of his experience are to be regarded as essential, significant, important. In this sense, art teaches man how to use his consciousness (Rand 1969, p 45).

8 Arawak men and women, naked, tawny, and full of wonder, emerged from their villages onto the island's beaches and swam out to get a closer look at the strange big boat. When Columbus and his sailors came ashore, carrying swords, speaking oddly, the Arawaks ran to greet them, brought them food, water, gifts. He later wrote of this in his log:

> They… brought us parrots and balls of cotton and spears and many other things, which they exchanged for the glass beads and hawks' bells. They willingly traded everything they owned… . They were well-built, with good bodies and handsome features.… They do not bear arms, and do not know them, for I showed them a sword, they took it by the edge and cut themselves out of ignorance. They have no iron. Their spears are made of cane… . They would make fine servants.… With fifty men we could subjugate them all and make them do whatever we want (Zinn 1980, p 1).

9 HAPPINESS is generally considered an ultimate goal of life; virtually everybody wants to be happy. The United States Declaration of Independence of 1776 [see Jefferson 1776] takes it as a self-evident truth that the "pursuit of happiness" is an "unalienable right," comparable to life and liberty. It follows that economics is-or should be-about individual happiness; in particular, how do economic growth, unemployment and inflation, and institutional factors such as governance affect individual well-being? In addition to this intrinsic interest, there are important reasons for economists to consider happiness research. The first is economic policy. At the microlevel, it is often impossible to make a Pareto-improving proposal, because a social action entails costs for some individuals. Hence an evaluation of the net effects, in terms of individual utilities, is needed (Frey & Stutzer 2002, p 402).

10 One of the central, unresolved controversies in biology concerns the distribution of primitive *versus* advanced characters at different stages of vertebrate development. This controversy has major implications for evolutionary developmental biology and phylogenetics. Ernst Haeckel addressed the issue with his Biogenetic Law.... Haeckel's important but overlooked alphabetical analogy of evolution and development is an advance on von Baer.... Despite his obvious flaws, Haeckel can be seen as the father of a sequence-based phylogenetic embryology (Richardson & Keuck 2002, abstract).

11 Knowledge consists in the search for truth–the search for objectively true, explanatory theories... It is not the search for certainty. To err is human. All human knowledge is fallible and therefore uncertain. It follows that we must distinguish sharply between truth and certainty. That to err is human means not only that we must constantly struggle against error, but also that, even when we have taken the greatest care, we cannot be completely certain that we have not made a mistake.

In science, a mistake we make–an error–consists essentially in our regarding as true a theory that is not true... to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can never be completely certain that we have not made a mistake (Popper, 1992, p 4).

12 The genuine discipline of the Enlightenment, the true rationalist, does not even want to persuade, nor even to convince. He remains always aware that he may err. Thus he esteems too highly the *independence* [italics mine] of the other person to try to sway him in important matters; rather he wants objections and criticisms. He wants to arouse and stimulate the cut and thrust of argument. This is what is valuable to him. Not only because we may approach truth better with the free exchange of opinion, but also because he values this process as such (Popper 1999, pp 206-207).

13 Non-economists are using the results produced in modern economics and its publication system less and less, because they judge them to be far from relevant.... The Economist (1997: 13; 2000: 90), for example, wonders about the "Puzzling Failure of Economics", and asks "In the long run, is the subject dead?", or the New Yorker (Cassidy 1996: 50 - 1) remarks: "... a good deal of modern economic theory, even the kind that wins Nobel Prizes, simply does not matter much". This apparent failure has been reflected on the market for students. In most countries, economists have lost much ground to other disciplines, in particular to management. At least according to such evidence, it is not easy to defend the position that the existing journal publication process contributes greatly to making economics a generally relevant, innovative and exciting discipline (Frey 2002, p 16).

14 (a) My present design... is not to teach the method which each ought to follow for the right conduct of his reason, but solely to describe the way in which I have endeavoured to conduct my own.... This tract is put forth merely as a history, or, if you will, as a tale, in which, amid some examples worthy of imitation, there will be found, perhaps, as many more which it were advisable not to follow, I hope it will prove useful to some without being hurtful to any, and that my openness will find some favour with all (Descartes 1637, p 1).

(b) It is possible I may be mistaken; and it is but a little copper and glass, perhaps, that I take for gold and diamonds. I know how very liable we are to delusion in what relates to ourselves, and also how much the judgments of our friends are to be suspected when given in our favour (Ibid, p 1).

15 (a) Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics (Kirzner 2006, p1).

(b) The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers (Hayek, Bartley, & Kresege 1991, pp 8-9).

(c) In contrast to the majority of economists, [Austrian economists]… produce relatively more books and contribute fewer articles to established journals.… They are very much concerned with methodological and philosophical fundamentals and what makes the label *extraordinary* most applicable to their work is that they share a conviction that orthodox economics is at the point of breakdown, that it is unable to provide a coherent and intelligible analysis of the present-day economic world (Edwin G. Dolan, "Austrian Economics as Extraordinary Science," in *The Foundations of Modern Austrian Economics* [Kansas City: Sheed & Ward, 1976]).

16 (a) Economic theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgment in choosing between rival sets of assumptions (Coase 1930, p 386).

(b) When I began the study of economics some forty one years ago, I was struck by the incongruity between the models that I was taught and the world that I had seen growing up, in Gary Indiana, a city whose rise and fall paralleled the rise and fall of the industrial economy. Founded in 1906 by U.S. Steel, and named after its Chairman of the Board, by the end of the century it had declined to but a shadow of its former self. But even in its heyday, it was marred by poverty, periodic unemployment, and massive racial discrimination. Yet the theories that we were taught paid little attention to poverty, said that all markets cleared – including the labour market, so unemployment must be nothing more than a phantasm, and that the profit motive ensured that there could not be economic discrimination. If the central theorems that argued that the economy was Pareto efficient – that, in some sense, we were living in the best of all possible worlds – were true, it seemed to me that we should be striving to create a different world (Stiglitz 2001, p 473).

17 As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them* [italics mine]. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person (Popper 1956, p 5).

18 There are, so Montaigne implied, no legitimate reasons why books in the humanities should be difficult…; wisdom does not require a specialized vocabulary or syntax, nor does an audience benefit from being wearied….Every work presents us with a choice of whether to judge the author inept for not being clear, or

ourselves stupid for not grasping what is going on. Montaigne encouraged us to blame the author. (de Botton 2001, p 158).

19 (a) Every intellectual has a very special responsibility. He has the privilege and the opportunity of studying. In return, he owes it to his fellow men (or 'to society') to represent the results of his study as simply, clearly and modestly as he can. The worst thing that intellectuals can do–the cardinal sin–is to try to set themselves up as great prophets vis-à-vis their fellow men and to impress them with puzzling philosophies. Anyone who cannot speak simply and clearly should say nothing and continue to work until he can do so (Popper 1992, p 83).

(b) What I called the cardinal sin above…—the presumptuousness of the three-quarters educated—is simply talking hot air, professing a wisdom we do not possess….

When a student comes up to university he has no idea what standards he should apply, and so he adopts the standards he finds. Since the intellectual standards in most departments… permit pomposity and presumed knowledge (all these people seem to know an awful lot), even good heads are completely turned (Ibid, p 86).

20 It is important to realize that the national accounts statistics may well understate the real contribution of the fishing industry to the economies in question. There are two fundamental reasons for this. First there are a number of economic activities closely linked with the fishing industry but not part of it. These activities consist of the production of inputs to the fishing industry, the so-called backward linkages, and the various secondary uses of fish products, the so-called forward linkages (Arnason 1994). The backward linkages include activities such as ship building and maintenance, fishing gear production, the production of fishing industry equipment and machinery, the fish packaging industry, fisheries research, educations and so on. The forward linkages comprise the transport of fish products, the production of animal feed from fish products, the marketing of fish products, retailing of fish products, part of the restaurant industry and so on. According to Arnason 1994, these backward and forward linkages may easily add at least a quarter to the GDP contribution of the fishing industry. The other reason why the national accounts may underestimate the true contribution of the fishing industry to the GDP is the role of the fishing industry as a disproportionately strong exchange earner. To the extent that the availability of foreign currency constrains economic output, the economic contribution of a disproportionately strong export earner may be greater than is apparent from the national accounts. While the size of this "multiplier effect" is not easy to measure, some studies suggest it may be of a significant magnitude (Arnason 1994). If that is true, the total contribution of the fishing industry to the GDP might easily be much higher than the above direct estimates suggest, in the sense that removal of the fishing industry would, ceteris paribus, lead to this reduction in the GDP (Agnarsson & Arnason, 2003, p 8).

21 (a) The successful politician owes his power to the fact that he moves within the accepted framework of thought, that he thinks and talks conventionally. It would be almost a contradiction in terms for a politician to be a leader in the field of ideas. His task in a democracy is to find out what the opinions held by the largest number are, not to give currency to new opinions which may become the majority view in some distant future (Hayek 1982).

(b) Politicians do not find any attractions in a view which does not lend itself to party declamation, and ordinary mortals prefer views which attribute misfortune to the machinations of their enemies. Consequently people fight for and against quite irrelevant measures, while the few who have a rational opinion are not listened to because they do not minister to any one's passions (Russell 1928, p3).

22 Even the official motto belies its aspirations. The motto of Prince Edward Island, Parva sub ingenti, "the small under the protection of the great," is an apt metaphor for Canada's smallest province. It is also a bitterly paradoxical expression of the Island's status as a "have not" province, largely dependent on others for its survival [italics mine], first as a colony under British rule and then as a somewhat reluctant new province of Canada. As Prince Edward Island comes to the end of the 20th century, the goal of greater self-sufficiency and self-reliance remains as elusive as ever (Baldacchino & Greenwood 1998, p 175).

23 It seems a consensus on this position has not yet been reached. While editing this paper, my wife marked this

line for omission.

24EXT. CORNER OFFICE -- NIGHT

Bam. Jerry's door opens. He exits his office with box. He is now in a state of advancing melancholy, slightly unhinged. Many of the other agents now try not to watch him leaving.

JERRY
Well, don't worry! I'm not going to do what you think I'm going to do, which is FLIP OUT!

JERRY
(continuing)

Jerry goes to a water dispenser, calming himself, and fills a small Dixie cup. Downs it and fills it again, rubbing his face..

JERRY
(continuing)
But let me just say, as I ease out of the office I helped build -- sorry, but it's a fact --

ON DOROTHY -- WATCHING

from her cubicle.

JERRY
-- that there is such a thing as manners. A way of treating people...

He notices the fish tank nearby. He attemps to be profound.

JERRY
(continuing)
These fish have manners! They have manners.

And now Jerry feels bravado, mixed with a wave of anger. Another cup of water as he finds power.

JERRY
(continuing)
In fact. They're coming with me! I'm starting a new company, and the fish will come with me and... you can call me sentimental.

He begins dipping into the tank, grabbing the one exotic fish that failed to escape his cup. It's a fire-tailed Peruvian beauty. He grabs a baggie from an assistant's desk, shakes out some crumbs, and dumps the fish inside.

JERRY
(continuing; to fish)
it's okay... it's okay...

Nearby, a Xerox Repair Guy watches the human train wreck.

JERRY
(continuing)
But if anybody else wants to come with me, this moment will be the ground floor of something real and fun and inspiring and true in this godforsaken business and we will do it together! Who's coming with me besides... "Flipper" here?

But clearly even Flipper is not happy with the new arrangement. Panicked, he whips around the small baggie.

JERRY
(continuing)
Anybody going with me?

Silence, someone coughs, as agents and office personnel look on with equal parts pity and embarrassment. Jerry downs another small cup of water. His lid is blowing off with each second.

JERRY
(continuing)
Wendy? Shall we?

Assistant Wendy looks at Maguire. Painfully polite:

WENDY
I'm three months away from the pay increase, Jerry. I have to, uh... you know, stay.

Jerry absorbs the blow, and takes the keys from the top of her desk. She can't look at him. Jerry stands alone, the blue Mission Statement on Wendy's desk sits accusingly in frame. There is only silence now, the loudest kind.

JERRY
Okay, anybody else?

ON DOROTHY

She looks around. Doesn't anybody believe in the very thing they were applauding three days ago? She has an odd reaction, a muscle twitch of the soul. Before she knows it, she stands boldly, unfortunately knocking a cup of coffee onto herself in the process.

DOROTHY
I'll go with you.
(quietly, on her coffee mess)
Wonderful...

She dabs at her pants. Next to her, Cleo looks on sadly.

ON JERRY

halfway across the office.

JERRY
Dorothy Boyd! Thank you!

She gathers her things, increasingly aware of what she's done.

JERRY
(continuing)
We will see you all again. Sleep tight!

He walks to Dorothy, and together they exit down the hallway corridor, past the framed posters and awards.

WIDE-SHOT

rising over the huge office. For the first time, we see the full expanse of the huge SMI headquarters. And down in the corner of the frame, two small figures leave carrying boxes.

JERRY
(to Dorothy)
Let's see how they do without us.

A beat of silence, then noise returns to its normal commercial roar. A couple of fleas have been swatted off the carcass of an immense beast.

(Crowe 1996, pp 36-39)

25 (a) Iceland is an island of some 103 100 km^2 located in the North Atlantic just south of the Arctic Circle. Iceland's central point is approximately 65 North and 19 West. The country's exclusive economic zone (EEZ) is 758 000 km^2 or more than seven times the surface area of the mainland. Shortest distances to neighbouring countries are: to Greenland 290 km, to the Faroe Islands 435 km, to Scotland 812 km and to Norway 970 km (Arnason 1995, p 5).

(b) Settled by Norwegian and Celtic (Scottish and Irish) immigrants during the late 9th and 10th centuries A.D., Iceland boasts the world's oldest functioning legislative assembly, the Althing, established in 930. Independent for over 300 years, Iceland was subsequently ruled by Norway and Denmark. Fallout from the Askja volcano of 1875 devastated the Icelandic economy and caused widespread famine. Over the next quarter century, 20% of the island's population emigrated, mostly to Canada and the US. Limited home rule from Denmark was granted in 1874 and complete independence attained in 1944. *Literacy, longevity, income, and social cohesion are first-rate by world standards* [italics mine, *CIA World Factbook*, updated 1 November 2007].

26 Alone in my hotel room that night, I naturally began to ask myself what it would mean to a poor wanderer, a writer from one of the most remote islands in the world….

I spent my entire childhood in an environment in which the mighty of the earth had no place outside story books and dreams. Love of, and respect for, the humble routine of everyday life and its creatures was the only moral commandment which carried conviction when I was a child….

My thoughts fly to the old Icelandic storytellers who created our classics, whose personalities were so bound up with the masses that their names, unlike their lives' work, have not been preserved for posterity. They live in

their immortal creations and are as much a part of Iceland as her landscape. For century upon dark century those nameless men and women sat in their mud huts writing books without so much as asking themselves what their wages would be, what prize or recognition would be theirs. There was no fire in their miserable dwellings at which to warm their stiff fingers as they sat up late at night over their stories. Yet they succeeded in creating not only a literary language which is among the most beautiful and subtlest there is, but a separate literary genre. While their hearts remained warm, they held on to their pens (also see Laxness 1955).

27 Iceland is the cradle of narrative art here in the North. This is ultimately due to the peculiar nature and development of the Icelandic community. In Iceland there were no conditions for the rise of the class society elsewhere so characteristic of the Middle Ages, with its sharp contrast between Church and people, between the learned and the peasants. There books were not, as in other lands, the privilege of a few priests versed in Latin. Even in the Middle Ages literacy was far more widespread among the common people in Iceland than in other parts of Europe (Wessén 1995, *The Nobel Prize in Literature Presentation Speech*).

28 Contrary to popular opinion, "*The Problem of Global Warming*," is *not*, I submit, ecological distress due to the superheating of the Earth--because this is clearly not the problem—it is merely a single symptom of far more significant problems, which, I further submit, stem from the *Problem of Induction* (see Hume 1739). In short, *The Problem of Induction* has generated convenient myths (see Archbar, Wintonick, Symansky, & Chomsky 1992), which encourage men to act irrationally. Irrationality spawns and maintains irrational institutions which manufacture consent (see Herman and Chomsky 1992), drive irrational conspicuous consumption (Veblen 1899), and, moreover, foster hyperirrational resource consumption— which is certainly not limited to the consumption of superheating fossil fuels. I propose a variety of counter-intuitive, viable solutions, but conclude the problem may be insoluble, as the philosophical and methodological foundations (see Popper 1945, 19556, 1959, & 1963, Russell 1928, 1938, 1941, Rowbottom & Aiston 2006) render dominant irrational agents and institutions unable to recognize the true nature of the problem (see Festinger 1957) and/or unwilling to act upon otherwise viable solutions (Funk 2007a).

29 (a) Prior to 1970 or so, most researchers in judgement and decision-making believed that people are pretty good decision–makers… Since then, however, opinion has taken a decided turn for the worse…. The view that people are irrational is real in the sense that people hold it to be true. But the reality is mostly in the rhetoric." (Lopes, 1991, p 66, 80) (Smith 2002, p 524).

(b) Many psychologists appear to find irrationality everywhere, and many economists appear to see the findings as everywhere irrelevant" (Smith 2002, p525).

(c) The economist may attempt to ignore psychology, but it is sheer impossibility for him to ignore human nature. If the economist borrows his conception of man from the psychologist, his constructive work may have some chance of remaining purely economic in character. But if he does not, he will not thereby avoid psychology. Rather, he will force himself to make his own, and it will be bad psychology (Clark 1918).

30 We have… a hierarchy of comforting beliefs: those private to the individual, those which he shares with his family, those common to his class or his nation, and finally those that are equally delightful to all mankind. If we desire good relations with a man, we must respect these beliefs; we do not, therefore, speak of a man to his face as we should behind his back. The difference increases as his remoteness from our selves grows greater. In speaking to a brother, we have no need of conscious politeness as regards his parents. The need of politeness is at its maximum in speaking with foreigners, and is so irksome as to be paralyzing to those who are only accustomed to compatriots. I remember once suggesting to an unravelled American that possibly there were a few small points in which the British Constitution compared favourably with that of the United States. He instantly fell in to a towering passion; having never heard such an opinion before, he could not imagine that anyone seriously entertained it. We had both failed in politeness, and the result was a disaster (Russell 1928, p 17).

31 (a) I uphold the ancient theory of truth… according to which truth is the agreement with the facts of what is

being asserted. Kuhn's views on this fundamental question seem to me affected by relativism; more specifically, by some for of subjectivism and of elitism, as proposed for example by Polanyi. Kuhn seems to me also affected by Polanyi's fideism: the theory that a scientist *must* have faith in the theory he proposes (while I think that scientists--like Einstein in 1916 or Bohr in 1913--often realize that they are proposing conjectures that will, sooner or later, be superseded). There are many other such points of difference, of which perhaps the most important is my emphasis on objective rational criticism: I regard as characteristic of ancient and modern science the critical approach towards theories, from the point of view of whether they are true or false. Another important point seems to me that Kuhn does not seem to see the great importance of the many purely scientific revolutions that are *not* connected with *ideological* revolutions [all italics Popper's] (pp xxxi-xxxii).

(b) *My goal is to defend what one might call a scientific worldview* [italics mine] -- defined broadly as a respect for evidence and logic, and for the incessant confrontation of theories with the real world; in short, for reasoned argument over wishful thinking, superstition and demagoguery. And my motives for trying to defend these old-fashioned ideas are basically political. I'm worried about trends in… [America]… -- particularly here in academia -- that at a minimum divert us from the task of formulating a progressive social critique, by leading smart and committed people into trendy but ultimately empty intellectual fashions, and that can in fact undermine the prospects for such a critique, by promoting subjectivist and relativist philosophies that in my view are inconsistent with producing a realistic analysis of society that we and our fellow citizens will find compelling (Sokal 1996, pp 126-129).

32 When economics was yet a fledgling science, Adam Smith carefully elaborated his vision of a productive economy which achieves economic growth and prosperity by relying on individual initiative and limited government. His implicit acceptance o the revolutionary slogan which asserts “that government governs best which governs least” rests on the belief that coordination will come about in a market economy through the free play of competition.

Marx argued that Smith merely parroted the interests of the ruling capitalist class, which he called the bourgeoisie…. *To Marx, it made no sense to describe the market as organized economic activity because there was no organizer* (Eklelund and Hebert 1997, 236).

33 c.1530, "household management," from L. oeconomia, from Gk. oikonomia "household management," from oikonomos "manager, steward," from oikos "house" (cognate with L. vicus "district," vicinus "near;" O.E. wic "dwelling, village;" see villa) + nomos "managing," from nemein "manage" (see numismatics). The sense of "manage the resources of a country" (short for political economy) is from 1651. Hence, economic (1835) means "related to the science of economics," while economical (1780) retains the sense "characterized by thrift." Economist is 1586 in the sense of "household manager," 1804 meaning "student of political economy." Economy (adj.) as a term in advertising at first meant simply "cheaper" (1821), then "bigger and thus cheaper per unit or amount" (1950) (Online Etymology Dictionary 2007).

34 The derivatives genie is now well out of the bottle, and these instruments will almost certainly multiply in variety and number until some event makes their toxicity clear. Knowledge of how dangerous they are has already permeated the electricity and gas businesses, in which the eruption of major troubles caused the use of derivatives to diminish dramatically. Elsewhere, however, the derivatives business continues to expand unchecked. Central banks and governments have so far found no effective way to control, or even monitor, the risks posed by these contracts.

Charlie and I believe Berkshire should be a fortress of financial strength – for the sake of our owners, creditors, policyholders and employees. We try to be alert to any sort of megacatastrophe risk, and that posture may make us unduly apprehensive about the burgeoning quantities of long-term derivatives contracts and the massive amount of uncollateralized receivables that are growing alongside. In our view, however, derivatives are financial weapons of mass destruction, carrying dangers that, while now latent, are potentially lethal [Buffett 2003, p 15 ; also see Jon Danielsson's (2000) *The Emperor has no Clothes: Limits to Risk Modelling*].

35 Economic power, unlike military power, is not primary, but derivative. Within on State, it depends on law; in international dealings it is only on minor issues that it depends on law, but when large issues are involved it depends upon war or the threat of war. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it [italics mine, Russell 1928, p 95].

36 Godfrey Baldacchino has kindly directed me to the works of Anthony Doeman, who may offer an exception to this general observation.

37 Jevons' romance with statistical investigations unfortunately carried him to the most fanciful and, unfortunately, the most ridiculed idea of his life, the explanation of commercial crises on the basis of the periodic alteration of spots on the sun. The "sunspot theory" integrated Jevons' earlier work on the prices with his lifelong interest in astronomical and meteorological phenomena. In "The Solar Period and the Price of Corn" (1875), he put the matter succinctly:

> If the planets govern the sun, and the sun governs the vintages and harvests, and thus the prices of food and raw materials and the state of the money market, it follows that the configurations of the planets may prove to be the remote causes of the greatest commercial disasters (Ekelund and Hebert 1997, p332).

38 (a) Abstract: Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) Theory of Bullshit, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, The Problem of Induction, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry. In the process, we falsify de Vany's 'Nobody knows anything' theory and advance our replacement theory: George Lucas knows something (Funk 2007b).

(b) The differential equations used to solve the Black-Scholes formula were adapted from physics equations that describe, among other phenomena in the physical world, the way cream spreads through a cup of coffee. Any *one* molecule's trip is random, but as a group, the molecules distribute themselves in predictable fashion, from the centre out. The cream will never go all to one side (Lowenstein 2000, p 66).

39 It appears almost all ecological and evolutionary processes…are amplified on islands; generally speaking, the smaller the island, the more amplified these processes are. Small size and low diversity seem to be the main factors. With populations existing in miniature, they are prone to stochastic, or random, processes…. Such a mosaic of habitats in a tiny area promotes evolutionary radiation. Conversely, the small size of islands means that they are exquisitely vulnerable to biological invasion and disturbance as there are few distance barriers to dispersal, and few areas are immune to disturbance by inaccessibility. On the plus side, 'amplification by compression' makes islands particularly useful…on islands, process that may be subtle on continents tend to be more clearly exposed (Baldacchino 2007b, p 193).

40 The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the

consumers and the producers (Hayek, Bartley, & Kresge, 1991, pp 8-9).

41 Towards the end of her life, Robinson's work concentrated mostly on methodological problems in economics (notably, stressing her dissatisfaction with "equilibrium" theories) and trying to revive the original message of Keynes's General Theory. Her many popular writings… [including 1962] brought her an even greater pominence with a wider public. She was invited to address the American Economic Association in 1971, wherein she gave one of her most provocative deliveries…

Robinson was also intensely interested in problems in underdeveloped and developing countries - a natural outgrowth of her work on growth…

Robinson joined the British Academy in 1958 and was elected fellow of Newnham College in 1962. In 1965, she finally became a full professor and a fellow of Girton College (Cepa 2007, p 1).

42 During the course of his newspaper work [Menger] noticed a discrepancy between what the classical economics he was taught in school said about price determination and what real world market participants believed. In 1867 Menger began a study of political economy which culminated in 1871 with the publication of his *Principles of Economics* (*Grundsätze der Volkswirtschaftslehre*), thus becoming the father of the Austrian School of economic thought. It was in this work that he challenged the classical labour theory of value with his theory of marginality. At the time *Principles* was largely ignored….

Ensconced in his professorship he set about refining and defending the positions he took and methods he utilized in Principles, the result of which was the 1883 publication of *Investigations into the Method of the Social Sciences with Special Reference to Economics* (*Untersuchungen über die Methode der Socialwissenschaften und der politischen Oekonomie insbesondere*). The book caused a firestorm of debate, during which members of the Historical School of economics began to derisively call Menger and his students the 'Austrian School' to emphasize their departure from mainstream economic thought in Germany. In 1884 Menger responded with the pamphlet *The Errors of Historicism* in German Economics and launched the infamous Methodenstreit, or methodological debate, between the Historical School and the Austrian School (Hayek pp. 14-15).

43 It is the fact that in [economics] no knowledge can be regarded as established once and for all, and that, in fact, knowledge once gained and spread is often, not disproved, but simply lost and forgotten…. The reason why in our field knowledge can be so lost is, of course, that is never established by experiment, but can be acquired only by following a rather difficult process of reasoning…. The result is that in economics you can never establish a truth once and for all but have always to convince every generation anew (Hayek, Bartley, & Kresege 1991, p 38).

44 For comic relief, see Plaidophile (2007).

45 In economics the most fundamental of these central problems is the theory of value. The theory of value must explain how the comparative values of different goods and services are established. Until that problem is solved, it is not possible to analyse for scientific purposes what will be produced and in what quantities, how the resources will be employed in producing the menu of outputs, and how the resources will be valued. Without a theory of value the economist can have no theory of international trade nor possibly a theory of money. This central problem of value does not change in its essential content if one seeks to explain values in rural or urban societies, or in agricultural or industrial societies. Indeed, if the problem of value were so chameleon like as to alter its nature whenever the economic or political system altered, each epoch in economic life would require its own theory, and short epochs would get short-lived theories (Stigler 1982, p 61).

46 (a) Education is a mere contrivance for moulding people to be exactly like one another: and the mould in which it casts them is that which pleases the predominant power in the government, whither this be a monarch, a priesthood, and aristocracy, or the majority of the existing generation; in proportion as it is efficient and successful, it establishes a despotism over the mind, leading by natural tendency to one over the body (Mill 1946, p 376).

(b) State education… produces, so far as it is successful, a herd of ignorant fanatics, ready at the word of command to engage in war or persecution as may be required of them. So great is this evil that the world be a better place (at any rate, in my opinion) if State education had never been inaugurated (Russell 1955, p 526).

47 That *the manufacture of consent* [italics mine] is capable of great refinements no one, I think, denies. The process by which public opinions arise is certainly no less intricate than it has appeared in these pages and the opportunities for manipulation open to anyone who understands the process are plain enough.

The creation of consent is not a new art. It is a very old one which was supposed to have died out with the appearance of democracy. But it has not died out. It has, in fact, improved enormously in technic, because it is now based on analysis rather than on rule of thumb. And so, as a result of psychological research, coupled with the modern means of communication, the practice of democracy has turned a corner. A revolution is taking place, infinitely more significant than any shifting of economic power.

Within the life of the generation now in control of affairs, persuasion has become a self-conscious art and a regular organ of popular government. None of us begins to understand the consequences, but it is no daring prophecy to say that the knowledge of how to create consent will alter every political calculation and modify every political premise…It has been demonstrated that we cannot rely upon intuition, conscience, or the accidents of casual opinion if we are to deal with the world beyond our reach (Lippmann 1922, p 158).

48 Compliments of Plato, Lippmann, and Kuhn (see Fuller 2003 ; Plato *c.* 360 B.C. ; Lippmann 1922 ; Kuhn 1962).

49 (1) Cognitive dissonance theory suggests that we have an inner drive to hold all our attitudes and beliefs in harmony and avoid disharmony (or dissonance).

Cognitive dissonanc**e** refers to a situation involving conflicting attitudes, beliefs or behaviours. This produces a feeling of discomfort leading to an alteration in one of the attitudes, beliefs or behaviours to reduce the discomfort and restore balance etc. For example, when people smoke (behaviour) and they know that smoking causes cancer (cognition).

Attitudes may change because of factors within the person. An important factor here is the principle of cognitive consistency, the focus of Festinger's (1957) theory of cognitive dissonance. This theory starts from the idea that we seek consistency in our beliefs and attitudes in any situation where two cognitions are inconsistent. Festinger… proposed cognitive dissonance theory, which states that a powerful motive to maintain cognitive consistency can give rise to irrational and sometimes maladaptive behaviour. According to Festinger, we hold many cognitions about the world and ourselves; when they clash, a discrepancy is evoked, resulting in a state of tension known as cognitive dissonance. As the experience of dissonance is unpleasant, we are motivated to reduce or eliminate it, and achieve consonance (i.e. agreement) (Simplypsychology 2007, p1).

(2) Just as we be with children, we support those in whom we have a heavy investment of food and time until they are able to propagate our genes, so we do with ideas. An academic who became famous for espousing an opinion is not going to voice anything that can possibly devalue his own past work and kill years of investment (Taleb 2001, p 240).

(3) Human beings are perhaps never more frightening than when they are convinced beyond doubt that they are right (van der Post 1958).

(4) The strongest guard is placed at the gateway to nothing.… because the condition of emptiness is too shameful to be divulged (Fitzgerald 1934, p 60).

50 (1) "Bioeconomics refers to that school of economics stressing the fact that the human species is a part of the larger biosystem of the planet and ultimately subject to the same laws and limitations as other life forms," [Gordy 1991, p77]. The 'Island' aspect denotes an economic modelling technique developed in Funk (2007): an island-based (amplification through compression), highly descriptive model which offers several advantages to

well-known (and equally suspect) mathematical modelling techniques. In reality, however, all life is *problem solving*.

(2) The success of Darwinism and its view of evolution have induced economists who are interested in an evolutionary approach in economics to borrow, more or less extensively, concepts and tools from Darwinian theory. Particularly prominent are constructions based on analogies to the theory of natural selection. Because several objections to such analogy constructions can be raised, generalization rather than analogy is advocated here as a research strategy. This means to search for abstract features which all evolutionary theories have in common. Third, the question of what a Darwinian world view might mean for assessing long term economic evolution is discussed. Such a view, it is argued, can provide a point of departure for reinterpreting the hedonistic approach to economic change and development. On the basis of such an interpretation bioeconomics may not only go beyond the optimization-cum-equilibrium paradigm currently prevailing in economics. It may also mean adding substantial qualifications to the subjectivism the neoclassical economists, at the turn of the century, were proud to establish in the course of their scientific revolution (Witt 1999, abstract).

51 The term "Viking" has come to be applied to all Scandinavians of the period, but in the Viking age itself the term *vikingr* applied only to someone who went *i viking,* that is plundering (Haywood 1995, p 8).

52 The existence of social norms is one of the big unsolved problems in social cognitive science. Although no other concept is invoked more frequently in the social sciences, we still know little about how social norms are formed, the forces determining their content, and the cognitive and emotional requirements that enable species to establish and enforce social norms….

Human societies represent a spectacular outlier with respect to all other animal species because they are based on large-scale cooperation among genetically unrelated individuals. In most animal societies, cooperation is either orders of magnitude less developed compared with humans, or it is based on substantial genetic relatedness (Fehr & Fischbacher 2004, p 1).

53 A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason (Russell 1928, pp 6-7).

54 (a) Nothing is easier than to admit in words the truth of the universal *struggle for life*, or more difficult--at least I have found it so--than constantly to bear this conclusion in mind. *Yet unless it be thoroughly engrained in the mind, I am convinced that the whole economy of nature, with every fact on distribution, rarity, abundance, extinction, and variation, will be dimly seen or quite misunderstood*. We behold the face of nature bright with gladness, we often see superabundance of food; *we do not see, or we forget, that the birds which are idly singing round us mostly live on insects or seeds, and are thus constantly destroying life; or we forget how largely these songsters, or their eggs, or their nestlings, are destroyed by birds and beasts of prey; we do not always bear in mind, that though food may be now superabundant, it is not so at all seasons of each recurring year.*

I should premise that I use the term Struggle for Existence in a large and metaphorical sense, including dependence of one being on another, and including (which is more important) not only the life of the individual, but success in leaving progeny [all italics mine, Darwin 1859, p 62].

(b) It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds

singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. These laws, taken in the largest sense, being Growth with Reproduction; inheritance which is almost implied by reproduction; Variability from the indirect and direct action of the external conditions of life, and from use and disuse; a Ratio of Increase so high as to lead to a Struggle for Life, and as a consequence to Natural Selection, entailing Divergence of Character and the Extinction of less-improved forms. Thus, from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows. There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved (Ibid, pp 489-490).

55 Learning from history does not come naturally to us humans.... It is a platitude that children learn only from their own mistakes; they will cease to touch a burning stove only when they are themselves burned; no possible warning by other s can lea to developing the smallest form of cautiousness. Adults, too, suffer from such a condition. This point has been examined by behavioural economics pioneers Daniel Kahneman and Amos Tvesrsky.... In some respects we do not learn from our own history. Several branches of research have been examining our inability to learn from our own reactions to past events: For example, people fail to learn that their emotional reactions to past experiences (positive or negative) were short-lived—yet they continuously retain the bias of thinking that the purchase of an object will bring long-lasting , possibly permanent happiness or that a setback will cause severe and prolonged distress (when in the past similar setbacks did not affect them for very long and the joy of the purchase was short-lived) (Taleb 2001).

56 Try to understand the world...and try to improve the world...and develop *courses of intellectual self defence* [emphasis Chomsky's].... *I don't mean go to school, cause you're not going to get it there*. [italics mine]. It means you have to develop an *independent mind* [emphasis Chomsky's] and work on it—and that's extremely hard to do alone.... Each person is sitting alone in front of the tube and it's very difficult to have ideas or thoughts under those circumstances (Archbar, Wintonick Symansky, & Chomsky1992).

57 *The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today* [italics mine]. But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory.

The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. *Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge* [italics mine] (Popper 1994, p 37).

58 A similar discomfort was encountered when *On the Revolutions of the Celestial Orbs* (Copernicus 1543) advanced the argument that the sun, not the earth, was at the centre of our solar system.

59 The main conclusion arrived at in this work, namely, that man is descended from some lowly organised form, will, I regret to think, be highly distasteful to many. But there can hardly be a doubt that we are descended from barbarians. The astonishment which I felt on first seeing a party of Fuegians on a wild and broken shore will never be forgotten by me, for the reflection at once rushed into my mind-such were our ancestors. These men were absolutely naked and bedaubed with paint, their long hair was tangled, their mouths frothed with excitement, and their expression was wild, startled, and distrustful. They possessed hardly any arts, and like wild animals lived on what they could catch; they had no government, and were merciless to every one not of their own small tribe. He who has seen a savage in his native land will not feel much shame, if forced to acknowledge that the blood of some more humble creature flows in his veins. *For my own part I would as soon be descended from that heroic little monkey, who braved his dreaded enemy in order to save the life of his keeper, or from that old baboon, who descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs--as*

from a savage who delights to torture his enemies, offers up bloody sacrifices, practices infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstitions (italics mine, Darwin 1883, conclusion).

60 The final lesson: extinction. We are pre-conditioned to disbelieve the possibility that human life on Earth is capable of destroying human life on Earth because there are, quite obviously, no recorded instances (data) of such events. The general acceptance of inductive logic (inductive inferences) and probability theory in the social sciences (most notably economics) lead us to this and innumerable other false conclusions and *may be* (note the cautionary qualifier) leading us towards self-destruction (Funk 2007a, p 3).

61 For the Greeks the distinction between earth and water was elemental. *They saw themselves inhabiting an Earth Island completely surrounded by a watery chaos*….

Even in the waters [the Greeks] knew best, the eastern Mediterranean, they always tried to stay within sight of land… They were more comfortable onshore than off, and did not sleep or take meals on ships if they could help it….

For the Greeks the sea was a non-place, a void, "as worrying metaphysically as it was physically"… For them it was boundless space (*aperion*), representing everything they feared: "vast extent, impassibility, atavism, and monstrous disorder" [(Romm 1992, p 26)]. Earth, by contrast, represented order (cosmos). By constructing their mythical geography in this dichotomous way, the Greeks managed to project all they found disturbing beyond their shores, thus reinforcing their own unshakable sense of earthly order. Greek city-states have been described as "islands on dry land," and Greece itself as a "pattern of islands"… *This preference for insularity would be one of Greece's legacies to Western civilization* [all italics mine, Gillis 2004, pp 5-9].

62 (a) open societies, closed societies:
These terms were introduced by Karl Popper in his book *The Open Society and its Enemies* (1945), and further explored in *The Poverty of Historicism* (1957). Popper argued that both science and human history are essentially indeterminate and fluid. Applied to social theory, this produced Popper's lively and devastating attack on historicism. Theories such as those of Plato, Hegel, and Marx, which proposed the existence of laws of history and a knowable human destiny, were dismissed by Popper as scientifically insupportable and politically dangerous. He proposed that all such theories would lead to authoritarian and inhumane regimes, which he called closed societies because they were closed to the normal processes of change. Open societies by contrast were based on the activity, creativity, and innovation of many individuals, and would develop unpredictably through piecemeal social engineering. They are those societies in which social policies are monitored for unintended consequences, openly criticized, and altered in the light of such criticism. Such societies must be both liberal and democratic, in the sense that it must be possible to remove from office rulers who fail to respond to justified criticism.[1]

(b) Popper was one of the few Western philosophers whose ideas were of sufficient scope amd depth to be applied to the task of linking free inquiry, free communication, freedom to enter and exit, with openness and freedom in politics. George Soros, the American billionaire of Hungarian origin who had encountered Popper's ideas during studies at the LSE, set up a network of philanthropic institutions in the region - aptly called "Open Society Foundations" - to put into practice Popper's ideas, by encouraging critical thinking in education, and by contributing to the development of an active, lively, civil society. In addition, Soros set up the Central European University (CEU) in Prague and then Budapest, to provide, among other things, an intellectual training ground for these ideas (Jarvie & Pralong 1999, p 8).

1"open societies and closed societies" A Dictionary of Sociology. John Scott and Gordon Marshall. Oxford University Press 2005. Oxford Reference Online. Oxford University Press. University of Prince Edward Island. 28 July 2006 <http://www.oxfordreference.com.rlproxy.upei.ca/views/ENTRY.html?subview=Main&entry=t88.e1613>

63 The selection of issues that should rank high on the agenda of concern for human welfare and rights is, naturally, a subjective matter. But there are few choices that seem unavoidable, because they bear so directly on the prospects for decent survival. Among them are at least three: nuclear war, environmental disaster, and the fact

that the government of the world's leading power is acting in ways that increase the likelihood of these catastrophes (Chomsky 2007, Preface).

64 In the ultimatum game, a proposer offers a responder a fraction *s* of a fixed amount of money put up by the experimenter [typically a figure between zero and ten]. If the responder accepts *s*, he gets *s* and the proposer keeps the remainder. If the responder rejects *s*, both get 0. A rational, profit-maximizing responder would accept any *s,* no matter how small. However, in one-shot experiments with complete anonymity conducted in numerous cultures, proposers routinely offer much more than 0, and in a few societies many responders reject even relatively generous offers (Hagen & Hammerstein 2006, p 340).

65 I must confess that, since completing this paper, my recent reformulation of *The Problem of Global Warming* has resulted in a decision to recant my critical position regarding U.S. foreign policy: Given the levels of uncertainty surrounding the three inter-related Problems of *Ohmic Decay* (see Kuang & Bloxham 1997), *Solar Flux* (see Lovelock & Whitfield 1982), and *Meteorites* (see Wisdom 1985), I am no longer able to reasonably conclude that U.S. foreign policy represents sub-optimal strategy. In fact, I am considering presenting the arguement *for* a standing army and industrial military complex which, in turn, finance space exploration, which could enable the possibility of the continuity of lifefoms (of earthly origin) in the event of dire consequences given the possibility of one or more of the above (and/or, naturally, something else, such as a VEI-8 volcanic eruption or trophic collapse, see McGuire, 2002). I will add, however, that, in the unlikely event that U.S. foreign policy should prove optimal, I maintain it may be largely due to luck and through the relatively inhumane machinations of a failed democratic state.

66 Human events spring from passions, which generate systems of *attendant myths* [italics mine]. A man who has suffered some humiliation invents a theory that he is King of England, and develops all kinds of ingenious explanations of the fact that he is not treated with that respect which his exalted position demands. In this case, his delusion is one with which his neighbours do not sympathize, so they lock him up. But if, instead of asserting only his own greatness, he asserts the greatness of his nation or his class or his creed, he wins hosts of adherents, and becomes a political or religious leader, even if, to the impartial outsider, his views seem just as absurd as those found in asylums. In this way a collective insanity grows up, which follows laws very similar to those of individual insanity. Every one knows that it is dangerous to depute with a lunatic who thinks he is King of England; but as he is isolated, he can be overpowered. When a whole nation shares a delusion, its anger is of the same kind as that of an individual lunatic if its pretensions are disputed, but nothing short of war can compel it to submit to reason (Russell 1928, pp 6-7).

67 Modern industrial civilization has developed within a certain system of *convenient myths* [italics mine]. The driving force of modern civilization has been individual material gain which is accepted as legitimate, even praiseworthy, on the grounds that private vices yield public benefits in the classic formulation. Now it's long been understood, very well, that a society that is based on this principle will destroy itself in time. It can only persist with whatever suffering and injustice it entails as long as it's possible to pretend that the destructive forces that humans create are limited, that the world is an infinite resource, and that the world is an infinite garbage can. At this stage of history either one of two things is possible. Either the general population will take control of its own destiny and will concern itself with community interests guided by values of solidarity and sympathy and concern for others. Or alternatively, there will be no destiny for anyone to control. In this possibly terminal phase of human existence, democracy and freedom are more than values to be treasured, they may well be essential to survival (Chomsky 1992, Finale).

68 The simple yet difficult solution to this problem lies *not*, as corporate agricultural interests will readily offer, in growing more food, it is growing fewer people.

69 Barlow said the big problem on P.E.I. will be an agricultural one with pesticides and nitrates leaching into groundwater.

"For you, it will be an issue of preserving your way of life" (Stewart 2007).

70 The Roman Catholic Church on P.E.I. is preparing to close churches as congregations shrink, but participants at a public forum Thursday night were ready to fight for them (CBC 2007b).

71 Islands are synecdoches: their understanding facilitates a 'coming to grips' with a more complex whole. They also act as advance indicators or extreme reproductions of what is future elsewhere. Crucial, new insights into evolutionary theory, and the realization of so much species differentiation on islands in modern zoogeography, are primarily due to the unwitting and haphazard stumbling of what, at first sight, may have appeared to be inconsequential, island-based, island-specific fieldwork. This includes such investigations as the study of Darwin's finches on the Galapagos Islands (Darwin, 1979; Lack, 1947) or Alfred Wallace's study of birds-of-paradise on the Aru Islands (Wallace, 1975)… The forays of Bronislaw Malinowski amongst the Trobriand (or Kiriwina) Islanders of Papua New Guinea (1922), Margaret Mead to Samoa and the Admiralty Islands (1928; 1934) and Raymond Firth to Tikopia (1936) led to the birth of ethnography (Baldacchino 2007b, p 9).

72 (a) The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate "given" resources-if "given' is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge not given to anyone in its totality. *This character of the fundamental problem has, I am afraid, been rather obscured than illuminated by many of the recent refinements of economic theory, particularly by many of the uses made of mathematics* [italics mine, Hayek 1956, pp 519-520].

(b) What has gone wrong with the development of economics as a science? Answer: There was a bunch of intelligent people who felt compelled to use mathematics just to tell themselves that they were rigorous in their thinking, that theirs was a science. Someone in a great rush decided to introduce mathematical modelling techniques…without considering the fact that either the class of mathematics they were using was too restrictive for the class of problems they were dealing with, or that perhaps they should be aware that the precision of the language of mathematics could lead people to believe that they had solutions when in fact they had none (Taleb 2001, p 177).

(c) It is an interesting speculation to think what direction the development of Menger's thought would have taken if he had been acquainted with these founders of mathematical analysis. It is a curious fact that, so far as I am aware, he has nowhere commented on the value of mathematics as a tool of economic analysis. There is no reason to assume that he lacked either the technical equipment or the inclination. On the contrary, his interest in the natural sciences is beyond doubt, and a strong bias in favour of their methods is evident throughout his work….He does not even refer to the mathematical method in any of his writings on methodology…Must we conclude that he felt rather sceptical about its usefulness? (Hayek p 15).

(d) Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds (Maxwell 1873, p 400).

(d) Mathematicians… set to work to purge their subject of fallacies and slipshod reasoning. The great mathematicians of the seventeenth century were optimistic and anxious for quick results; consequently they left the foundations of analytical geometry and the infinitesimal calculus insecure (Russell 1945, p).

(e) In the *Principles*, Marshall [1891] confined his use of diagrams and other mathematical notations to footnotes and appendixes so as not to allow his mathematics to detract from his economics. He was interested above all in

plain communication—with businessmen as well as with students. Moreover, he was acutely aware that over reliance on mathematics "might lead us astray in pursuit of intellectual toys, imaginary problems not conforming to the conditions of real life: and, further, might distort our sense of proportion by causing us to neglect factors that could not easily be worked up in the mathematic machine" (Pigou, Memorials, p. 84) (Ekelund, p 341).

73 Mathematics is a study which, when we start from its most familiar portions, may be pursued in either of two opposite directions. The more familiar direction is constructive, towards gradually increasing complexity : from integers to fractions, real numbers, complex numbers ; from addition and multiplication to differentiation and integration, and on to higher mathematics. *The other direction, which is less familiar, proceeds, by analysing, to greater and greater abstractness and logical simplicity ; instead of asking what can be defined and deduced from what is assumed to begin with, we ask instead what more general ideas and principles can be found, in terms of which what was our starting-point can be defined or deduced* [italics mine]....

We may state the same distinction in another way. The most obvious and easy things in mathematics are not those that come logically at the beginning ; they are things that, from the point of view of logical deduction, come somewhere in the middle. Just as the easiest bodies to see are those that are neither very near nor very far, neither very small nor very great, so the easiest conceptions to grasp are those that are neither very complex nor very simple (using "simple" in a logical sense) (Russell 1919, pp1-2).

74 Compared with continents... [islands] have a restricted area and definite boundaries, and in most cases their biological and geographical boundaries coincide. The number of species and of genera they contain is always much smaller then in the case of continents, and their peculiar species and groups are usually well defined and strictly limited in range... their relations with other lands are often direct and simple and even when they are more complex are far easier to comprehend than those of continents (Wallace 1880, pp 241-242).

75 It appears almost all ecological and evolutionary processes...are amplified on islands; generally speaking, the smaller the island, the more amplified these processes are. Small size and low diversity seem to be the main factors. With populations existing in miniature, they are prone to stochastic, or random, processes.... Such a mosaic of habitats in a tiny area promotes evolutionary radiation. Conversely, the small size of islands means that they are exquisitely vulnerable to biological invasion and disturbance as there are few distance barriers to dispersal, and few areas are immune to disturbance by inaccessibility. On the plus side, 'amplification by compression' makes islands particularly useful...on islands, process that may be subtle on continents tend to be more clearly exposed (Baldacchino 2007b, p 193).

76 *Rapid evolution of island immigrants is not only possible but frequent. Change after arrival is inevitable.*

"Explosive" evolution is demonstrated by various groups thathave had good ecological oppurtunities (Carlquist 1974, p 20).

77 There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these . . . laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience' (Popper 1959, p 37).

(b) Scientific discovery must ever depend upon some happy thought, of which we cannot trace the origin; — some fortunate cast of intellect rising above all rules. No precepts will elevate a man of ordinary endowments to the level of a man of genius: nor will an inquirer of truly inventive mind need to come to the teacher of inductive philosophy to learn how to exercise the faculties which nature has given him. (Whewell 1849, reprinted under the title 'Mr Mill's Logic' in Butts 1968, p. 117).

78 All things living are in search of a better world.

Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their

situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.

An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements.

We can see that life – even at the level of the unicellular organism - brings something completely new into the world, something that did not previously exist: problems and active attempts to solve them; assessments, values: trial and error.

It may be supposed that, under the influence of Darwin's natural selection, it is the most active problem solvers, the seekers and the finders, the discoverers of new worlds and new forms of live, that undergo the greatest development.

Each organism also strives to stabilize its internal conditions of life and to maintain it's individuality – an activity whose results biologists call 'homoeostasis'. Yet this too is an internal agitation, an internal activity: an activity that attempts to restrict the internal agitation, a feedback mechanism, a correction of errors. The homoeostasis must be incomplete. It must restrict itself. Were it completely successful, it would mean the death of the organism, or, at the very least, the temporary cessation of all its vital functions. Activity, agitation, search are essential for life, for perpetual restlessness, perpetual imperfection; for perpetual seeking, hoping, evaluation, finding, discovering, improving, for learning and for the creation of values; but also for perpetual error…

Darwinism teaches that organisms become adapted to the environment through natural selection. And it teaches that they are passive throughout this process. But it seems to me far more important to stress that the organisms find, invent and reorganize new environments in the course of their search for a better world [italics mine]…

All organisms are fully occupied with problem-solving. Their first problem is survival. But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.

According to this optimistic interpretation, it is through natural selection and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche.

This pressure from within results in a choice of niches; that is, in forms of behavior that may be regarded as a choice of lifestyles and of surrounding. This must be taken to include choice of friends, symbiosis, and above all, perhaps most importantly… the choice of a mate" (Popper 1992).

79 [Do not] believe *anything* that I suggest! Please do not believe a word! I know that that is asking too much, as I will speak only the truth, as well as I can. But I warn you: I know *nothing*, or *almost nothing*. We all know nothing or almost nothing. I *conjecture* that that is a basic fact of life. We know nothing, we can only conjecture: we guess [all italics Popper's 1999, p 37].

80 The great logician, mathematician, and philosopher Bertrand Russell faced as much violent opposition from mediocre minds as Einstein had, and in light of this opposition Einstein (1940) wrote a letter to a professor of philosophy at the College of the City of New York, defending the appointment of Bertrand Russell to a teaching position:

> *Great spirits have always encountered violent opposition from mediocre minds. The mediocre mind is incapable of understanding the man who refuses to bow blindly to conventional prejudices and chooses instead to express his opinions courageously and honestly.*

On the Problem of Vague Terms: A Glossary of Clearly Stated Assumptions & Careful, Patient, Descriptions

Funk, Matt
The University of Prince Edward Island

31. October 2008

On the Problem of Vague Terms:

A Glossary of Clearly Stated Assumptions

&

Careful, Patient, Descriptions

For my friend Colin MacIntyre,
an Island survivor who understands the
Value of Relative Insularity[1]
&
The Evolutionary Stable Strategy[2] *of*
The Island Survival Game,[3]

31 October 2008

Matt Funk
The Funk Island Institute for Theoretical Nonlinear System Dynamics[5]
Working Paper No. 6
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1 See: *Funk-Zweikampf Formula*

2 See: *Evolutionary Stable Strategy*

3 See *Island Survival Game ; Earth Island Survival Game*

4 Original material, theoretical description, artwork, commentary & personal correspondence.

5 Funk Island…, 60 km east of Fogo Island off the northeast coast of Newfoundland, is home to more than one million common murres, numbers that make it the largest colony of common murre in the western North Atlantic….

As a seabird ecological reserve, Funk Island is now known for its ability to protect seabirds. This was not always the case. In previous centuries, Funk Island was one of the major nesting areas of the Great auk, and people came regularly to hunt the birds and take their eggs…. The Great auk—large, flightless birds—were eventually hunted to extinction.

This loss shows how human activity can result in the extermination of… species. Making Funk Island an ecological reserve has helped other… species recover from similar exploitation and near extirpation….

At 5.2 km^2 (5 km^2 of which is the marine component), the reserve is the smallest seabird ecological reserve in Newfoundland and Labrador, but it's also one of the most important (FI 2008).

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TOUCHSTONE[1]

[**Problem**:] *Economic theory has suffered in the past from a failure to state clearly its assumptions. Economists in building up a theory have often omitted to examine the foundations on which it was erected. This examination is, however, essential not only to prevent the misunderstanding and needless controversy which arise from a lack of knowledge of the assumptions on which a theory is based, but also because of the extreme importance for economics of good judgement in choosing between rival sets of assumptions.*[2]

[**Solution**:] *In… economics the most fruitful work may be that of careful, patient description; indeed this may be by far the largest domain for the present and some time to come….*

Economic problems [have been and are often] not formulated clearly and are often stated in such vague terms as to make mathematical treatment a priori appear hopeless because it is quite uncertain what the problems really are. There is no point in using exact methods where there is no clarity in the concepts and issues to which they are to be applied. Consequently the initial task is to clarify the knowledge of the matter by further careful descriptive work.[3]

1 Every man carries about him a touchstone… to distinguish… truth from appearances [Locke 1706, as cited in Popper 1963, p 3].

2 Coase 1930, p 386

3 Von Neumann & Mogenstern 1944, pp 2-4

GLOSSARY

Academic Prostitution

Survival in academia depends on publications in refereed journals. Authors only get their papers accepted if they intellectually prostitute themselves by slavishly following the demands made by anonymous referees without property rights on the journals they advise. Intellectual prostitution is neither beneficial to suppliers nor consumers. But it is avoidable. The editor (with property rights on the journal) should make the basic decision of whether a paper is worth publishing or not. The referees only give suggestions on how to improve the paper. The author may disregard this advice. This reduces intellectual prostitution and produces more original publications.[1]

Applied Mathematics

(a) The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem of how to allocate "given" resources-if "given' is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge not given to anyone in its totality. *This character of the fundamental problem has, I am afraid, been rather obscured than illuminated by many of the recent refinements of economic theory, particularly by many of the uses made of mathematics.*[2]

(b) What has gone wrong with the development of economics as a science? Answer: There was a bunch of intelligent people who felt compelled to use mathematics just to tell themselves that they were rigorous in their thinking, that theirs was a science. Someone in a great rush decided to introduce mathematical modelling techniques…without considering the fact that either the class of mathematics they were using was too restrictive for the class of problems they were dealing with, or that perhaps they should be aware that the precision of the language of mathematics could lead people to believe that they had solutions when in fact they had none.[3]

(d) We may also observe that part of the feeling of dissatisfaction with the mathematical treatment of economic theory derives largely from the fact that frequently one is offered not proofs but mere assertions which are really no better than the same assertions given in literary form. Very frequently the proofs are lacking because a mathematical treatment has been attempted of fields which are so vast and so complicated that for a long time to come… there is hardly any reason at all to expect progress more mathematico.[4]

(e) Mathematicians may flatter themselves that they possess new ideas which mere human language is as yet unable to express. Let them make the effort to express these ideas in appropriate words without the aid of symbols, and if they succeed, they will not only lay us laymen under a lasting obligation, but, we venture to say, they will find themselves very much enlightened during the process, and will even be doubtful whether the ideas as expressed in symbols had ever quite found their way out of the equations into their minds.[5]

(f) Civilization advances by extending the number of important operations which we can perform without thinking about them. This is of profound significance in the social field. We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have

1 Frey 2002, abstract

2 Italics mine, Hayek 1956, pp 519-520

3 Taleb 2001, p 177

4 Von Neumann & Morgenstern 1944, p 5

5 Maxwell 1873, p 400

proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up.[1]

(g) It is an interesting speculation to think what direction the development of Menger's thought would have taken if he had been acquainted with these founders of mathematical analysis. It is a curious fact that, so far as I am aware, he has nowhere commented on the value of mathematics as a tool of economic analysis. There is no reason to assume that he lacked either the technical equipment or the inclination. On the contrary, his interest in the natural sciences is beyond doubt, and a strong bias in favour of their methods is evident throughout his work....He does not even refer to the mathematical method in any of his writings on methodology...Must we conclude that he felt rather sceptical about its usefulness?[2]

(h) In... *Principles*, Marshall confined his use of diagrams and other mathematical notations to footnotes and appendixes so as not to allow his mathematics to detract from his economics. He was interested above all in plain communication—with businessmen as well as with students. Moreover, he was acutely aware that over reliance on mathematics "might lead us astray in pursuit of intellectual toys, imaginary problems not conforming to the conditions of real life: and, further, might distort our sense of proportion by causing us to neglect factors that could not easily be worked up in the mathematic machine" (Ekelund & Hebert 1997, p 341).

Aristotelian Method

The development of thought since Aristotle could, I think, be summed up by saying that every discipline, as long as it used the Aristotelian method of definition, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which the various sciences have been able to make any progress depended on the degree to which they have been able to get rid of this essentialist method. (this is why so much of our 'social science' still belongs to the Middle Ages.) This discussion of this method will have to be a little abstract, owing to the fact that the problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright.[3]

Art of Denunciation

One of the most important elements of success in becoming a man of genius is to learn the art of denunciation. You must always denounce in such a way that your reader thinks that it is the other fellow who is being denounced and not himself; in that case he will be impressed by your noble scorn, whereas if he thinks that it is himself that you are denouncing, he will consider that you are guilty of ill-bred peevishness. Carlyle remarked: "The population of England is twenty millions, mostly fools." Everybody who read this considered himself one of the exceptions, and therefore enjoyed the remark. You must not denounce well-defined classes, such as persons with more than a certain income, inhabitants of a certain area, or believers in some definite creed; for if you do this, some readers will know that your invective is directed against them. You must denounce persons whose emotions are atrophied, persons to whom only plodding study can reveal the truth, for we all know that these are other people, and we shall therefore view with sympathy your powerful diagnosis of the evils of the age.[4]

Asteroids

(a) The Earth has a long and violent history of collisions with extraterrestrial bodies such as asteroids and comet nuclei. Several of these impacts have been large enough to produce major environmental changes, causing mass extinctions and severe alterations to weather patterns and geography. There is no reason to suppose that the likelihood of such collisions will be any less in the future and the spread of human settlement, civilisation, and particularly urbanisation, makes it

1 Hayek 1945, pp 519-530
2 Menger & Hayek 1871, p 15
3 Popper 1945, Vol. II, p 9
4 Russell 1932

much more likely that a future impact, even relatively small, could result in the massive loss of human life and property. Despite the fact that the technology exists to predict and to some extent prevent such events, there is currently no co-ordinated international response to this threat.[1]

(b) It is widely believed that meteorites originate in the asteroid belt, but the precise dynamical mechanism whereby material is transported to Earth has eluded discovery. The observational data for the ordinary chondrites, the most common meteorites, impose severe constraints on any proposed mechanism. The ordinary chondrites are not strongly shocked, their cosmic ray exposure ages are typically <20 Myr, their radiants are concentrated near the antapex of Earth's motion and they show a pronounced 'afternoon excess' (for every meteorite which falls in the morning two fall in the afternoon). Wetherill concluded that these data could only be explained by an "unobserved source" of material... His subsequent, more sophisticated investigations have not changed this basic conclusion.... Since asteroidal debris is quite easily injected into this chaotic zone, it could provide Wetherill's 'unobserved source' if chaotic trajectories which begin at asteroidal eccentricities (e<0.2) reach such large eccentricities that Earth's orbit is crossed (e>0.57)... At least some of these chaotic trajectories do have the properties required to transport meteoritic material from the asteroid belt to Earth. Combined with the Monte Carlo calculations which show that the resulting meteorites are consistent with all the observational constraints, *the case for this chaotic route to Earth is fairly strong*.[2]

(b) The greatest natural threat to the long-term survivability of mankind is an asteroid or comet impact with the Earth. SHIELD is an architectural concept for a comprehensive Earth defense system designed to discover, catalogue, calculate orbits of near-Earth objects, and to deflect potential impactors. SHIELD consists of Sentries, Soldiers, and an Earth Control Center. Sentries are spacecraft designed to search and locate NEOs of all types. Sentries maximize the lead-time for a potential impact, which simplifies the task of the Soldiers to deflect the object. Sentry spacecraft determine the orbit of each object, and compare it with the onboard database of known NEOs. The results are kept in a distributed space-Earth database. Soldier spacecraft deflect or disperse the potential impactor. Several mitigation methods have been compared by their specific impulse. Each technique requires some development to be feasible. These techniques can be categorized into "rendezvous" in which the Soldier physically lands on the NEO and "intercept". The required number of Soldiers and their locations has been examined. SHIELD has clearly shown that an Earth-protection system is practical and that a full system could be built within a few years. Indeed, very capable Sentries can be launched today.[3]

Asteroid Tugboat

An Asteroid Tugboat... is a fully controlled asteroid deflection concept using a robotic spacecraft powered by a high efficiency, electric propulsion system (ion or plasma) which docks with and attaches to the asteroid, conducts preliminary operations, and then thrusts continuously parallel to the asteroid velocity vector until the desired velocity change is achieved. Based on early warning, provided by ground tracking and orbit prediction, it would be deployed a decade or more prior to a potential impact.[4]

Austrian Economics

What Mises taught us in his writings, in his lectures, in his seminars, and in perhaps everything he said, was that economics—yes, and I mean sound economics, Austrian economics—is primordially, crucially important. Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics.

This is a lesson, which is located almost entirely outside economics proper. But all Mises' work

1 Tate 2006, abstract

2 Italics mine, Wisdom 1985, abstract

3 Gold 2001, abstract

4 Schweickart et. al., 2003, abstract

depended ultimately upon this tenet. Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not identified by science as worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability calmly to ignore the sneers of, and the isolation imposed by, academic contemporaries, was his conviction that the survival of mankind depends on the development and dissemination of Austrian economics.

Austrian economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race.[1]

Axiom

(a) "Fundamental Ideas"... are the sources of necessary truths (sometimes called "Axioms").[2]
(b) The choice of axioms is not a purely objective task. It is usually expected to achieve some definite aim – some specific theorem or theorems are to be derivable from the axioms – and to this extent the problem is exact and objective. But beyond this there are always other important desiderata of a less exact nature: The axioms should not be too numerous, their system is to be as simple and transparent as possible, and each axiom should have an immediate intuitive meaning by which its appropriateness may be judged directly.... (to strike a proper balance is a matter of practical – and to some extent even esthetic – judgement). In a situation like ours this last requirement is particularly vital, in spite of its vagueness: we want to make an intuitive concept amenable to mathematical treatment and to see as clearly as possible what hypotheses this requires.[3]

Byr **Billion Years**

Biogeography

(a) Biogeography is the study of the distribution and patterns of distribution of plants, animals and other organisms across the globe, on land, in the sea and in the air.[4]
(b) The study of the facts and the patterns of species distribution. It's the science concerned with where animals are, where plants are, and where they are not. On the island of Madagascar, for instance, there once lived an ostrichlike creature that stood ten feet tall, weighed half a ton, it thumped across the landscape on a pair of elephantine legs. Yes, it was a bird. One thousand pounds of bone, flesh, feathers. This 1s no hypothetical monster, no implausible fantasy of Herodotus or Marco Polo. h a ramshackle museum in Antananarivo, I've seen its skeleton; I've seen its two-gallon egg, Palaeontologists know it as *Aepyomzs maximus*. The species summed until Europeans reached Madagascar m the sixteenth century and began hunting it, harrying it, transforming the ecosystem a was part of, scrambling those bounteous eggs. A millennium ago, *Aepyomzs maxzmus* existed only on that single island; now it exists nowhere. To say so is the business of biogeography. As practiced by thoughtful scientists, biogeography does more than ask *Which species?* and *To Where?* It also asks Why? and, what is sometimes even more crucial, Why *not?*[5]
(c) *Godfrey Baldacchino wrote:*

I should be there on Monday... but, if you wish, I can arrange something more 'formal' - with an invitation issued to all members of the Faculty... Even later on during next week - say, Thursday, 2 to 3.30pm - so we don't have to listen to two presentations back to back...

I have asked Matt to consider a presentation comparing development policy in Barbados and Mustique...

Some more good news: we may have a MAIS grad course in island biogeography on offer as from next September. Courtesy of Dr Marina Silva (Dept of Biology).

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1 Kirzner 2006
2 Whewell 1837, reprinted in Butts 1968, p 5
3 Von Neumann & Morgenstern 1944, p 25
4 Spellerberg & Sawyer 1999, p xi.
5 Quammen 1996, p 2.

Matt Funk wrote:

A formal invite to the department would be great; I'd be happy to deliver a Barbados/ Mustique/Sustainable Economic Development seminar....

Very exciting news about the Biogeograpical course offering, by the way, as the more I read about this conceptual tool, the more I understand the basis for Bowman's[1] conjecture: "Since biogeography holds the key to the survival of life, it deserves more attention." But I also believe his conjecture is ultimately incorrect, since I have also become more acutely aware that 'Biogeography' does not exist. And it is in fact unfortunate that there are many who mistakenly believe that it (and every other subject matter) exists. I'm sure you will all recall my emphasis on Popper's contention that subject matters do not exist;[2] please consider this notion yet again in this light:

***"I**t is easy to call for interdisciplinary syntheses, but will anyone respond? Scientists know how to train the young in narrowly focused work; but how do you teach people to stitch together established specialities that perhaps should not have been separated in the first place? Early in this century the specialities of biology and chemistry were joined to form biochemistry; similarly, economics and ecology are now in the process of being combined into ecological economics.*

My first attempt at interdisciplinary analysis led to an essay, "The Tragedy of the Commons." Since it first appeared in Science 25 years ago, it has been included in anthologies on ecology, environmentalism, health care, economics, population studies, law, political science, philosophy, ethics, geography, psychology, and sociology. It became required reading for a generation of students and teachers seeking to meld multiple disciplines in order to come up with better ways to live in balance with the environment.

I did not start out intending to forge an interdisciplinary link, but rather to present a retiring president's address to the Pacific division of the American Association for the Advancement of Science. But even after six revisions, each quite different from the one before, my summary of an ecologist's view of the human overpopulation problem would not crystallize. Repeatedly, I found fault with my own conclusions."[3]

The reason I say that it is unfortunate that "Biogeography" exists, is because its methods are absolutely *essential* to understanding "island studies," and it is very easy to see how many scholars may never dig into this "specialty". It is rather ironic that Spellerberg & Sawyer's[4] *An Introduction to Applied Biogeography* (the best introduction I have been able to discover) reaches the same conclusion (Indeed, it seems rather lucky that I stumbled into it. I've attached Hardin 1998 (which contains the citation above) and Hardin 1968.

Again, *there are only problems, and our urge to solve them*. If we must insist on subject matters, there is only one subject and it is called 'Nature' or perhaps 'Biology,' and all other problems fit into these laws, as even art and even the laws of physics must be held within the biological realm, since biological organisms form, evaluate, and utilize both the laws of physics and works of art.

Remember, Darwin was not a 'evolutionary biologist' or even a 'biologist,' he was a *Naturalist*. One of the most influential books he read while onboard *The Beagle* was a work by a so-called economist (Malthus, whom also happened to influence Lloyd, of which more to follow), and don't forget that *he* borrowed the concept of the survival of the fittest from Adam Smith, not the other way around. How many 'economists' today take time to seek out relevant works in 'evolutionary biology'? How many biologist read economics? True, the answer to both questions is "far more than ten years ago," but, as Hardin noted above (and Popper insisted everwhere), perhaps these 'subjects' *should not have been separated in the first place*. I will also suggest that it is no coincidence that, although 'The Tragedy of the Commons' is cited by economists more often than any other 'specialist,' (Hardin 1968 is also the single-most cited article in so-called 'ecological economics')

1 1994.

2 See: *Scientific Method*

3 Hardin 1998. Also see: *Tragedy of the Commons*

4 1999

and that Hardin was a biologist.

Another important element I will briefly share is this: If a scholar does not completely understand and accept the fundamentals of what we refer to as evolutionary biology, very close to nothing else will be understood, and his or her analysis is likely to demonstrate this deficit. I believe it may be unfortunate that one may be conferred with a PhD in 'Economics' (and every other social science, for that matter) without first (or concurrently) producing a PhD thesis in Biology (and preferably evolutionary biology,[1] or perhaps at the very least, something like 'evolutionary game theory'),[2] as I have discovered that *economics without evolutionary biology is about as effective as letters without a language*. The famous evolutionary geneticist Theodosius Dobzhansky remarked that, "nothing in biology makes sense except in the light of evolution,"[3] but – perhaps as an 'evolutionary geneticist' – he was only able to see the tip of the iceberg, because *nothing on Earth makes sense except in the light of evolution!*

I would like you all to carefully consider the six pages which make up Hardin 1968: I submit that if, for example, we had (1) read and discussed these six pages, and (2) agreed to accept the central thesis, (which I realize may not have occurred) then (3) we would have systematically provided solutions for very close to 100% of the problems which we had grappled with many – if not most – of our seminars for the past year. Yes, it is true that one *may* endeavour to formulate arguments based upon what amount to, essentially, religious grounds (such as a belief in the redistribution of wealth and so-called 'inalienable, global human' rights – of course just who or how the wealth is to be redistributed and how these 'global' rights are to be insured is another story), but the burden of proof will be heavy on their hands, as the empirical evidence in favour of evolutionary biology outweighs the empirical evidence demonstrating the existence of god/s.

If you decide to accept and utilize the arguments I'm submitting, and should find yourself criticized for being a 'Social Darwinist' kindly thank your critic for essentially calling you a 'naturalist,' because what he or she has unwittingly stated is that your argements are *logical, sound, rational*, and founded upon fact, not fiction. You might also want to remark that, since Adam Smith had formulated 'Darwinism' in 1776 (*On the Wealth of Nations*), if there was any name-calling to done along these lines, it is to call Darwin a "Natural Smithian," or, to go with the title of his book instead, a "Natural Wealthiest!"

Finally, please consider [the ABSTRACT], for I have found that the deep roots of religion and 'social norms' may combine to make *nothing more difficult* than to always bear [it] in mind…
And please do consider this carefully, for in this light you will find *cooperative behaviour*, *kin selection*, *reciprocity*, etc, but you will not find *social justice*. For, once again, who do you propose would administer this 'social justice'? The wise owl? The noble lion? Ah, but some will say, 'but we are *different*!' Somehow, one single species on Earth (humans) is different than all of the rest. Well, I'm afraid, once again, the burden of proof in this argument is, once again, on their hands,[4] for, again, the argument is essentially religious/irrational.[5] When Nietzsche said "God is dead," what he was trying to say was God will not protect your nest, God will not collect insects for you, money does not grow on trees, etc. - you must *fight* for survival (including your family's survival,

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1 (a) Among the things that science does know, evolution is about as certain as anything we know (Dawkins 2004). (b) The two basic questions in evolutionary biology are (1) how does evolution occur and (2) why does evolution occur? The first is a question of mechanisms and the second is a question of influences on those mechanisms (Grant 1998, p 1).

2 See Cressman 1996, Kolstad 2007, Sigmund & Nowak 1999, Stumpf 2001, Vincent 1996, and many excellent works by Weibull.

3 Wilson 2006, p 1479.

4 I am aware that the conclusions arrived at in this work will be denounced by some as highly irreligious; but he who denounces them is bound to shew why it is more irreligious to explain the origin of man as a distinct species by descent from some lower form, through the laws of variation and natural selection, than to explain the birth of the individual through the laws of ordinary reproduction (Darwin 1883, p 1242).

5 Those whom we called brutes had their revenge when Darwin shewed us that they are our cousins (Shaw 1903, ln 129).

your community's survival, your nation's survival, etc.). For those not fortunate enough to have studied the 'subject' of 'evolutionary biology', the *inalienable survival instinct* is known and universally accepted (with the exception of those whom failed in this course of study) as *The Ground Zero Premise,*[1] which, even Bertrand Russell, perhaps the greatest logician of the past century, was not able to fully grasp.[2] And yes, more organisms will perish than will survive (and this holds true for *every* species, including ants, bees, birds, humans, hogs, fish, dragonflies, etc.).

I would also like to suggest that *Tragedy of the Commons* serve as a required text for the Introduction to Island Studies course, as this phrase serves as useful shorthand when it is fully understood, and may help accelerate the learning process when it comes to understanding islands, and thus, understanding the world in which we live.

I Hope you all find this more interesting than tedious; I'm interested and open to any comments and criticisms you may have to offer (including comments or criticisms from Dr Silva and/or other members of our biology department!). I've also CC'd Faiz since I value his criticism and suspect he may strongly disagree; if someone is brave enough to forward to Ariana (I do not have her email), I suspect she may disagree even more adamantly…

Hope to see you all on Monday…Matt

PS: I have attached a third Hardin paper (1974) which may also brew interesting discussions over coffee, as well as an excellent PNAS paper(which I have found to be the single best source for my research purposes) from last week, which, I believe demonstrates how relevant Hardin is yet today. Note the first citation in this PNAS paper is Hardin 1968. I will also add that this citation is *incorrect*, or, at the very least, inadequate, since Hardin did *not* in fact first formulate "The Tragedy of the Commons." - Hardin's work was based upon a much earlier finding by Oxford economist, WF Lloyd (1833), whose work I have also attached; Lloyd's promethean vision was extraordinary.[3]

Bullshit

(a) One of the most salient features of our culture is that there is so much bullshit. Everyone knows this. Each of us contributes his share. But we tend to take the situation for granted. Most people are rather confident of their ability to recognize bullshit and to avoid being taken in by it. So the phenomenon has not aroused much deliberate concern, nor attracted much sustained inquiry. In consequence, we have no clear understanding of what bullshit is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory.[4]

(b) Another worthwhile source is the title essay in *The Prevalence of Humbug* by Max Black [(1985)]. Am uncertain just how close in meaning the word *humbug* is to the word *bullshit*. Of course, the words are not freely and fully interchangeable; it is clear that they are used differently. But the difference appears on the whole to have more to do with considerations of gentility, and certain other rhetorical parameters, than with the strictly literal modes of significance that concerns me most.. It is more polite, as well as less intense, to say "Humbug!" than to say "Bullshit!" For the sake of this discussion, I shall assume that there is no other important difference between the two.[5]

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1 See: *Ground Zero Premise*

2 Our instinctive apparatus consists of two parts -- the one tending to further our own life and that of our descendants, the other tending to thwart the lives of supposed rivals. The first includes the joy of life, and love, and art, which is psychologically an offshoot of love. The second includes competition, patriotism, and war. Conventional morality does everything to suppress the first and encourage the second. True morality would do the exact opposite. Our dealings with those whom we love may be safely left to instinct; it is our dealings with those whom we hate that ought to be brought under the dominion of reason. In the modern world, those whom we effectively hate are distant groups, especially foreign nations. We conceive them abstractly, and deceive ourselves into the belief that acts which are really embodiments of hatred are done from love of justice or some such lofty motive (Russell 1928, p 13).

3 Funk 2008c, appendix iv

4 Frankfurt 2005, p 1

5 Ibid, pp 4-6

Cognative Dissonance

(a) The strongest guard is placed at the gateway to nothing… because the condition of emptiness is too shameful to be divulged.[1]

(b) Also see Festinger 1957.

Consilience

(a) Of the two major methods for inferring history from single configurations, consilience calls upon a greater range of evidence. This word, coined by William Whewell in 1840, means "jumping together." By this term, Whewell referred to proof by coordination of so many otherwise unrelated consequences under a single causal explanation that no other organization of data seems conceivable. In a sense, consilience defines the larger method underlying all Darwin's inference from historical records In a more specific context, I use consilience… for Darwin's principal tactic of bringing so many different points of evidence to bear on a single subject, that history wins assent as an explanation by overwhelming confirmation and unique coordination.[2]

Cultural Evolution

(a) Theoretical models of cultural transmission and observations of the development of societies suggest that patterns in cultural evolution do occur.... Cultural change, like genetic evolution, can follow theoretically derived patterns.[3]

(b) It may be that cultural process will often mimic genetic ones; but there is one distinction which needs to be made between kinds of cultural inheritance. First, consider a case in which all children acquire some trait by imitating their mothers, and in which mothers pass n the trait by imitating their mothers, and in which mothers pass on the trait which they themselves acquired. In the evolution of such traits, 'fitness' would be measured by the Darwinian fitness of mothers; those traits would increase which enabled their possessors to survive and have more children. At the opposite extreme, suppose that each child acquires some trait by imitating a mentor who is not a parent, but who is judged to be 'successful' by some criterion. Traits will then increases which ensure 'success', however that is measured. Since the criteria of success are themselves to some degree culturally determined, a much more complex, but perhaps more realistic, process is involved.[4]

Darwinian Fitness

(a) The term Darwinian fitness refers to the capacity of a variant type to invade and displace the resident population in competition for available resources (Demetrius & Ziehe 2007, *abstract*).[5]

(b) Darwinian fitness of a biological trait refers to the contribution to successive generations made by individuals possessing the trait. This contribution depends on the age-specific fecundity and mortality of the individuals in the population. …For human populations, …two [examples] of Darwinian fitness [measurements are] *the Malthusian parameter*, which describes the rate of increase of the actual population size, and *entropy* which describes the rate of increase of the effective population size (Demetrius et. al. 1984, *abstract*).[6]

(c) Imagine that two… [people] are contesting a resource of value *V*. By 'value', I mean that the Darwinian fitness of an individual obtaining the resource would be increased by *V*. Note that the individual which does not obtain the resource need not have zero fitness. Imagine, for example, that the 'resourse' is a territory in a favourable habitat, and that there is adequate space in a less favourable habitat in which losers can breed. Suppose, also, that animals with a territory in a

1 Fitzgerald 1934, p 60
2 Gould 2002, p 104
3 Rogers & Ehrlich 2008, p 3416.
4 Maynard Smith 1982, p 172.
5 Demetrius & Ziehe 2007, *abstract*
6 Demetrius et. al. 1984, *abstract*

favourable habitat produce, on average, 5 offspging, and that those breeding in the less favourable habitat produce 3 offspring. Then *V* would equal 5-3=2 offspring. Thus *V* is the *gain* in fitness to the winner, and losers do not have zero fitness.[1]

(d) Evolutionary game theoretic models may often be given both a biological and a cultural evolutionary interpretation. In the biological interpretation, the numeric quantities which play a role analogous to "utility" in traditional game theory correspond to the fitness (typically Darwinian fitness) of individuals. How does one interpret "fitness" in the cultural evolutionary interpretation?

In many cases, fitness in cultural evolutionary interpretations of evolutionary game theoretic models directly measures some objective quantity of which it can be safely assumed that (1) individuals always want more rather than less and (2) interpersonal comparisons are meaningful. Depending on the particular problem modeled, money, slices of cake, or amount of land would be appropriate cultural evolutionary interpretations of fitness (SEP 2002).

(e) In traditional game theory, a strategy's fitness was measured by the expected utility it had for the individual in question. Yet evolutionary game theory seeks to describe individuals of limited rationality (commonly known as "boundedly rational" individuals), and the utility theory employed in traditional game theory assumes highly rational individuals. Consequently, the utility theory used in traditional game theory cannot simply be carried over to evolutionary game theory. One must develop an alternate theory of utility/fitness, one compatible with the bounded rationality of individuals, that is sufficient to define a utility measure adequate for the application of evolutionary game theory to cultural evolution (SEP 2002).

Denaturalization of Economics

[During] the late eighteenth century and the mid-nineteenth, … economic theorists [came] to posit and identify an economy as a distinct entity and maintain that it was subject, not to natural processes, but to the operation of human laws and agency. …Until the mid-nineteenth century, economic theorists regarded the phenomena of their discourse as part of the same natural work studied by natural philosophers. *Not only were economic phenomena understood mostly by drawing analogies to natural phenomena, but they were also viewed as contiguous with nature*. Economic discourse was, in short, considered to be part of natural philosophy and not, as we would now deem it, a *social* or *human* science. It did not then address an autonomous sphere as it does today.

How and why political economists came to see the economic domain as severed from the physical world, as the product of human action, human deliberation, and human institutions, …[is] the… *denaturalization* of the economic order.[2]

Economic Power

(a) *Economic power, unlike military power, is not primary, but derivative.* Within one State, it depends on law; in international dealings it is only on minor issues that it depends on law, but *when large issues are involved it depends upon war or the threat of war*. It has been customary to accept economic power without analysis, and this has led, in modern times, to an undue emphasis upon economics, as opposed to war and propaganda, in the causal interpretation of history.

Apart from the economic power of labour, all other economic power, in its ultimate analysis, consists in being able to decide, by the use of armed force if necessary, who shall be allowed to stand upon a given piece of land and to put things into it and take things from it.[3]

(b) The very nature of economics is rooted in nationalism….It would never have been developed except in the hope of throwing light upon questions of policy, but policy means nothing unless there is authority to carry it out, and authorities are national.[4]

(c) Power Projection: The ability of a nation to apply all or some of its elements of national power - political, economic, informational, or military - to rapidly and effectively deploy and sustain forces

1 Italics Maynard Smith's, 1982, pp 11-12.

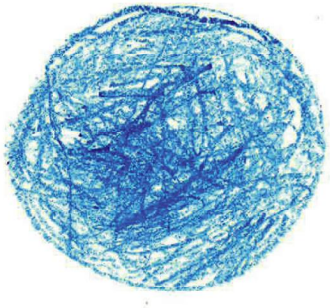
2 Italics mine, Schabas 2005, p 2.

3 All italics mine, Russell 1928, p 95

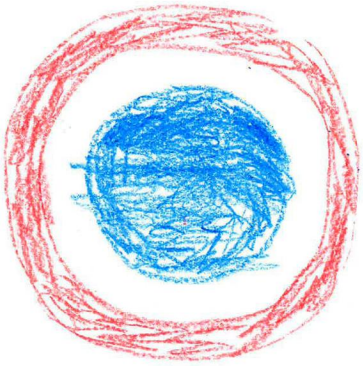
4 Robinson 1962, p 117

in and from multiple dispersed locations to respond to crises, to contribute to deterrence, and to enhance regional stability.[1]
(d) Also see: *Land Power*

The Earth



The beautiful[2] orb represents the theoretical framework of so-called "ecological economics." The blue represents the Earth, the biosphere and all of its inter-connected systems, which are, naturally, beholden to the second law of thermodynamics. Although practicioners 'ecological economics' refer to this as a 'whole-systems,' approach; as you will see in the next figure, they 'forgot' two mission-critical levels of uncertainty in their 'system' See: UNIVERSAL THEORY OF VALUE: Axioms I-III.[3]



This beautiful[4] orb represents the theoretical framework of sound analysis informed by our universal theory of value based upon relative insularity. Note that, in addition to the axioms represented in the previous artwork (the beautiful, but *unprotected* blue orb), this framework *also* recognizes two additional, fundamental assumptions: (1) *political uncertainty* (white), and (2) *planetary uncertainty* (red). As you can see, this is the 'bigger picture,' or truly 'whole systems analysis' so to speak. See: UNIVERSAL THEORY OF VALUE: AXIOMS I-VI.[5]

1 The United States Department of Defense 2001.
2 Artwork courtesy of William Matthew Funk © 2008.
3 See APPENDIX I.
4 Artwork courtesy of William Matthew Funk © 2008.
5 See APPENDIX I.

EISG **Earth Island Survival Game**

This asymmetric, non-cooperative game[1] models *The Problem of Sustainable Economic Development* on Earth, and, theoretically any/all inhabitable planets. Thus our master island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All bio-geo-politico regions on Earth are distinguishable by various degrees of relative insularity, and thus, all regions on Earth – islands, continents, and oceans alike – make up the 'island' sub-set: $\{i_1, i_2, i_{3,\ldots}i_n\}$. In other words: $\{i_1, i_2, i_{3,\ldots}i_n\} \subseteq \{I_1\}$.

Our Axioms, UTV, and the *Funk-Zweikampf Formula* offer the 'Rules of he Game.'

We animate our axioms by modelling sustainable economic development by playing the game: We divide earth into geo-political island 'players': P_1: *Relatively Insular States* (RIS, i.e. high I_R), and P_2: *Global Economic Military Superpowers* (GEMS, i.e. low I_R). In light of the inherent and inescapable political and planetary uncertainties outlined in our axioms, our UTV reveals divergent, optimizing strategies (ESS) for GEMS and RIS economic development. We discover pure GEMS and pure RIS ESS are antithetical, yet also discover these naturally opposing, ESS represent the most tenable, rational solution-set possible (for the earth): GEMS = S_1: (*Maximum Economic Development),* and RIS = S_2: (*Maximum Ecological Preservation)*. We note our solution represents the Prisoner's Dilemma. We also note, that, ceteris paribus, based upon revealed 20th and 21st century preferences, RIS strategy has been sub-optimal/irrational (S_1). A stable, strategic equilibrium is attained when players pursue respective rational, opposing evolutionary stable economic development strategies (ESS); this equilibrium offers optimal windfall: surplus value is created (RIS-driven *ecological* protection and GEMS-driven *planetary* protection). In essence, this non-cooperative, strategic equilibrium paves the way for rational, mutually beneficial, cooperative behaviour, and yields higher ecological and planetary insularities, and thus surplus economic and biologic value: RIS maximize self-interests by maximizing their sustainable economic development opportunities by cooperating, forming coalitions, and struggling for greater *ecological and economic insularity* (ecological and economic preservation); GEMS maximize self-interests by maximizing their sustainable economic development opportunities by fighting for *globalized economic development* ('globalization') *and planetary insularity* (global defence, extraterrestrial exploration, and extra-planetary threat mitigation, such as the finance, R&D, and deployment of NEO deflectors, SHIELDS, Asteroid Tugboats, etc.). Surplus value is maximized through strategic transparency: *If* (1) all players recognize the value of respective, opposing, and antithetical, rational strategies, and employ the ESS, *then* (2) all players maximize Darwinian fitness, interact and negotiate more rationally, more efficiently, more peacefully, *and* (3) maximum global sustainable economic development is achieved and human survival prospects are maximized. Darwinian fitness is measured on a global level by the collective ability to (1) protect and sustain natural resources *and* (2) protect and sustain the planet from nuclear exchange and extra-planetary threats. We demonstrate our solution is as powerful at local and individual levels as it is at the national and regional levels, including its use as a tool for strategic decision-making under uncertainty and variable insularity. Furthermore, our game illuminates a deeply entrenched, systemic RIS strategic error which reflects the false application of generally misunderstood economic principles and fundamental constitutional flaws which promote *The Tragedy of the Commons.* As we play the game, we discover our UTV promotes maximum global insularity, and thus offers a tenable solution to *The Problem of Sustainable Development.*

1 Although haste may bring one to a premature conclusion that our game could 'be' or 'become' cooperative, it is in inevidably non-cooperative, as we are (1) unable to 'communicate' with the future (i.e. planetary uncertainties), and (2) 'communicate' with other nation's *intentions* (i.e. political uncertainties). See: *non-cooperative game*

Einfühlung

The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man—whether it is a musical theme, a dramatic conflict, or a scientific theory—may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge. This latter is concerned not with questions of fact (Kant's quid facti?), but only with questions of justification or validity (Kant's quid juris?). Its questions are of the following kind. Can a statement be justified? And if so, how? Is it testable? Is it logically dependent on certain other statements? Or does it perhaps contradict them? In order that a statement may be logically examined in this way, it must already have been presented to us. Someone must have formulated it, and submitted it to logical examination.

Accordingly I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically. As to the task of the logic of knowledge—in contradistinction to the psychology of knowledge—I shall proceed on the assumption that it consists solely in investigating the methods employed in those systematic tests to which every new idea must be subjected if it is to be seriously entertained.

Some might object that it would be more to the purpose to regard it as the business of epistemology to produce what has been called a 'rational reconstruction' of the steps that have led the scientist to a discovery—to the finding of some new truth. But the question is: what, precisely, do we want to reconstruct? If it is the processes involved in the stimulation and release of an inspiration which are to be reconstructed, then I should refuse to take it as the task of the logic of knowledge. Such processes are the concern of empirical psychology but hardly of logic. It is another matter if we want to reconstruct rationally the subsequent tests whereby the inspiration may be discovered to be a discovery, or become known to be knowledge. In so far as the scientist critically judges, alters, or rejects his own inspiration we may, if we like, regard the methodological analysis undertaken here as a kind of 'rational reconstruction' of the corresponding thought processes. But this reconstruction would not describe these processes as they actually happen: it can give only a logical skeleton of the procedure of testing. Still, this is perhaps all that is meant by those who speak of a 'rational reconstruction' of the ways in which we gain knowledge.

It so happens that my arguments in this book are quite independent of this problem. However, my view of the matter, for what it is worth, is that there is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these . . . laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience.'[1]

Equilibrium

(a) The notion of an equilibrium point… yields a generalization of the concept of the solution of a two-person…game. It turns out that the set of equilibrium points of a two-person…game is simply the set of all pairs of opposing "good strategies."[2]

(b) A Nash equilibrium is defined as a strategy combination with the property that every player's strategy is a *best reply* to the other players' strategies. This of course is true also for Nash equilibria in *mixed* strategies. But in the latter case, besides his mixed *equilibrium strategy,* each player will also have infinitely many *alternative* strategies that are his *best replies* to the other players' strategies. This will make such equilibria potentially unstable.[3]

1 Popper 1959, pp 7-9.
2 Nash 1950, p 286.
3 Harsanyi 1994, p 167.

Evolutionary Game Theory

(a) Evolutionary theorizing has a long tradition in economics. Only recently has this approach been brought into the framework of noncooperative game theory. Evolutionary game theory studies the robustness of strategic behavior with respect to evolutionary forces in the context of games played many times in large populations of boundedly rational agents. This new strand in economic theory has… opened up doors to other social sciences.[1]

(b) Nowadays it almost seems to be obvious that the correct application of Darwinism to problems of social interaction among animals requires the use of non-cooperative game theory, but when this idea was first conceived it was a revolutionary great insight.[2]

ESS **Evolutionary Stable Strategy**

(a) Maynard Smith and Price (1973) introduced the concept of an evolutionarily stable strategy (ESS). Initially they were not aware of the relationship between the concept of an ESS and that of a Nash equilibrium. Rational game theory looked at mixed strategies as produced by conscious randomization. Nash's interpretation of a mixed equilibrium as a mass action phenomenon was buried in his unpublished dissertation and not found in textbooks on game theory. In biology the mass action interpretation is very natural and guided the work on evolutionary stability already from its beginning.… They defined an ESS as a strategy prescribed by a symmetric equilibrium point.[3]

(b) One of the great discoveries of game theory came in the early seventies, when the biologists John Maynard Smith and George Price realized that strategic equilibrium in games and population equilibrium in the living world are defined by the same equations. Evolution be it genetic or memetic – leads to strategic equilibrium.[4]

(c) The first explicit use of game theory terminology in this context was by Hamilton (1967), who sought for an 'unbeatable strategy' for the sex ratio when there is local competition for mates. Hamilton's 'unbeatable strategy' is essentially the same as an ESS as defined by Maynard Smith & Price (1973).[5]

(d) An ESS is a strategy such that, if all the members of a population adopt it, then no mutant strategy could invade the population under the influence of natural selection.[6]

(e) A theoretical analysis is made of the evolution of behavioural strategies in contest situations. It is assumed that behaviour will evolve so as to maximize individual fitness. If so, a population will evolve an 'evolutionarily stable strategy', or ESS, which can be defined as a strategy such that, if all members of a population adopt it, no 'mutant' strategy can do better. A number of simple models of contest situations are analysed from this point of view. It is concluded that in 'symmetric' contests the ESS is likely to be a 'mixed' strategy; that is, either the population will be genetically polymorphic or individuals will be behaviourally variable. *Most real contests are probably asymmetric, either in pay-off to the contestants, or in size or weapons, or in some 'uncorrelated' fashion; i.e. in a fashion which does not substantially bias either the pay-offs or the likely outcome of an escalated contest. An example of an uncorrelated asymmetry is that between the 'discoverer' of a resource and a 'late-comer'*. It is shown that the ESS in asymmetric contests will usually be to permit the asymmetric cue to settle the contest without escalation. Escalated contests will, however, occur if information to the contestants about the asymmetry is imperfect.[7]

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1 Weibull 2002, abstract.
2 Selten 1994, p 168.
3 Selten 1994, p 168.
4 Aumann 2005, p 352
5 Maynard Smith 1982, p 2
6 Ibid, p 10
7 Italics mine, Maynard Smith & Parker 1976, abstract

Fortuna, Fortune

(1) She was to be found on the back of many Roman coins, holding a cornucopia in one hand and a rudder in the other. She was beautiful and usually wore a light tunic and a coy smile. Her name was Fortune. She had originated as a fertility goddess, the firstborn of Jupiter, and was honoured with a festival on the 25th of May and with temples throughout Italy, visited by the barren and farmers in search of rain. But gradually her remit had widened, she had become associated with money, advancement, love and health. The cornucopia was a symbol of her power to bestow favours, the rudder's course, maintaining an imperturbable smile as she watched us choke to death on a fishbone or disappear in a landslide.

(b) Because we are injured most by what we do not expect, and because we must expect everything ('There is nothing which Fortune dies not dare'), we must, proposed Seneca, hold the possibility of disaster in mind at all times. No one should undertake a journey by car, or walk down the stairs, or say goodbye to a friend, without an awareness, which Seneca would have wished to be neither gruesome nor unnecessarily dramatic, of fatal possibilities (Botton 2000, p 87).

(c) When a wise man is told that his suitcase has been lost in transit, he will resign himself in seconds to the fact. Seneca reported how the founder of Stoicism had behaved upon the loss of his possessions:

When Zeno received news of a shipwreck and heard that all his luggage had been sunk, he said, 'Fortune bids me to be a less encumbered philosopher' (Ibid, p 108).

(d) Seneca's wisdom was more than theoretical. Exiled to Corsica, he found himself abruptly stripped of all luxuries. The island had been a Roman possession since 238 BC, but it had not enjoyed the benefits of civilization. The Romans on the island rarely settled outside two colonies on the east coast, Aleria and Mariana, and it was unlikely that Seneca was allowed to inhabit them, for he complained of hearing only 'barbaric speech' around him, and was associated with a forbidding building near Luri at the northing tip of the island known since ancient times as 'Seneca's Tower'.

Conditions must have contrasted painfully with life in Rome. But in a letter to his mother, the former wealthy statesman explained that he had managed to accommodate himself to his circumstances, thanks to years of morning [] and periods of thin soup:

> Never did I trust Fortune, even when she seemed to be offering money, public office, influence – I relegated to a place from which she could take them back without disturbing me. Between them and me, I have kept a wide gap, and so she has merely *taken* them, not *torn* them from me (Ibid, p 99).

(e) [The wise] will start each day with the thought… Fortune gives us nothing which we can really own. Nothing, whether public or private, is stable; the destinies of men, no less than those of cities, are in a whirl. Whatever structure has been reared by a long sequence of years, at the cost of great toil and through the great kindness of the gods, is scattered and dispersed in a single day. No, he who has said 'a day' has granted too long a postponement to swift misfortune; an hour, an instant of time, suffices for the overthrow of empires. How often have cities in Asia, how often in Achaia, been laid low by a single shock of earthquake? How many towns in Syria, how many in Macedonia, have been swallowed up? How often has this kind of devastation laid Cyprus in ruins? We live in the middle of things which have all been destined to die. Mortal have you been born, to mortals have you given birth. Reckon on everything, expect everything (Botton 2000, p 91).

Funk-Zweikampf Formula

Our formula is derived from the logical and theoretical implications of our unified theory of value, based upon our observation that *Value* (V) is a derivative function of *relative insularity* (I_R): $V=f'(I_R)$.

I_R is determined with multiple regression analysis of: *Military Power (GDP + population + annual defense spending + soldiers + NPT Treaty status),*[1] *Land Area (km²), Distance from nearest Continent (km),*

1 The main metrics of world power… are gross domestic product (GDP), population, defense spending, and a less precise factor that includes innovation in technology. Power is summed as a percentage of total global power: Fourteen nations hold at least a 1 percent share. The United States holds about 20 percent of global power; the

Distance from nearest Neighbour (km), Nearest Neighbour Military Power, Nearest Neighbour Land Area (km^2), Elevation (m), Renewable Water Resources (m^3/person/year), Food Imports (%), Population Density (p/km^2), Exclusive Economic Zone (km^2), International Airports (n), Deep Water Harbours (n), Marine Links, (n) Land Links (n), Forests (% km^2), Fishery (Kg/person/year) Commercial Agriculture (% km^2), Organic Agriculture (% km^2), Nature Preserve (%k m^2), Tourist Visits (Land Area/n), Irrigation I (m^3/person/year) Irrigation II (% km^2), Industrial Water Consumption (m^3/person/year), Organic Water Pollutants (Land Area/ grammes/p/day), and Cultural Homogeneity (%). Depending upon research objectives (especially with relatively small islands), two additional qualitative inputs – Sovereign Status and Constitutional balance – may be considered. Our formula's multiple regression output offers Darwinian fitness – the economic and biologic value for each corresponding politico-biogeographic 'island.'[1] This value suggests *resource holding power* (RHP) – the ability for citizens of each, corresponding politico-biogeopraphic 'island' to protect, maintain, and hold (by *Land Power* and sustainable harvest practices alike, for example), *property rights* (Land Area, EEZ, Forests, Renewable Water Resources, Nature Preserves, etc.).

Although the scope of our inquire is limited to human interests, a reformulation for other species may be derived with modest alterations – *military power*, for example, is re-formulated as *hunting power* (*size* + *population*), and all non purely biogeographic values (EEZ, land links, airports, etc.) are merely excluded.

Game

First, one must distinguish between the abstract concept of a game, and the individual plays of that game. The game is simply the totality of the rules which describe it. Every particular instance at which the game is played – in a particular way – from beginning to end, is a play.

Second, the corresponding distinction should be made for the moves, which are the component elements of the game. A move is the occasion of a choice between various alternatives, to be made either by one of the players, or by some device subject to chance, under conditions precisely prescribed by the rules of the game. The move is nothing but this abstract "occasion," with the attendant details of description – i.e. a component of the game. The specific alternative chosen in a concrete instance – i.e. in a concrete play – is the choice. Thus the moves are related to the choices in the same way as the game is to the play. The game consists of a sequence of moves, and the play of a sequence of choices.

Finally, the rules of the game should not be confused with the strategies of the players... The distinctions which we stress must be clear from the start. Each player selects his strategy – i.e. the general principles governing his choices – freely. While any particular strategy may be good or bad – provided that these concepts can be interpreted in an exact sense – it is within the player's discretion to use or to reject it. The rules of the game, however, are absolute commands. If they are infringed, then the whole transaction by definition ceases to be the game described by those rules.[2]

Game Theory

(a) It is conventional to call these situations "games" when they are being studied from an abstract mathematical viewpoint. Here the original situation is reduced to a mathematical description, or model. In the abstract "game" formulation only the minimum quantity of information necessary for

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European Union (considered as a unified actor) and China, about 14 percent each. India holds about 9 percent. Brazil, South Korea, and Russia hold about 2 percent each. In moving toward 2015, the United States will first gain power, then decline somewhat, ending up at about where it is now. The EU, however, will lose power, as will all non-U.S. members of the G-8. The gainers will be China and India. The assessment identifies possible alliances that could match the power of the United States acting alone or with its traditional allies. It also examines the most likely locations for future conflict. Asia is by far the most dangerous region, with six of the eight conflict-prone bilateral balances involving China (Treverton & Jones 2005).

1 See *Island*

2 Von Neumann & Morgenstern 1944, p 49

the solution is retained. What the actual alternative courses of action are among which the individuals must choose is not regarded as essential information. These alternatives are treated as abstract objects without special qualities and are called "strategies." Only the attitudes (like or dislike) of the two individuals towards the ultimate results of the use of the various possible opposing pairs of strategies are considered.[1]

(b) A game is non-cooperative if it is impossible for the players to communicate or collaborate in any way (Ibid, pp 128-129).

(c) Game theory is a theory of *strategic interaction*. That is to say, it is a theory of *rational behavior* in social situations in which each player has to choose his moves on the basis of what he thinks the other players' *countermoves* are likely to be.

After preliminary work by a number of other distinguished mathematicians and economists, game theory as a systematic theory started with von Neumann and Morgenstern's book, *Theory of Games and Economic Behavior,* published in 1944. One source of their theory was reflection on *games of strategy* such as chess and poker. But it was meant to help us in defining rational behavior also in *real-life* economic, political, and other social situations.[2]

(d) Game theory concerns the behaviour of decision makers whose decisions affect each other. Its analysis is from a rational rather than a psychological or sociological viewpoint. It is indeed a sort of umbrella theory for the rational side of social science, where 'social' is interpreted broadly, to include human as well as non-human players (computers, animals, plants). Its methodologies apply in principle to all interactive situations, especially in economics, political science, evolutionary biology, and computer science. There are also important connections with accounting, statistics, the foundations of mathematics, social psychology, law, business, and branches of philosophy such as epistemology and ethics.[3]

GEMS **Globalized Economic Military Superpowers**

Presently, the USA represents the only true player in this arena, but our definition includes all five signatory members of the UK-USA agreement (UK, USA, Canada, Australia, and New Zealand), often referred to as AUSCANZUKUS, and six other nations which have developed, detonated, and presently maintain nuclear weapons (Russia, France, China, India, Pakistan, and North Korea).

Ground-Zero Premise

(i) Survival and reproduction is the basic, continuing, inescapable problem for all living organisms; life is at bottom a survival enterprise. It follows that survival is the… "problem" for human societies as well; it is a prerequisite for any other, more exalted objectives. Although the term "adaptation" is also familiar to social scientists, until recently it has been used only selectively, and often very imprecisely….Our economic and social life (and the motivations behind our revealed preferences and subjective utility assessments), not to mention the actions of modern governments… [is] either directly or indirectly related to the meeting of our basic survival needs.[4]

Hecatomb

"Hecatomb," an unfamiliar word in English, should enter the vocabulary of all evolutionists as a wonderfully appropriate description for this key aspect of Darwinism. A hecatomb I, literally, an offering of a hundred oxen in sacrifice. Yet, even in Homer, the word had come to designate any large number of deaths incurred as a sacrifice for some intended benefit – a good description of natural selection. And hecatomb trips so much more lightly off the tongue than "substitutional load."[5]

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1 Nash 1953, p 128

2 All italics Harsanyi's 1994, p 136

3 Aumann 2008

4 Corning 2000, abstract

5 Gould 2002, p 122

Historicism

(1) It will be enough if I say here that I mean by 'historicism' an approach to the social sciences which assumes that historical prediction is their principal aim, and which assumes that this aim is attainable by discovering the 'rhythms' or the 'patterns', the 'laws' or the 'trends' that underlie the evolution of history. Since I am convinced that such historicist doctrines of method are at bottom responsible for the unsatisfactory state of the theoretical social sciences…, my presentation of these doctrines is certainly not unbiased.[1]

Hollywood Economics

Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, we have constructed a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory.

Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's '*Nobody knows anything*' theory and advance our replacement theory: *George Lucas*[2] *knows something*.[3]

Hyperbolic Discounting

It is well known from the literature that hyperbolically discounting agents tend to postpone actions into the future from an ex ante point of view, as declining discount rates imply a change of the relative weight of benefits and losses. It is also well known that naive agents tend to further procrastinate actions from an ex post point of view, as they are not aware of the time-inconsistency problem and that this outcome may be inefficient (e.g., Ackerlof 1991, O'Donoghue and Rabin 1999). Yet, the interesting result derived from the exposition so far is that, no matter whether agents are sophisticated or naive, they will never invest in environmental protection if agent 1 does not invest (Winker 2006, p 13).

I_n / i_n **Island**

(a) Islands are synecdoches: their understanding facilitates a 'coming to grips' with a more complex whole. They also act as advance indicators or extreme reproductions of what is future elsewhere. Crucial, new insights into evolutionary theory, and the realization of so much species differentiation on islands in modern zoogeography, are primarily due to the unwitting and haphazard stumbling of what, at first sight, may have appeared to be inconsequential, island-based, island-specific fieldwork. This includes such investigations as the study of Darwin's finches on the Galapagos Islands (Darwin 1859…) or Alfred Wallace's study of birds-of-paradise on the Aru Islands (Wallace,

1 Popper 1957, p 17

2 I came to the conclusion after 'American Graffiti' that what's valuable for me is to set standards, not to show people the world the way it is…around the period of this realization…it came to me that there really was no modern use of mythology…The Western was possibly the last generically American fairy tale, telling us about our values. And once the Western disappeared, nothing has ever taken its place. In literature we were going off into science fiction…so that's when I started doing more strenuous research on fairy tales, folklore, and mythology, and I started reading Joe's books. Before that I hadn't read any of Joe's books…It was very eerie because in reading 'The Hero with a Thousand Faces' I began to realize that my first draft of 'Star Wars' was following classic motifs…so I modified my next draft [of 'Star Wars'] according to what I'd been learning about classical motifs and made it a little bit more consistent…I went on to read 'The Masks of God' and many other books (Larsen & Larsen, 2002, p 541).

3 Funk 2007a, abstract.

1880)… The forays of Bronislaw Malinowski amongst the Trobriand… Islanders of Papua New Guinea (1922), Margaret Mead to Samoa… (1928; 1934) and Raymond Firth to Tikopia (1936).[1]
(b) The foundation to our game theoretical approach to comparative island studies rests on the principles of set theory, and our primary island set includes all known planets capable of supporting human life. To date this set includes a single element, the island of Earth: $\{I_1\}$. All biogeographical regions on Earth are distinguishable to various degrees of relative insularity, and thus, *all* regions on Earth – islands, continents, and oceans alike – make up the sub-set: $\{i_1, i_2, i_{3, \ldots}i_n\}$. Thus, the 'islands' of Earth are a subset Earth Island: $\{i_1, i_2, i_{3, \ldots}i_n\} \subseteq \{I_1\}$.

ISG **Island Survival Game**

(a) An asymmetric, cooperative sub-game of the Earth Island Survival Game which models *The Problem of Sustainable Economic Development* on RIS. Darwinian fitness is measured by Resource Holding Power (RHP), the ability to achieve sustainable economic development by protecting and sustaining property and natural resource rights through time, and thus battling *The Tragedy of the Commons*. RIS are elements of the island set: $\{i_1, i_2, i_{3, \ldots}i_n\}$, and, like GEMS, are a sub-set of the island of Earth: $\{I_1\}$. In other words: $\{i_1, i_2, i_{3, \ldots}i_n\} \subseteq \{I_1\}$. Our Axioms (See Funk 2008e) offer the "Rules of he Game." Also see: *Earth Island Survival Game.*
(b) From: colin macintyre, To: Matt Funk, Date: Monday, July 21, 2008 03:22 pm
Hey Matt, Just finished reading the piece you wrote… Here are my thoughts…. Was the final answer that relative insularity promotes control over land use policies, which equates to ecological and economic health? [Yes Colin, *exactly*, sorry that wasn't clear!]

I liked the example of the Island Survival Games. Yes, the farmer would want to sustain and protect their farm for genetic survival. I never thought of it in terms of PEI's founder population decreasing, therefore it is an evolutionary unstable strategy driving the founder population extinct. (I am the founder population, and yes we are going extinct!). *I liked how you explained: Drastic reduction in relative insularity represents unstable evolutionary strategy*, and then used the Bridge as an example. *I agree Islanders evolved to live with the niches of insularity, because I feel it*. People from away feel that they are really far away from everything when they are here. Islanders don't feel like they are on the outskirts, because the Island feels like the center of the world. *It was a great Island Studies example, explaining how the problem of the Bridge represent the universal worldwide problem. PEI should conduct a carrying capacity study.* I didn't know about that point. Very interesting. *I think it is great that Mustique is the only known instance of ecologically planned development. It is excellent that you found out about it, and I am with you 100% ecological heath = economic health.*[2]
(c). Here's an example (rough-draft, keep in mind) of my introduction to the application of John Maynard Smith's *Evolution and Theory of Games* (1982) to the assessment of the quality of life on PEI. This analysis focuses on the quality of life on Prince Edward Island at the evolutionary level, and it presents a particular challenge since, as Richard Dawkins noted, "our brains are built to deal with events on radically different *timescales* from those that characterize evolutionary change" [1]. Indeed, analysis requires the adoption of the Iroquois Confederation concept of the *Seventh Generation*: that it takes seven generations of data to offer meaningful economic analysis when it comes to *The Problem of Sustainable Economic Development*. And although we might initially object that 'we' have even inhabited PEI for seven generations, or that even several thousand years of human life would be inadequate for analysis on an evolutionary time scale, our analysis of the evolutionary stability of the strategies which have and which continue to direct the quality of life on Prince Edward Island begins more than 10,500 years ago, and, we will demonstrate, offers a valuable portal for discovery. Building upon the foundation set by John von Neumann & Oscar Morgenstern's *Theory of Games and Economic Behaviour*, John Nash's early development of non-cooperative game theory, and many other notable game theorists , Smith & Price (1973) introduced the concept of an *Evolutionary Stable Strategy* (ESS), which John Maynard Smith fully developed in seminal *Evolution and Theory of Games*

1 Baldacchino 2007a, p 9.
2 MacIntyre 2008

(1982). This useful tool has much to offer economic analysis, the economic analysis of islands and other relatively insular states in particular. Moreover, once the relatively complex mathematical models have been digested and properly discarded, the ESS concept, and, moreover, it's applicability to PEI is very clear.

A 'stable' stragegy (we'll add the "evolutionary" element shortly) is, quite simply, an unbeatable strategy, a strategy which always results in victory. Children quickly learn, for example, that a stable strategy may be readily deployed in the game of tic-tack-toe by the player with the first move. In the game of chess, however, a stable strategy has eluded every Grand Master from Bobby Fischer to Boris Spassky. But, as it turns out, in many ways, the lives of humans, *especially those whom live on islands*, are not nearly as complex as the game of chess. This is primarily due to the fact that humans insulate themselves into distinct political communities (nations, states, provinces), and often further insulate themselves into biogeographical communities (such as islands, alpine regions, and even deserts). In short, our analysis is "easier on islands than on continents, because islands are [and/or have been] relatively free from the ebb and flow of genes."

Now we'll add the 'evolutionary' element to an illustration which may clarify the meaning of an ESS.

Imagine an uninhabited, one million acre island. On another island on the opposite side of the Atlantic, a king divides this island into ten, 100,000 acre farms, allots each farm to a single women from his vast (genetically speaking) kingdom, ships them across the Atlantic to the one million acre island, then lets the game of life begin. At this point, the 'game' begins, and play is observed at two levels: at the individual farm level, and island-wide as well . Each player "wins" or "loses" based upon their abilities to (1) survive and (2) resist 'invaders.'

From 8,600 B.C. to the 17th century various nomadic hunters, gatherers, and fishermen inhabited this island on a seasonal basis, but for simplicity's sake we'll refer to this group as the Mi'kmaq. During this period, although the natural resource base remained well below the island's carrying capacity, it would be incorrect to conclude that the Mi'kmaq executed an ESS, because an ESS for the sustainable economic development of islands requires it must thrwart *invasion* - and by "invasion" we mean we must be able to hold the resource.

Kuhnian

(a) *The Structure of Scientific Revolutions* by Thomas Kuhn was the most influential book on the nature of science in the second half of the twentieth century – and arguably, the entire twentieth century. Nevertheless, a reminder of the book's contents immediately makes this fact rather surprising. *Structure* purports to provide a general account of scientific change in 200 non-technical, lightly referenced pages, in the manner of an extended encyclopaedia entry, as the book was in fact originally conceived.[1]

(b) For Kuhn, science is simply good at solving its self-defined problems, whose purely technical nature led him to dub them 'puzzles'. But far from demoting the physical sciences, Kuhn was actually trying – as a latter-day Plato might – to insulate them from responsibility for real world effects, entanglement in which has historically prevented the social and biological science from taking full control of their inquiries.[2]

(c) -----Original Message-----

Greetings Dr Doherty....I am researching a theory that the rejection of Karl Popper's logic and methods and general acceptance (in a popular sense) of Thomas Kuhn's logic and methods have been detrimental to science, especially social sciences such as economics.

Nearly a dozen Nobel Laureates have thanked Popper and acknowledged his great influence upon their work: most notably, of course, is F.A. von Hayek's Sveriges Riksbank Prize Lecture and, perhaps the most notable example in your field may be revealed in Eccles' Nobel biography.

I have only been able to discover one Nobel Laureate who acknowledged Kuhn's influence and,

1 Fuller 2003, pp18-19.

2 Ibid, p69.

curiously, this noble individual (whom of course is you!) acknowledged both Popper and Kuhn: "I was influenced early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper and Thomas Kuhn."

So, naturally, I'm very curious to know if, after nearly a decade, the balance of this influence or your opinions regarding these two philosophers of science has changed?

I thank you very much for your time and consideration regarding this matter, as I am inclined to believe the long-term prospects of human survival may hang in the balance to the ultimate answer to this debate.

Any words of wisdom you are able to offer on this topic would be greatly appreciated.

Sincerely...Matt Funk[1]

From: Peter C. Doherty, Department of Immunology, St Jude Children's Research Hospital 332 North Lauderdale, Memphis TN 38105, Tel 901-495-3470, Fax 901-495-3107, also at: pcd@unimelb.edu.au,

To:Mfunk@upei.ca, Date:10/28/07 11:58 pm

Subject: Re: Thomas Kuhn & Karl Popper:

-----Original Message-----

A long time since I've read either. Popper's views re falsification of a null hypothesis seem correct to me. Much of the world's worst science is done by people who are determined to prove a point. Kuhn's idea of the paradigm shift is spot on.

(d) The Kuhn-Popper debate, strictly speaking, refers to an encounter that took place at the former Bedford College, University of London on 13 July 1965, as part of the International Colloquium in the Philosophy of Science. It was designed to pit a relatively young theorist of science (Kuhn, aged 43) whose 1962 book, *The Structure of Scientific Revolutions*, was touted as the latest word from the Unite States, against a relatively old theorist of science (Popper, aged 63) whose seminal book, *The Logic of Scientific Discovery*, had been translated into English on in 1959, a quarter-century after it first appeared in German (Fuller 2003, p10)

(e) This brings me to the... source of the debate's continuing significance. Kuhn and Popper tapped into long-simmering, deep-rooted disagreements that went well beyond the pages of their major works on science.... Sometimes behind such scholastic fodder that frames philosophical debate lie opponents who are not so different from each other after all.... But sometimes the stereotype, for all its crudeness, *does* [italics Fuller's] capture differences in sensibility that become deeper the more one looks. This is certainly the case with Popper and Kuhn (Ibid, pp14-15).

(f) The clash between Popper and Kuhn is not about a mere technical point in epistemology. It concerns our central intellectual values, and has implications not only for theoretical physics but also for the underdeveloped social sciences and even moral and political philosophy (Lakatos 1978, vol 1, p 9).

(a) I uphold the ancient theory of truth... according to which truth is the agreement with the facts of what is being asserted. Kuhn's views on this fundamental question seem to me affected by relativism; more specifically, by some for of subjectivism and of elitism, as proposed for example by Polanyi. Kuhn seems to me also affected by Polanyi's fideism: the theory that a scientist *must* have faith in the theory he proposes (while I think that scientists--like Einstein in 1916 or Bohr in 1913--often realize that they are proposing conjectures that will, sooner or later, be superseded). There are many other such points of difference, of which perhaps the most important is my emphasis on objective rational criticism: I regard as characteristic of ancient and modern science the critical approach towards theories, from the point of view of whether they are true or false. Another important point seems to me that Kuhn does not seem to see the great importance of the many purely scientific revolutions that are *not* connected with *ideological* revolutions [all italics Popper's] (pp xxxi-xxxii).

1 Funk 2007d

Land Power

Landpower is the ability—by threat, force, or occupation—to promptly gain, sustain, and exploit control over land, resources, and people. Landpower includes the ability to:

★ Impose the Nation's will on adversaries—by force if necessary—in diverse and complex terrain.

★ Establish and maintain a stable environment that sets the conditions for a lasting peace.

★ Address the consequences of catastrophic events—both natural and manmade—to restore infrastructure and re-establish basic civil services.

★ Support and provide a base from which forces can influence and dominate the air and sea dimensions of the joint operational area.[1]

Meditations on Hunting

Meditations on Hunting is the most quoted book in sporting literature. It is the finest work on the essence and ethics of hunting. Today when both hunting and fishing are often condemned, *Meditations* takes on an even greater significance. Ortega points out that life is a dynamic interchange between man and his surroundings. He explains that hunting is part of man's very nature, that:

> hunting is a universal and impassioned sport…it is the purest form of human happiness. The essence of hunting or fishing involves a complete code of ethics of the most distinguished design. The sportsman who accepts the sporting code of ethics keeps his commandments in the greatest solitude with no witnesses or audience other than the sharp peaks of the mountain, the stern oak, and the passing animal [Bodio's 2007 introduction to Gasset 1972].

Menger, Carl (1840 - 1921)

(a) Founder of the Austrian School of economics, famous for contributing to the development of the theory of marginal utility. This refuted the labor theory of value developed by the classical economists Adam Smith and David Ricardo….

During the course of his newspaper work he noticed a discrepancy between what the classical economics he was taught in school said about price determination and what real world market participants believed. In 1867 Menger began a study of political economy which culminated in 1871 with the publication of his *Principles of Economics* (*Grundsätze der Volkswirtschaftslehre*), thus becoming the father of the Austrian School of economic thought. It was in this work that he challenged the classical labor theory of value with his theory of marginality. At the time *Principles* was largely ignored….

Ensconced in his professorship he set about refining and defending the positions he took and methods he utilized in Principles, the result of which was the 1883 publication of *Investigations into the Method of the Social Sciences with Special Reference to Economics* (*Untersuchungen über die Methode der Socialwissenschaften und der politischen Oekonomie insbesondere*). The book caused a firestorm of debate, during which members of the Historical School of economics began to derisively call Menger and his students the 'Austrian School' to emphasize their departure from mainstream economic thought in Germany. In 1884 Menger responded with the pamphlet *The Errors of Historicism* in German Economics and launched the infamous Methodenstreit, or methodological debate, between the Historical School and the Austrian School (Menger & Hayek 1871, pp. 14-15).

(b) The following account of his impression by a young American economist who attended Menger's lectures in the winter 1892–93 may be reproduced here as representative: "Professor Menger carries his fifty-three years lightly enough. In lecturing he rarely uses his notes except to verify a quotation or a date. His ideas seem to come to him as he speaks and are expressed in language so clear and simple, and emphasized with gestures so appropriate, that it is a pleasure to follow him. The student feels that he is being led instead of driven, and when a conclusion is reached it comes into his mind not as something from without, but as the obvious consequence of

1 DOD 2005, p 1-1

his own mental process. It is said that those who attend Professor Menger's lectures regularly need no other preparation for their final examination in political economy, and I can readily believe it. I have seldom, if ever, heard a lecturer who possessed the same talent for combining clearness and simplicity of statement with philosophical breadth of view. His lectures are seldom 'over the heads' of his dullest students, and yet always contain instruction for the brightest.

All his students retain a particularly vivid memory of the sympathetic and thorough treatment of the history of economic doctrines, and mimeographed copies of his lectures on public finance were still sought after by the student twenty years after he had retired, as the best preparation for the examinations. His great gifts as a teacher were, however, best shown in his seminar where a select circle of advanced students and many men who had long ago taken their doctor's degree assembled. Sometimes, when practical questions were discussed, the seminar was organized on parliamentary lines with appointed main speakers pro and contra a measure. More frequently, however, a carefully prepared paper by one of the members was the basis of long discussions. Menger left the students to do most of the talking, but he took infinite pains in assisting in the preparations of the papers (Ibid, p 35).

Mind-Body Problem

The nature of the subject... makes its first task the most important and the most difficult: clearly to state the problem to which it will attempt an answer. We shall have moved a considerable distance towards the solution of our problem when we have made its meaning precise and have shown what kind of statement could be regarded as a solution.

The traditional heading under which our problem has been discussed in the past is that of the 'relation' between mind and body, or between mental and physical events. It can also be described by the questions of 'What is mind?' or 'What is the place of mind in the realm of nature?' But while these expressions indicate a general field of inquiry, they do not really make it clear what it is that we want to know. Before we can successfully ask how two kinds of events are related to each other (or connected with each other), we must have a clear conception of the distinct attributes by which they can be distinguished. The difficulty of the any fruitful discussion of the mind-body problem consists largely in deciding what part of our knowledge can properly be described as knowledge of mental events as distinguished from our knowledge of physical events.[1]

Mt **Million Tons**

Myr **Million Years**

Mustique

Since Mustique is a small island under single ownership..., development will be inherently expensive. But it will also offer the opportunity of preserving an especially high quality of environment ....

Although we have found some indications from the regional demands and projections, it is the nature of the island itself that must determine the actual quality and quantity of the potential demands that should be accommodated, firstly in terms of environment, secondly in terms of service problems and costs....

The charm of Mustique derives largely from its hilly topography. These hills, acted upon by the sea and the prevailing winds have divided the island's 1400 acres into a number of distinctly different microclimates, and have given rise to a curving coastline that is long (12 miles) in relation to the area it encloses....

The variety of these separate places, with their interplay of forest, rocky headland, sandy bay and turquoise sea, creates an impression that makes the island seem much larger than it actually is. The hills also afford fine views of the white beaches and out over the neighbouring islands....

In order to discover the most suitable use for the land and achieve the best fit between the

1 Hayek 1952, p I

activities of man and the natural systems, an ecological survey was undertaken..., for it is obvious that the varied geology, vegetation and wild life of Mustique and the sea around are crucial to the attractiveness of the island....

The aim of this study was to identify areas of special interest for conservation, and to find ecological indicators for the degree of intensity and type of use for which the land is best suited....

It is necessary to ensure that no unique species or features of outstanding natural beauty are destroyed by development. Similarly the extent and variety of the vegetation on Mustique contributes greatly to the- charm of the island, and must be preserved.....

Mustique is an extremely beautiful island and one which is very rich biologically. At the same time, the natural resources of the island are in limited supply or extremely sensitive to development. The challenge that must be met by the developers is to utilize its charm and habitat richness whilst maintaining its delicately balanced ecosystems in as natural a state as possible....

Several primary physical features of the island combine to determine the range of possibilities for development. These are, most notably, the availability of water, the pronounced alternation of wet and dry season, the physical make-up of soils, wind velocity, salt spray and soil salinity. These same features also determine the kind and distribution of the naturally renewable resources of plant and animal communities and, at the same time, determine their response to various kinds of development. Careful exploitation and management will be required to ensure that the biological habitat-types represented in the island's ecosystems continue to contribute to the beauty and interest of the environment...

The biotic component of the island's ecosystems is seen as a resource in its own right. It contributes to the quality of the landscape and contains plants and animals in a little-disturbed, semi-natural environment which justify conserving in their own right. It is difficult to make an assessment of the conservation status of Mustique from a scientific point of view without a more extensive survey of neighbouring islands and literature. However, it is clear that some individual species obviously deserve protection and these include the turtles and iguana. More important, in the context of the proposed future development, and as an important contribution to the island's character, is the conservation of a range of habitat types and these should include more mature areas of forest, coastal scrub, sea-grape communities, and mangrove swamp...

There appears to be universal agreement that the scenery on Mustique is superb and this beauty is derived from an interplay of forest, rocky headland, sandy bay and turquoise sea. The quality is partly the result of the small scale of this heterogeneity and the feeling of being on a small, secluded island and yet one so little exploited that an excursion to any beach or headland requires a half-day expedition. This sensation of being on both a very small and a very big and varied island is important to preserve.

Secondly there is a smaller scale of beauty and interest. This is totally attributable to biological components of the environment such as the widely distributed solitary cacti, the palm plantations, epiphytic plants, windswept distorted trees, and the occasional tortoise, humming-bird or butterfly. Thirdly there is interest that derives from past and present forms of land-use. Relics of the past include an abandoned village, Fort Shandy, Carib remains, a solitary cannon, a sugar-cane press, old wells and water-tanks. Present day activities also contribute to the interest of the landscape and most visitors will appreciate seeing cattle and ponies, fields of pigeon pea and cassava, scattered mangoes and tamarinds. citrus groves and banana plantations....

The case for maintaining and developing the agriculture of the island partly rests on the importance of preserving the feeling for the visitor of being part of a functioning system as well as to open-up views and increase diversity in the landscape....

Most visitors would appreciate interpretative facilities to enable them to understand more of the variety and richness of the flora, fauna and history of the island. We suggest that an information centre be provided and short, self-guided nature trails from natural focal points such as beaches and the lagoon. These should not be *too* arduous and should provide an alternative route back to the starting point....

Mustique is a special and unusual place. The natural resources of this beautiful island must be safeguarded, and all development carefully designed to complement the landscape. We have tried in this report to create a planning framework of which the principles are comprehensible as a kind of

language of "the way things are done here".[1]

In this report we have particularly concerned ourselves with the relationship between peoples and places. We feel that for the charm of the present day Mustique to grow into a special identity that can be comprehended by people arriving on the island, the development of tourism must be seen to enhance the landscape and benefit the local islanders. Only if the planning framework is administered by people who care about this, will visitors wish to belong there and participate in the island's plan for growth. For when people belong to a place and feel that they can interact with it, the place will grow fruitfully. We hope that the principles outlined in this report, both physical and methodological, will help ensure a harmonious and profitable future for Mustique.[2]

Non-cooperative Game

A game is non-cooperative if it is impossible for the players to communicate or collaborate in any way (Nash 1953, pp 128-129).

Normative

These days, one commonly asserted imperfection in the science-policy interface is that some so-called "science" is imbued with policy preferences. Such science may be labelled as normative and it is potentially an insidious kind of scientific corruption. By normative science, I mean "information that is developed, presented, or interpreted based on an assumed, usually unstated, preference for a particular policy or class of policy choices." In some forms, normative science is not obviously normative to policy makers or even to many scientists. Such "science" has become a serious problem. I believe that use of normative science is stealth policy advocacy. Science, of course, is not value free because it is a human enterprise, but this fact does not make all science normative. Policy-neutral science is a way of learning about the world and it is characterized by transparency, reproducibility, and independence. Consider the simple but fundamental difference between scientific "is" and the policy "ought." Science deals with the "is" world (and the "was" and "will be" states of the world) as does the policy world, but the policy world also deals with the "oughts" and "shoulds." Science is, or should be, bounded in the "is" world.[3]

Politician

(a) The successful politician owes his power to the fact that he moves within the accepted framework of thought, that he thinks and talks conventionally. It would be almost a contradiction in terms for a politician to be a leader in the field of ideas. His task in a democracy is to find out what the opinions held by the largest number are, not to give currency to new opinions which may become the majority view in some distant future.[4]

(b) Politicians do not find any attractions in a view which does not lend itself to party declamation, and ordinary mortals prefer views which attribute misfortune to the machinations of their enemies. Consequently people fight for and against quite irrelevant measures, while the few who have a rational opinion are not listened to because they do not minister to any one's passions.[5]

Prisoner's Dilemma

(a) Al Tucker was on leave at Stanford in the Spring of 1950 and, because of the shortage of offices, he was housed in the Psychology Department. One day a psychologist knocked on his door and asked what he was doing. Tucker replied: "I'm working on game theory.", and the psychologist asked if he would give a seminar on his work. For that seminar, Al Tucker invented the Prisoner's Dilemma as an example of game theory.[6]

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1 Reprinted from Funk 2008a.

2 Llewelyn-Daviel et. al. 1970, pp 7 – 43.

3 Lackey 2004, p 2

4 Hayek 1982.

5 Russell 1928, p3.

6 Kuhn 1994, p 161. Also see: Tucker 1950.

(b) 5 June 2005 Eric Rasmusen (erasmuse@indiana.edu) notes…

Albert Tucker, "A Two- Person Dilemma," unpublished notes (May 1950)

When I was writing the first edition of Games and Information back in the 1980's I was confused by the varying citations give for The Prisoner's Dilemma. I asked Lloyd Shapley about it, since he was there at the founding, and he referred me to Albert Tucker. Professor Tucker replied with this letter [next page] telling me about his Stanford handout [on the page following the letter] and the article by Straffin that tells the story, Philip Straffin, "The Prisoner's Dilemma," UMAP Journal. 1: 101-103 (1980). I republished both in Readings in Games and Information.[1]

Princeton University DEPARTMENT OF MATHEMATICS
FINE HALL ~~Box~~ 37 Lake Lane
PRINCETON, NEW JERSEY 08540

2/25/87

Dear Professor Rasmusen,

Here is a copy of the reprint which was published in 1980 UMAP, page 101, along with a copy of the accompanying article by Philip Straffin. In 1949-50 I was at Stanford on sabbatical leave, and became a consultant at Rand.

I expect Lloyd Shapley did not want to become involved because Merrill Flood, a mutual friend, seems to feel that he and Rand colleagues did not get the credit they deserved. Lloyd was a Princeton graduate student at the time and became my Ph.D. student when I returned.

Anyhow, I claim no active part in the matter except inventing the prisoner story. I have always tried for catchy examples in my talks.

Excuse this rough reply, but I am 81 and hobbled by arthritis.

Sincerely,

A W Tucker

1 Rasmusen 2005

See UMAP Journal 1 (1980) 101-103.

A TWO*PERSON DILEMMA

Two men, charged with a joint violation of law, are held separately by the police. Each is told that

(1) if one confesses and the other does not, the former will be given a reward of one unit and the latter will be fined two units,

(2) if both confess, each will be fined one unit.

At the same time each has good reason to believe that

(3) if neither confesses, both will go clear.

This situation gives rise to a simple symmetric two-person game (not zero-sum) with the following table of payoffs, in which each ordered pair represents the payoffs to I and II, in that order:

		II: confess	II: not confess
I	confess	(-1, -1)	(1, -2)
I	not confess	(-2, 1)	(0, 0)

Clearly, for each man the pure strategy "confess" dominates the pure strategy "not confess." Hence, there is a unique equilibrium point* given by the two pure strategies "confess." In contrast with this non-cooperative solution one sees that both men would profit if they could form a coalition binding each other to "not confess."

The game becomes zero-sum three-person by introducing the State as a third player. The State exercises no choice (that is, has a single pure strategy) but receives payoffs as follows:

		II: confess	II: not confess
I	confess	2	1
I	not confess	1	0

*see J. Nash, PROC. NAT. ACAD. SCI. 36 (1950) 48-49.

Stanford, May 1950

A. W. Tucker

(c) The Prisoner's Dilemma... is a game where two players have the option to cooperate or to defect. If both cooperate they receive the reward, *R*. If both defect they receive the punishment, *P*. If one cooperates and the other defects, then the cooperator receives the sucker's payoff, S, while the defector receives the9 temptation, *T*. The Prisoner's Dilemma is defined by the ranking

$T>R>P>S$.

Would you cooperate or defect? Assuming the other person will cooperate it is better to defect, because $T>R$. Assuming the other person will defect it is better to defect, because $P>S$. *Hence, no matter what the other person will do it is best to defect. If both players analyze the game in this rational way then they will end up defecting. The dilemma is that they both could have received a higher payoff if they had chosen to cooperate. But cooperation is irrational.*[1]

(d) This "collective-risk social dilemma" exists in various social scenarios, the globally most challenging one being…climate change.[2]

The Problem of Chaotic Behaviour

There are several physical situations in the solar system where chaotic behaviour plays an important role. Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behaviour also seems to be an essential ingredient in the explanation of certain non-uniformities in the distribution of asteroids. The long-term motion of Pluto is suspiciously complicated.[3]

Problem of Induction[4]

(a) [Problem:] Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience.*[5]

[Solution:] According to a widely accepted view… the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences….

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity' [Reichenbach, Erkenntnis 1, 1930, p. 186]. At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes. I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

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1 Italics ours, May & McLean, 2007, p 8. Also see APPENDIX II, Cressman 1996, Hauert 2006, Weibull & Salomonsson 2006

2 Milinski et. al. 2008, p 2291.

3 Wisdom 1987, abstract.

4 Also see Cournot 1838, Reichenbach 1930, 1966, Reichenbach et. al. 1971, Russell 1903, 1908, 1913, 1919, 1948,Ludwig et. al. 1993, and Wittgenstein 1969. Most works by Popper address this problem from various angles and within variable contexts.

5 Italics ours, Hume 1739, Book I, Vol I, p 137.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads...to an infinite regress.[1]

(b) Liebig (in *Induktion und Deduktion*, 1865) was probably the first to reject the inductive method from the standpoint of natural science; his attack is directed against Bacon. Duhem (in *La théorie physique, son objet et sa structure*, 1906; English translation by P. P. Wiener: *The Aim and Structure of Physical Theory*, Princeton, 1954) holds pronounced deductivist views. (*But there are also inductivist views to be found in Duhem's book, for example in the third chapter, Part One, where we are told that only experiment, induction, and generalization have produced Descartes's law of refraction; cf. the English translation, p. 34.) So does V. Kraft, *Die Grundformen der Wissenschaftlichen Methoden*, 1925; see also Carnap, Erkenntnis 2, 1932, p. 440.[2]

The Problem of Ohmic Decay

The mechanism by which the Earth and other planets maintain their magnetic fields against ohmic decay is among the longest standing problems in planetary science. Although it is widely acknowledged that these fields are maintained by dynamo action, the mechanism by which the dynamo operates is in large part not understood. Numerical simulations of the dynamo process in the Earth's core have produced magnetic fields that resemble the Earth's field, but it is unclear whether these models accurately represent the extremely low values of viscosity believed to be appropriate to the core.[3]

The Problem of Solar Flux

There has been life on Earth for at least 3,500 Myr but the assumption that a comparable future lies ahead may not be justified. Main sequence stars appear to increase their burning rate as they age. Thus the Sun, if a typical star, can be predicted to have increased its output by 30% since the Earth's origin 4,500 Myr ago. The maintenance of an equable climate since life began probably required some means of planetary thermo-stasis. The Gaia hypothesis proposed by Lovelock and Margulis included an unspecified biological means for climate control. Walker... suggests an abiological automatic thermostasis in which the atmospheric abundance of CO2, a greenhouse gas, adjusts to resist the warming tendency of the increased solar flux. It is clear that whatever the mechanism, atmospheric CO2 is now close to its lower limit of partial pressure, so the biosphere may soon, in geological terms, be exposed without protection to the predicted progressive increase of solar luminosity.[4]

Problem Solving

All things living are in search of a better world.

Men, animals, plants, even unicellular organisms are constantly active. They are trying to improve their situation, or at least to avoid its deterioration. Even when asleep, the organism is actively maintaining the state of sleep: the depth (or else the shallowness) of sleep is a condition actively created by the organism, which sustains sleep (or else keeps the organism on the alert). Every organism is constantly preoccupied with the task of solving problems. These problems arise from its own assessments of its condition and of its environment; conditions which the organism seeks to improve.

An attempted solution often proves to be misguided, in that it makes things worse. Then follow further attempts at solution – further trial and error movements.

We can see that life – even at the level of the unicellular organism - brings something completely new into the world, something that did not previously exist: problems and active attempts to solve them; assessments, values: trial and error.

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1 Popper 1959, pp 31-35

2 Ibid, p 35

3 Kuang & Bloxham 1997, abstract.

4 All italics mine, Lovelock & Whitfield 1982, abstract.

It may be supposed that, under the influence of Darwin's natural selection, it is the most active problem solvers, the seekers and the finders, the discoverers of new worlds and new forms of live, that undergo the greatest development.

Each organism also strives to stabilize its internal conditions of life and to maintain it's individuality – an activity whose results biologists call 'homoeostasis'. Yet this too is an internal agitation, an internal activity: an activity that attempts to restrict the internal agitation, a feedback mechanism, a correction of errors. The homoeostasis must be incomplete. It must restrict itself. Were it completely successful, it would mean the death of the organism, or, at the very least, the temporary cessation of all its vital functions. Activity, agitation, search are essential for life, for perpetual restlessness, perpetual imperfection; for perpetual seeking, hoping, evaluation, finding, discovering, improving, for learning and for the creation of values; but also for perpetual error…

Darwinism teaches that organisms become adapted to the environment through natural selection. And it teaches that they are passive throughout this process. But it seems to me far more important to stress that the organisms find, invent and reorganize new environments in the course of their search for a better world…

All organisms are fully occupied with problem-solving. Their first problem is survival. But there are countless concrete problems that arise in the most diverse situations. And one of the most important problems is the search for better living conditions: for greater freedom; for a better world.

According to this optimistic interpretation, it is through natural selection and (we may suppose) through an external selection pressure that a strong internal selection pressure comes into being at a very early stage; a selection pressure exerted by the organisms upon their environment. This selection pressure manifests itself as a kind of behavior that we may interpret as searching for a new ecological niche. Sometimes it is even the construction of a new ecological niche.

This pressure from within results in a choice of niches; that is, in forms of behavior that may be regarded as a choice of lifestyles and of surrounding. This must be taken to include choice of friends, symbiosis, and above all, perhaps most importantly… the choice of a mate…"

Pyrrho

Sceptic: A seeker of truth. One who, like Pyrrho and his followers in Greek antiquity… holds that there are no adequate grounds for certainty as to the truth of any proposition… Those who deny the competence of reason, or the existence of a justification for certitude, outside the limits of experience. The difference between the two usages becomes clearer when considering 'sceptic's' Latin origin (scepticus): inquiring, reflective, assumed by the disciples of Phyrrho as their distinctive epithet… to look out (OED 1997).

Ratoinal Unity of Mankind

The fact that the rationalist attitude considers the argument rather than the person arguing is of far-reaching importance. It leads to the view that we must recognize everybody with whom we communicate as a potential source of argument and of reasonable information ; it thus establishes what may be described as the 'rational unity of mankind'[1]

RIS **Relatively Insular States**

This category includes sovereign island nations, sub-national island jurisdictions, insular provinces (i.e. Newfoundland & Labrador), states (i.e. Hawaii), municipalities (i.e. Vancouver Island), and relatively insular jurisdictions (i.e. The Alpine Convention region) We divide geopolitical regions based upon relative insularity, designating two players (1) RIS and (2) GEMS, but in reality, naturally, the true relative insularity of each region lies along a sliding scale with a true GEMS at one end (the United States) and a true RIS, such as the big island of Hawaii at the other.[2]

1 Popper 1992, p225

2 Funk 2008a

RHP **Resource Holding Power**

(a) The view is examined that the adaptive value of conventional aspects of fighting behaviour is for assessment of relative RHP (resource holding power) of the combatants. Outcomes of aggressive disputes should be decided by each individual's fitness budget available for expenditure during a fight (determined by the fitness difference between adoption of alternative strategies, escalation or withdrawal without escalation) and on the rate of expenditure of the fitness budget if escalation occurs (determined by the RHPs of the combatants). Thus response thresholds for alternative strategies ("assessments") will be determined by natural selection on a basis of which opponent is likely to expend its fitness budget first, should escalation occur. This "loser" should retreat (before escalation) and the winner should stay in possession of the resource. Many aggressive decisions depend on whether one is a resource holder, or an attacker. Assuming the RHP of the combatants to be equal, there are many instances of fitness pay-off imbalances between holder and attacker which should weight the dispute outcome in favour of one or other opponent by allowing it a greater expendable fitness budget. Usually the weighting favours the holder; the attacker therefore needs a correspondingly higher RHP before it may be expected to win. This is not invariably the case, and much observed data fits the predictions of this sort of model. If assessments are perfect and budget expenditure rates exactly predictable, then there would never seem to be any case for escalation. Escalation can be explained in terms of injury inflictions (expenditures) occurring as discrete events; i.e. as "bouts" won or lost during fighting. Assessment can give only a probabilistic prediction of the outcome of a bout. A simple model is developed to investigate escalation situations. Each combatant assesses relative RHP; this correlates with an absolute probability of winning the next bout (cabs). The stake played for is infliction of loss of RHP and is determined by the fitness budgets of the opponents. (Each individual plays for the withdrawal of its opponent.) This defines a critical probability of winning (ccrit) for each combatant, above which escalation is the favourable strategy (cabs > ccrit) and below which withdrawal is favourable (cabs < ccrit). Escalation should occur only where cabs-ccrit is positive for both combatants. This model gives predictions compatible with the observations, indicating that RHP loss alone can be adequate to explain withdrawal: escalation behaviour. Withdrawal tendency will be increased by low searching costs. Escalations should be restricted to closely matched RHP opponents if RHP disparity is the major imbalance. Outside the "escalation range" of a given individual, the higher RHP individual wins and the lower one loses (i.e. it should withdraw after conventional display). RHP disparity and holder: attacker imbalance should both interact to shape the observed pattern, though their relative importances will depend on species and situation. In some instances selection may favour immediate withdrawal from an occupied territory even without assessment of RHP (Parker 1974, abstract).

(b) Also see Parker & Knowlton 1980 ; Maynard Smith 1982

(c) The Great Law of the Iroquois Confederacy[1] is often cited by environmentalists as one of the best examples of a previous, indigenous population far more skilled in the art of sustainable development than we are today. But the Iroquois were far from able to 'sustain' economic development' because they *lost* nearly 100% of their resources, they did not possess the RHP (and thus did not have an ESS) for sustainable economic development because they were not ultimately able to *protect* and *hold* their land, just as the islanders on Newfoundland lost their ability to protect their 'land' (in this case, their land was 'the sea' – their primary natural resource – the cod fishery) when they relinquished its protection to the Canadian confederacy.

And although – in the most extreme measure – *Land Power* is obtained and maintained by war or the threat of war, of course military threat is not necessary in most cases, but the element of coercion is necessary, which of course requires some type of material advantage. In Canada, for example, Quebec has effectively coerced Ottawa to grant asymmetric rights to Canada's largest Province, and, more recently Premier Danny Williams has done likewise for Newfoundland & Labrador, effectively reclaiming and regaining RHP (accomplished largely in the same manner as Quebec – their relatively newfound leverage was and remains significant off-shore oil and natural gas resources) which this island province unwittingly relinquished upon joining confederation. And

1 In our every deliberation, we must consider the impact of our decisions on the next seven generations.

RHP is, ultimately, by far the best test of Darwinian fitness, since RHP is equally measurable and applicable for all organisms, including *humans and nations*! I believe I may have captured the essence in a recent communiqué:

> -------- Original Message -------- Subject: Independence! Date: Mon, 25 Aug 2008 21:56:32 -0300
> From: Matt Funk <matt@funkisland.org> To: premier@gov.nl.ca
>
> Greetings from Prince Edward Island, Mr Premier!
>
> You can't imagine how happy I was for you and your province when it came across the newswire in April that you were 'ushering in an era of unprecedented economic *independence* for Newfoundland and Labrador,' as the dependent nature of Atlantic Canada has been on my mind (and the focus of my research) since I arrived from my home in the United - yet very independent - States of America!
>
> To my point: I have attached a piece of recent research which I conducted and co-authored for a deputy minister here on PEI, and I have included a link to an in-depth, rather exhaustive comparative study of the dependent island on which I am now a landed immigrant, and the evolutionary stable, highly insular, independent island of Mustique, which shaped and informed a rather original universal theory of value based upon relative insularity, which, I might add, provides a tenable solution to the most fundamental, long-standing, open problem in economics. I delivered this paper at the Aland International Institute of Comparative Islands Studies in Finland in May, and they have generously published the paper on their website:
> http://www.aicis.ax/images/stories/pdf/mattfunkpaper3.pdf.
>
> I believe you may find my work rather intriguing, and, in fact I hope you may find it so intriguing that you may want to enlist my assistance for your worthy cause in Newfoundland and Labrador. My wife, a native Prince Edward Islander, has served as an registered nurse at the QEH here on PEI for the past five years, and I have no doubt her skills would be of use as well. And, as you may have noticed from the name of our fledgling research institute,[1] we're rather fond of a few of your uninhabited islands which presently serve as an illuminating, cautionary tale of the evolutionary unstable loss of relative insularity (which, for previous inhabitants of the Funk Islands – *the Great auks* – resulted in their extinction!). Of course I'm sure you may be aware that the islands take their name from the strong scent which the auks left on the rocks and have nothing to do with my German heritage). The important lesson here, as the people of Newfoundland learned the hard way in 1992, is that humans must preserve and fight for relative insularity as fiercely as any other species, including auks (and in Newfoundland's case, that meant fighting to preserve the insularity of the cod fishery (from foreigners and fellow Canadians alike).
>
> In any case, if you have further interests in my abilities and are curious to hear how I think I may be of service to you and, in turn, to your province, I would be happy to outline a proposal; I would also be very pleased to forward a CV, references, or other

1 Funk Island…, 60 km east of Fogo Island off the northeast coast of Newfoundland, is home to more than one million common murres, numbers that make it the largest colony of common murre in the western North Atlantic….

As a seabird ecological reserve, Funk Island is now known for its ability to protect seabirds. This was not always the case. In previous centuries, Funk Island was one of the major nesting areas of the Great auk, and people came regularly to hunt the birds and take their eggs…. The Great auk—large, flightless birds—were eventually hunted to extinction.

This loss shows how human activity can result in the extermination of… species. Making Funk Island an ecological reserve has helped other… species recover from similar exploitation and near extirpation….

At 5.2 km^2 (5 km^2 of which is the marine component), the reserve is the smallest seabird ecological reserve in Newfoundland and Labrador, but it's also one of the most important [Italics mine, Newfoundland & Labrador 2008].

'island' and/or 'economics' related research samples (including an intriguing study of the Gaspe peninsula). I have much to offer and hope to hear from you soon!

In any case, Mr Premier, I congratulate and salute you for holding your course - it is comforting to know that Quebec is not the only province in Canada willing to fight for independence!

Bidding you Godspeed…Matt Funk

I might also note that, not only will I be following Newfoundland's newfound independence, self-reliance, RHP, and relative insularity with great interest, I may also have the opportunity to participate.[1]

Scientific Method

(a) As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist. I add that I ought to know, having been, for a time at least, the one and only professor of this non-existent subject within the British Commonwealth.

It is in several senses that my subject does not exist, and I shall mention a few of them.

First, my subject does not exist because subject matters in general do not exist. *There are no subject matters; no branches of learning—or, rather, of inquiry: there are only problems, and the urge to solve them*. A science such as botany or chemistry (or say, physical chemistry, or electrochemistry) is, I contend, merely an administrative unit. University administrators have a difficult job anyway, and it is a great convenience to them to work on the assumption that there are some named subjects, with chairs attached to them to be filled by the experts in these subjects. I do not agree: even serious students are misled by the myth of the subject. And I should be reluctant to call anything that misleads a person a convenience to that person.

So much about the non-existence of subjects in general. But Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.

What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical period there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given

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1 -------- Original Message -------- Subject: Response to your e-mail to the PremierDate: Fri, 19 Sep 2008 14:37:09 -0230

From: Skinner, Shawn <shawnskinner@gov.nl.ca>To: <matt@funkisland.org>

Dear Mr. Funk:

Thank you for your correspondence of August 25, 2008 to Premier Williams regarding your report, Quality of Life on Prince Edward Island. Your letter has been forwarded to this department for a response….

We have a number of initiatives underway to explore and help improve the quality of life in Newfoundland and Labrador, including our Poverty Reduction Strategy which has received nation-wide recognition for its progressive and comprehensive approach. Further information about this strategy can be found at: www.hrle.gov.nl.ca/hrle/poverty/default.htm. I would also like to direct you to our Community Accounts (www.communityaccounts.ca) maintained by the Newfoundland and Labrador Statistics Agency. The Community Accounts is a world recognized data and information dissemination website that provides community level data for quality of life indicators. I have taken the liberty of forwarding your report to appropriate persons responsible for each of these initiatives for their information.

Your report provides valuable and interesting information concerning the quality of life and cost of living. These issues are becoming evermore important in our changing economy, in this province and throughout the world. I wish you success in advancing this research in the future.

Sincerely

SHAWN SKINNER, Minister, Department of Human Resources, Labour and Employment

cc: Office of the Premier, Aisling Gogan, Director, Poverty Reduction Strategy, Robert Reid, Director (A), NLSA

hypothesis was at least 'probable' to some ascertainable degree.

I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(1) There is no method of discovering a scientific theory.

(2) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.

(3) There is no method of ascertaining whether a hypothesis is 'probable', or probably true.[1]

(b) (i) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.

(ii) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.

(iii) If a proposed solution is refuted through our criticism we propose another solution.

(iv) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.

(v) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.

(vi) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism – the logical contradiction – is objective.[2]

(c) Whether educational research should employ the 'scientific method' has been a recurring issue in its history. Hence, textbooks on research methods continue to perpetuate the idea that research students ought to choose between competing camps: 'positivist' or 'interpretivist'. In reference to one of the most widely referred to educational research methods textbooks on the market-namely Research Methods in Education by Cohen, Manion, and Morrison-this paper demonstrates (1) the misconception of science in operation and (2) the perversely false dichotomy that has become enshrined in educational research. It then advocates a new approach, and suggests that the fixation with 'science' versus 'non-science' is counterproductive, when what is actually required for good inquiry is a critical approach to knowledge claims.[3]

(d) Scientific discovery must ever depend upon some happy thought, of which we cannot trace the origin; — some fortunate cast of intellect rising above all rules. No precepts will elevate a man of ordinary endowments to the level of a man of genius: nor will an inquirer of truly inventive mind need to come to the teacher of inductive philosophy to learn how to exercise the faculties which nature has given him. (Whewell 1849, reprinted under the title 'Mr Mill's Logic' in Butts 1968, p. 117).

(e) Scientific interest in social and political questions is hardly less old than scientific interest in cosmology and physics; and there were periods in antiquity (I have Plato's political theory in mind, and Aristotle's collection of constitutions) when the science of society might have seemed to have advanced further than the science of nature. But with Galileo and Newton, physics became successful beyond expectation, far surpassing all the other sciences; and since the time of Pasteur, the Galileo of biology, the biological sciences have been almost equally successful. But the social sciences do not as yet seem to have found their Galileo. In these circumstances, students who work in one or another of the social sciences are greatly concerned with problems of method; and much of their discussion of these problems is conducted with an eye upon the methods of the more flourishing sciences, especially physics.[4]

(f) Also see: *Kuhnian* and *Historicism*

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1 Popper 1956, pp 5-6.

2 Popper 1992, pp 66-67.

3 Rowbottom & Aiston 2006, abstract.

4 Popper 1957, p 15

Scientific Worldview

My goal is to defend what one might call a scientific *worldview* -- defined broadly as a respect for evidence and logic, and for the incessant confrontation of theories with the real world; in short, for reasoned argument over wishful thinking, superstition and demagoguery. And my motives for trying to defend these old-fashioned ideas are basically *political*. I'm worried about trends in the American Left -- particularly here in academia -- that at a minimum *divert* us from the task of formulating a progressive social critique, by leading smart and committed people into trendy but ultimately empty intellectual fashions, and that can in fact *undermine* the prospects for such a critique, by promoting subjectivist and relativist philosophies that in my view are inconsistent with producing a realistic analysis of society that we and our fellow citizens will find compelling.

David Whiteis, in a recent article, said it well:

> Too many academics, secure in their ivory towers and insulated from the real-world consequences of the ideas they espouse, seem blind to the fact that non-rationality has historically been among the most powerful weapons in the ideological arsenals of oppressors. The hypersubjectivity that characterizes postmodernism is a perfect case in point: far from being a legacy of leftist iconoclasm, as some of its advocates so disingenuously claim, it in fact … plays perfectly into the anti-rationalist -- really, anti-*thinking* -- bias that currently infects "mainstream" U.S. culture.
>
> Now of course, no one will admit to being against reason, evidence and logic -- that's like being against Motherhood and Apple Pie. Rather, our postmodernist and poststructuralist friends will claim to be in favor of some new and *deeper* kind of reason, such as the celebration of "local knowledges" and "alternative ways of knowing" as an antidote to the so-called "Eurocentric scientific methodology" (you know, things like systematic experiment, controls, replication, and so forth).[1]

Searchlight Theory of Science

The situation can be best described by comparison with a searchlight (the 'searchlight theory of science', as I usually call it in contradistinction to the 'bucket theory of the mind'). What the searchlight makes visible will depend upon its position, upon our way of directing it, and upon its intensity, colour, etc. ' although it will, of course, also depend very largely upon the things illuminated by it. Similarly, a scientific description will depend, largely, upon our point of view, our interests, which are as a rule connected with the theory or hypothesis we wish to test ; although it will also depend upon the facts described. Indeed, the theory or hypothesis could be described as the crystallization of a point of view.[2]

Semantics

One of the three branches into which semiotics is usually divided: the study of meaning of words, and the relation of signs to the objects to which the signs are applicable. In formal studies, a semantics is provided for a formal language when an interpretation or model is specified. However, a natural language comes ready interpreted, and the semantic problem is not that of specification but of understanding the relationship between terms of various categories (names, descriptions, predicates, adverbs…) and their meanings. An influential proposal is that this relationship is best understood by attempting to provide a truth definition for the language, which will involve giving a full description of the systematic effect terms and structure of different kinds have on the truth conditions of sentences containing them. See also inferential role semantics, possible world semantics, reference, truth.

SHIELD

The greatest natural threat to the long-term survivability of mankind is an asteroid or comet impact

1 Sokal 1996b

2 Popper 1945, vol. II, p 260

with the Earth. SHIELD is an architectural concept for a comprehensive Earth defense system designed to discover, catalogue, calculate orbits of near-Earth Object, and to deflect potential impactors (Gold 2001, abstract).

Social Dilemma

(a) Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE. We call these *choices between lesser evils*. We know that whatever we choose, something important will be sacrificed. Whatever we do, someone will get hurt. Worst of all we HAVE to choose. We cannot wait for better information or advice or some new set of circumstances. We have to decide NOW, and we can be sure that there will be a price to pay. If we do not pay it ourselves, someone else will (Ignatieff 2004, *preface*).

(b) An interactive decision in which individual interests are at odds with collective interests, the pursuit of individual self-interest by every decision maker leaving everyone worse off than if each had acted co-operatively. In empirical studies, social dilemmas are presented in one of three general forms, called N-person Prisoner's Dilemmas , public goods dilemmas , and resource dilemmas, and they have been used to model problems of inflation and voluntary wage restraint, conservation of scarce natural resources, environmental pollution, arms races and multilateral disarmament, mob behaviour, and many other social problems involving cooperation and trust. The Prisoner's Dilemma game is a social dilemma restricted to two interacting decision makers. See also [The Tragedy of the Commons]… So called because it is an extension of the Prisoner's Dilemma game and models social problems.[1]

Socratic Wisdom

(a) I am wiser than this man, for neither of us appears to know anything great and good; but he fancies he knows something, although he knows nothing; whereas I, as I do not know anything, so I do not fancy I do. In this trifling particular, then, I appear to be wiser than he, because I do not fancy I know what I do not know. [2]

(b) [Do not] believe *anything* that I suggest! Please do not believe a word! I know that that is asking too much, as I will speak only the truth, as well as I can. But I warn you: I know *nothing*, or *almost nothing*. We all know nothing or almost nothing. I *conjecture* that that is a basic fact of life. We know nothing, we can only conjecture: we guess.[3]

(c) Ever since the beginning of modern science, the best minds have recognized that 'the range of acknowledged ignorance will grow with the advance of science.' Unfortunately, the popular effect of this scientific advance has been a belief, seemingly shared by many scientists, that the range of our ignorance is steadily diminishing and that we can therefore aim at more comprehensive and deliberate control of all human activities. It is for this reason that those intoxicated by the advance of knowledge so often become the enemies of freedom.[4]

(d) All the great… scientists were intellectually modest; and Newton speaks for them all when he says: 'I do not know what I may appear to the world, but to myself I seem to have been only a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.'"

Moreover, all the great scientists realized that every solution to a scientific problem raises many new and unsolved problems. Our knowledge of our ignorance, becomes increasingly conscious, detailed and precise, the more we learn about the world. Scientific research is the best method we have for obtaining information about ourselves and about our ignorance. It leads us to the important insight that there may be great differences between us with regard to minor details of what we may perhaps know, yet we are all equal in our infinite ignorance.[5]

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1 Colman 2006

2 Socrates *c.* 399 B.C.

3 All italics Popper's 1999, p 37

4 Hayek1945

5 Popper 1992, p 40.

(e) The Socratic maxim that the recognition of our ignorance is the beginning of wisdom has profound significance for our understanding of society.... This fundamental fact of man's unavoidable ignorance of much on which the working of civilization rests has received little attention. Philosophers and students of society have generally glossed it over and treated this ignorance as a minor imperfection which could be more or less disregarded.... Perhaps it is only natural that the scientists tend to stress what we do know; but in the social field, where what we do not know is often so much more important, the effect of this tendency may be very misleading (Hayek 1960, pp 22-23).

Strategic Equilibrium

What do I mean by "strategic equilibrium"? Very roughly, the players in a game are said to be in *strategic equilibrium* (or simply *equilibrium*) when their play is *mutually optimal*: when the actions and plans of each player are rational in the given strategic environment – i.e., when each knows the actions and plans of the others. For formulating and developing the concept of strategic equilibrium, John Nash was awarded the 1994 Prize in Economics Sciences in Memory of Alfred Nobel, on the fiftieth anniversary of the publication of John von Neumann and Oskar Morgenstern's *Theory of Games and Economic Behavior*.[1]

Super-Eruptions

(a) In the past 2 Myr, there have been, on average, two super-eruptions every hundred millennia, the last of which shattered the crust of New Zealand's north island 26,500 years ago. To date, no mechanisms have been discovered for predicting these events; thus an eruption of this magnitude (VE8) is possible within this decade and likely within 50,000 years (see below). Post-eruption human survival is unlikely; even smaller eruptions (VE4, VE5, VE6) present extraordinary challenges.

(b) The largest explosive volcanic eruptions (supereruptions) produce >1000 km3 of ejected material and ≥1000 Mt (1015 g) of submicron atmospheric aerosols and dust. These eruptions may be capable of creating global climatic disturbances sufficient to cause severe problems for world agriculture and modern civilization. Supereruptions are estimated to occur on average about every 50,000 years, which is about twice the frequency of impacts by comets and asteroids ≥1 km diameter predicted to cause similar climatic effects. Prediction, prevention, and mitigation of global volcanic climatic disasters may be potentially more difficult than planetary protection from the threat of large impacts, so that explosive volcanism might limit the longevity of technological civilizations.[2]

(c) The greatest explosive eruption in the past few hundred thousand years was the Toba (Sumatra) event of ~73,500 years ago... This event produced at least 2,800 km^3 of magma... and is estimated to have created from 1,000 to 10,000 Mt of stratospheric dust and sulfuric acid aerosols.... The Toba aerosols apparently persisted for up to 6 years in the upper atmosphere... Based on scaling up from smaller eruptions and computer models, stratospheric aerosol loading of ~1000 Mt is predicted to have caused a "volcanic winter," with a global cooling of 3 to 5°C for several years, and regional coolings up to 15°C... Such a cooling is estimated to have drastically affected tropical and temperate vegetation and ecosystems... All above-ground tropical vegetation would have been killed by sudden hard freezes, and a 50% die-off of temperate forests is predicted from hard freezes during the growing season... This probable climatic and ecologic disaster may have impacted humans. Evidence from human genetic studies have been interpreted as indicating a severe human population bottleneck—a near extinction—with reductions to a total population as small as a few thousand at a time just prior to ~60,000 years ago... This is roughly the same interval as the great Toba eruption, and a cause and effect relationship with Toba has been proposed... and is supported by the predicted severe ecological effects of the eruption.

1 All italics Aumann's 2005, p 352

2 Rampino 2002, abstract.

Television

(a) Watching TV is a major human activity. Because of its immediate benefits at negligible immediate marginal costs it is for many people tempting to view TV rather than to pursue more engaging activities. As a consequence, individuals with incomplete control over, and foresight into, their own behavior watch more TV than they consider optimal for themselves and their well-being is lower than what could be achieved. We find that heavy TV viewers, and in particular those with significant opportunity cost of time, report lower life satisfaction. Long TV hours are also linked to higher material aspirations and anxiety (Frey et. al.2005).

(b) Watching TV is a very important activity, carried out by most people in the majority of countries. In many countries nowadays, watching TV occupies almost as much time as working. As it is a totally voluntary, freely chosen activity, it seems obvious that people enjoy it, because they would not do it otherwise. They are more satisfied with having the opportunity to watch TV to the extent they do rather than watching less TV or none at all.

This implication is shared by standard neoclassical economic theory. Individuals are assumed to know best what provides them with utility and are free to choose the amount of TV consumption that suits them best. By revealed preference, it follows from the fact that individuals watch so much TV as has been empirically observed that it provides them with considerable utility.

Recent developments, particularly in behavioral economics, cast doubt on this conclusion. The theory of revealed preference has been questioned (see, for instance, Sen 1982; 1995): it is, in general, not possible to infer the utility produced by observing behavior, because individuals do not always act rationally. More concretely, anomalies and biases in behavior have been identified (e.g. Thaler 1992), which undermine the direct link between observed behavior and the utility gained. Individuals may also be subject to habits which they do not have fully under control. They may consume some goods, such as drugs, alcohol or tobacco to a greater extent than they find to be good for themselves. They are subject to a self-control problem (e.g. Schelling 1984), again interfering with the direct relationship proposed by revealed preference theory. As Gruber and Mullainathan (2002) empirically show, predicted smokers, according to their own evaluation, consider themselves to be better off if smoking was restricted by a tax. Finally, individuals may systematically mispredict the utility derived from future consumption (e.g. Loewenstein and Schkade 1999; Loewenstein et al. 2003). In particular, happiness research (for a survey, see Frey and Stutzer 2002b) has empirically shown that individuals overestimate the utility of future income (e.g. Easterlin 2001), at the same time as they underestimate the utility of personal interactions (Frey and Stutzer 2004). The consumption decisions made by individuals are systematically distorted according to their own evaluations.

This paper argues that TV viewing is a case in which the theory of revealed preference does not fully apply: many people watch more TV than they consider good for themselves. The extent of TV viewing is not generally utility maximizing. Many individuals are subject to a self-control problem, mainly induced by the fact that watching TV offers immediate benefits (e.g. entertainment and relaxation) at very low immediate marginal costs. Many costs (e.g. not enough sleep, underinvestment in social contacts, education or career) are only experienced in the future. Individuals with time inconsistent preferences are therefore unable to adhere to the amount of TV viewing they planned or which, in retrospect, they would consider optimal for themselves. This tendency is aggravated when people mispredict future costs because they underestimate utility from socializing and neglect changes in preference due to TV consumption. Extensive TV viewing is thus understood to be the result of mispredicting utility and a self-control problem, lowering individuals' well-being (Ibid, pp 2-3).

(c) A certain Canadian city was unable to receive any TV signals up until 1973, due to its location in a steep valley. Otherwise, it was similar to two cities in the vicinity used as control cases. A study by Williams (1986) suggests that the introduction of TV crowded out other activities, in particular those outside the home, such as sports' activities and visiting clubs. It also reduced the reading abilities and creative thinking of children and fostered more aggressive behavior and stereotyped ideas about gender roles. TV also reduced the problem solving capacities of adults (Ibid, p8).

(d) Popper was… very concerned about the mass media, especially television, which exercised

'unlimited power without responsibility'. Indeed, the last text he published before his death was a pamphlet called *Una patente per fare TV* (A Licence to Make TV), which, far from being just a sterile denunciation, proposed a solution for the safeguarding of democracy and, above all, for the protection of young children and those least able to defend themselves from the aggressiveness of images and messages appearing on the small screen. What he suggested was to establish an organization similar to a professional body, which would train its members in certain values and have the power to issue reprimands for breaches of the rules (Corvi 1996, p 11)

(4) [Popper:] At present the greatest danger to the educational effort is television. Education just cannot go on if you let the television do what it likes. It is impossible for education to work against television unless television recognizes that it also has an educational task which overrules our mere entertainment. Otherwise we cannot have education. From the democratic point of view television must be controlled because of its potential political power which is almost unlimited. If you get hold of television, you can do whatever you like. And such power must be controlled. My proposal is to look at the problem of controlling television as a task similar to that of control of medical people. Medical people have to be controlled too, and they do it very largely themselves. For example, they have to have a certain education. The same applies to the system of control of lawyers, who have their own organization which controls them. Thanks to these systems of control the lawyers do not steal the money from their clients and doctors do not kill their patients. And you have to control all people who work for television in some kind of organization. They would have to be [admitted to] such an organization [only] on the basis of some [special] education, after passing appropriate examinations testing their awareness of the educational tasks, and their sense of responsibility. They would have to learn that their influence is very great and that their responsibility is equally great (Jarvie, 1999, p 36).

Theory

(a) Every scientific theory is a system of sentences…or ASSERTED STATEMENTS or, for short, simple STATEMENTS.[1]

(b) The empirical sciences are systems of theories. The logic of scientific knowledge can therefore be described as a theory of theories.

Scientific theories are universal statements. Like all linguistic representations they are systems of signs or symbols. Thus I do not think it helpful to express the difference between universal theories and singular statements by saying that the latter are 'concrete' whereas theories are merely symbolic formulae or symbolic schema; for exactly the same may be said of even the most 'concrete' stateements.

Theories are nets cast to catch what we call 'the world': to rationalize, to explain, to master it. We endeavour to make the mesh finer and finer.[2]

(c) Hypotheses are nets: only he who casts will catch.

—NOVALIS[3]

Tragedy of the Commons

(a) A situation in which individual competition reduces the resource over which individuals compete, resulting in lower overall fitness for all members of a group or population.[4]

(b) William Forster Lloyd (1794-1852)… made a lasting if long unrecognized mark in economics… From 1832 to 1837 Lloyd held the Drummond chair of political economy at the University of Oxford. A collection of his lectures… were first published in 1833 in Oxford under the title *Two Lectures on the Checks to Population*…. The chief original contribution in Lloyd's discussion of population issues is his recognition and incisive analysis of the deleterious consequences that ensue "when the constitution of society is such that as to diffuse the effects of individual acts throughout

1 Tarski 1941, p 3.

2 Popper 1959, pp 37-38

3 Ibid, *inscription*

4 Rankin *et. al.,* p 1.

the community at large, instead of appropriating them to the individuals, by whom they are respectively committed." Lloyd's discussion of this problem... [is] best known to modern readers through Garrett Hardin's influential 1968 article... *"The Tragedy of the Commons"*.[1]

(c) It should be clear by now that the idea of the commons did not suddenly arise out of nothing in the year 1968. Passing references to the problem occur as far back as Aristotle, and Lloyd certainly saw it clearly in 1833. H. Scott Gordon's work in 1954 saw the beginning of a new concern with the problems presented by this politico-economic system. Yet the fact remains that a widespread recognition of these problems did not develop until after 1968. Why the delay? Two reasons are apparent. First, a favourable climate of opinion was needed for remarks about the commons to be noticed. This was created in the 1960's by the rapid growth of the environmental movement, which alerted people to the consequences of distributional systems. Second, it was necessary that the properties of the commons be stated in no uncertain terms if people were to consider the matter seriously. It was necessary that the human tragedy of adhering to a commons-type distribution be emphasized. A good, solid fortissimo minor chord had to be sounded. Before 1968 most of the sounds were either mere grace notes or extended passages played pianissimo. The down-playing was for good reason, of course: the clear message of the commons threatened cherished beliefs and practices. Abandoning any traditional practice requires a political upset (though revolution may be too strong a word).[2]

(d) It is fair to say that most people who anguish over the population problem are trying to find a way to avoid the evils of overpopulation without relinquishing any of the privileges they now enjoy.[3] They think that farming the seas or developing new strains of wheat will solve the problem -- technologically. I try to show here that the solution they seek cannot be found. The population problem cannot be solved in a technical way, any more than can the problem of winning the game of tick-tack-toe (Hardin 1968).

(e) The tragedy of the commons... provides a useful analogy allowing us to understand why shared resources, such as fisheries or the global climate, tend to undergo human overexploitation. The analogy, which dates back over a century before Hardin's original paper, describes the consequences of individuals selfishly overexploiting a common resource. The tragedy of the commons was originally applied to a group of herders grazing cattle on common land. Each herder only gains a benefit from his own flock, but when a herder adds more cattle to the land to graze, everyone shares the cost, which comes from reducing the amount of forage per cattle. If the herders are driven only by economic self-interest, they will each realize that it is to their advantage to always add another animal to the common: they sacrifice the good of the group (by forgoing sustainable use of the resource) for their own selfish gain. Thus, herders will continue to add animals, eventually leading to a 'tragedy' in which the pasture is destroyed by overgrazing. The difficulties inherent in protecting shared common resources, such as marine stocks or clean air, are well known: whereas everyone benefits from an intact resource, there is an individual-level

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1 Population Council 1980, p 473

2 Hardin 1977, p 1.

3 To keep downtown shoppers temperate in their use of parking space we introduce parking meters for short periods, and traffic fines for longer ones. We need not actually forbid a citizen to park as long as he wants to; we need merely make it increasingly expensive for him to do so. Not prohibition, but carefully biased options are what we offer him. A Madison Avenue man might call this persuasion; I prefer the greater candor of the word coercion.

Coercion is a dirty word to most liberals now, but it need not forever be so. As with the four-letter words, its dirtiness can be cleansed away by exposure to the light, by saying it over and over without apology or embarrassment. To many, the word coercion implies arbitrary decisions of distant and irresponsible bureaucrats; but this is not a necessary part of its meaning. The only kind of coercion I recommend is mutual coercion, mutually agreed upon by the majority of the people affected.

To say that we mutually agree to coercion is not to say that we are required to enjoy it, or even to pretend we enjoy it. Who enjoys taxes? We all grumble about them. But we accept compulsory taxes because we recognize that voluntary taxes would favor the conscienceless. We institute and (grumblingly) support taxes and other coercive devices to escape the horror of the commons (Hardin 1968).

temptation to cheat (e.g. to overexploit or pollute), because cheating brings economic advantages to the individual, whereas costs are distributed among all individuals. The lesson drawn from these studies is that solving the dilemma often requires negotiation and sanctions on disobedient individuals. This changes the payoffs, so that group-beneficial behaviour also becomes optimal for the individual: an example would be imposing heavier taxes on polluting industries. Hardin's own main solution to the tragedy of the commons was state governance and privatization of the resource in question; in general, social norms as well as individual morality have been considered good candidates for preventing overexploitation of common resources.[1]

(f) Hardin's original analogy, involves individuals selfishly exploiting a common resource until the resource is reduced to the point that the individuals no longer can persist on it. Examples include simple competition for food, but reproductive traits, such as high virulence in parasites and laying larger clutches in an attempt to out-reproduce others, can also be involved. Although it has been suggested that only competition over an extrinsic resource should be viewed as a tragedy of the commons, evolutionary biologists have applied the term to a Hardin's original essay dealt with both pollution and human overpopulation, but the main point of his article was that a common resource would always be overexploited when utilized by self-interested individuals. Pollution, climate change and overexploitation of fisheries all involve public goods suffering from the free-rider problem, and are thus examples of the tragedy of the commons. For example, the collapse of North Atlantic cod shows how easily common resources can be overexploited. People tend to value their own short-term self-interests over the long-term good of the planet, so it is difficult to solve environmental problems by appealing to individual goodwill only. Public awareness of resource limitation can even hasten overexploitation: endangered species are traded at higher prices when their perceived rarity increases. Convincing participants to behave in a group-beneficial way requires that individuals trust that the desired outcome is reachable and that free-riders will not benefit. Such trust is difficult to create whenever data and experience show otherwise. A flipside of the tragedy of the commons is that avoiding it can often be beneficial to the players involved, and can be described as win–win situations if policies are improved. For example, right whales often become entangled in lobster fishing gear. Although fishermen are not keen to reduce their income, a comparison of Canadian and American lobster fisheries shows that reducing the risk of entanglement can be achieved with no economic cost: reducing fishing effort leads to improved yield of lobsters per recruit. Similarly, despite considerable resistance and cynicism, marine reserves (areas where fishing is prohibited) can benefit all fishermen, even over the short-term. Policy negotiations are difficult in these situations, because people distrust others, but also because long-term benefits are rarely given sufficient weight. Without extensive education, such benefits are met with scepticism. For example, the population dynamic arguments that relate catch effort to expected yield in fisheries are not intuitively obvious. Easily perceived individual benefits would help to solve these problems. For example, using people's desire to improve their social reputation could prevent exploitation of the common good, as is seen in experimental 'climate games' in which participants improve their reputation by investing publicly to sustain the global climate. *What is striking is that organisms with little cognitive ability are frequently able to resolve the tragedy with little or no cognitive or communicative abilities*. With our advantage of communication and foresight, solutions to human tragedies of the commons should be within reach, but they are best solved, as Hardin advocated, using 'mutual coercion, mutually agreed upon'.[2]

(g) Scientific certainty and consensus in itself would not prevent overexploitation and destruction of resources. Many practices continue even in cases where there is abundant scientific evidence that they are ultimately destructive. An outstanding example is the use of irrigation in arid lands. Approximately 3000 years ago in Sumer, the once highly productive wheat crop had to be replaced by barley because barley was more salt-resistant. The salty soil was the result of irrigation. E. W. Hilgard pointed out in 1899 that the consequences of planned irrigation in California would be similar. His warnings were not heeded. Thus 3,000 years of experience and a good scientific

1 Rankin *et. al.,* p 643.

2 Italics ours, bid, p 644.

understanding of the phenomena, their causes, and the appropriate prophylactic measures are not sufficient to prevent the misuse and consequent destruction of resources. [1]

(h) Will a group of people reach a collective target through individual contributions when everyone suffers individually if the target is missed? This ''collective-risk social dilemma'' exists in various social scenarios, the globally most challenging one being the prevention of dangerous climate change. Reaching the collective target requires individual sacrifice, with benefits to all but no guarantee that others will also contribute. It even seems tempting to contribute less and save money to induce others to contribute more, hence the dilemma and the risk of failure. Here, we introduce the collective-risk social dilemma and simulate it in a controlled experiment: Will a group of people reach a fixed target sum through successive monetary contributions, when they know they will lose all their remaining money with a certain probability if they fail to reach the target sum? We find that, under high risk of simulated dangerous climate change, half of the groups succeed in reaching the target sum, whereas the others only marginally fail. When the risk of loss is only as high as the necessary average investment or even lower, the groups generally fail to reach the target sum. We conclude that one possible strategy to relieve the collective-risk dilemma in high-risk situations is to convince people that failure to invest enough is very likely to cause grave financial loss to the individual. Our analysis describes the social window humankind has to prevent dangerous climate change. [2]

(i) Finally, I will also note that there was another important, insightful, largely unacknowledged pre-1968 work which clearly details this problem on the public lands of great American West: Stewart 1925. The black and white photographs in this work lend aesthetic, historical, and visual weight to the well-crafted argument.

(j) *commons dilemma* n. A type of resource dilemma interpreted as a problem of overgrazing on a common pasture, illustrated by the following simple example. Three farmers each own a single cow weighing 1,000 kg and have access to a common that can sustain a maximum of three cows without deterioration. They all want to increase their wealth by adding a further cow to the common, but for each additional cow on the common the weight of every cow decreases by 200 kg. If one farmer adds a cow, then that farmer's personal wealth increases from 1,000 kg (one 1,000 kg cow) to 1,600 kg (two 800 kg cows); if two farmers add a cow each, then the wealth of each increases from 1,000 kg to 1,200 kg (two 600 kg cows); and if all three add a cow each, then the wealth of each decreases from 1,000 kg to 800 kg (two 400 kg cows), and each farmer is poorer than if each had acted cooperatively by not adding a further cow to the common. It is always in a farmer's individual self-interest to acquire an additional cow, whether or not one or more of the others does so, but if they all pursue individual self-interests in this way, then each ends up poorer than if they all cooperate, which means that the problem is a social dilemma... So called because of a reference in 1833 in an essay on population growth by the English economist William Forster Lloyd (1795 – 1852) to the 'tragedy of the commons'—the overgrazing of the commons in 14th-century England, which led to the enclosures and the eventual disappearance of many of the commons. [3]

(k) Game theory is rarely used to deal with the overuse and misuse of tourism resources. When it happens, the issue is normally explained within a non-cooperative setting in which, because of the free riding option, a problem emerges as the socially irrational outcome of an individually rational behaviour (social dilemma). In some cases, the assumptions upon which this explanation rests risk lacking both descriptive accuracy and predictive power. Since tourism is the encounter of a stable (residents) with a changing (tourists) population, the paper asserts that, in many cases, the issue may be better investigated within a strategic game in which the players do not know an aspect of their environment that is important for their choice (Bayesian game). Building on this, the paper demonstrates why an unsustainable path may emerge even when both players prefer preservation to exploitation and no free ride incentive exists (Bimonte forthcoming, *abstract*).

(l) Investment in a common resource shared by all players is difficult to evolve despite higher

1 Ludwig et. al. 1993.

2 Milinski *et. al* 2008, abstract ; also see Hauert 2006

3 Colman 2006

returns because a non-investor (free-rider) always receives more than an investor (altruist). This situation is referred to as the Tragedy of the Commons and is often observed in various biological systems including environmental problems of human society.[1]

(m) As a final note, despite the assertion of a very confused Director of an Institute of Island studies, Hardin 1968 has not been "discredited" by "every biologist." In fact, in 2004, in-depth citation analysis[2] clearly demonstrated that Hardin 1968 is by far *the most cited, most influential paper in ecology!*

Truth

(a) Knowledge consists in the search for truth – the search for objectively true, explanatory theories…

It is not the search for certainty. To err is human. *All human knowledge is fallible and therefore uncertain. It follows that we must distinguish sharply between truth and certainty* [italics mine]. That to err is human means not only that we must constantly struggle against error, but also that, even when we have taken the greatest care, we cannot be completely certain that we have not made a mistake.

In science, a mistake we make – an error – consists essentially in our regarding as true a theory that is not true… to combat the mistake, the error, means therefore to search for objective truth and to do everything possible to discover and eliminate falsehoods. This is the task of scientific activity. Hence we can say: our aim as scientists is objective truth; more truth, more interesting truth, more intelligible truth. We cannot reasonably aim at certainty. Once we realize that human knowledge is fallible, we realize also that we can *never* be *completely certain* that we have not made a mistake.[3]

(b) This problem had been seen and solved long before; first, it appears, by Xenophanes, and then by Democritus, and by Socrates… The solution lies in the realization that all of us may and often do err, singly and collectively, but that this very idea of error and human fallibility involves another one-the idea of objective truth: the standard which we may fall short of. Thus the doctrine of fallibility should not be regarded as part of a pessimistic epistemology. This doctrine implies that we may seek for truth, for objective truth, though more often than not we may miss it by a wide margin. And it implies that if we respect truth, we must search for it by persistently searching for our errors: by indefatigable rational criticism, and self-criticism.[4]

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1 Wako 2007, abstract

2 We assessed the degree of influence of selected papers and books in ecological economics using citation analysis. We looked at both the internal influence of publications on the field of ecological economics and the external influence of those same publications on the broader academic community. We used four lists of papers and books for the analysis: (1) 92 papers nominated by the Ecological Economics (EE) Editorial Board; (2) 71 papers that were published in EE and that received 15 or more citations in all journals included in the Institute for Scientific Information (ISI) Citation Index; (3) 57 papers that had been cited in EE 15 or more times; and (4) 77 monographs and edited books that had been cited in EE 15 or more times. In all, we analyzed 251 unique publications. For each publication, we counted the total number of ISI citations as well as the total number of citations in EE. We calculated the average number of citations per year to each paper since its publication in both the ISI database and in EE, along with the percentage of the total ISI citations that were in EE. Ranking the degree of influence of the publications can be done in several ways, including using the number of ISI citations, the number of EE citations or both. We discuss both the internal and external influence of publications and show how these influences might be considered jointly. We display and analyze the results in several ways. By plotting the ISI citations against the EE citations, we can identify those papers that are mainly influential in EE with some broader influence, those that are mainly influential in the broader literature but have also had influence on EE and other patterns of influence. There are both overlaps and interesting lacunae among the four lists that give us a better picture of the real influence of publications in ecological economics vs. perceptions of those publications' importance. By plotting the number of citations vs. dates of publication, we can identify those publications that are projected to be most influential (Costanza et. al. 2004).

3 Italics Popper's 1992 p. 4

4 Popper 1963, p 21

UTV **Universal Theory of Value**
See Funk 2008a ; Funk 2008c ; Funk 2008d ; Funk 2008f

War
In one of the greatest speeches of all time – his second inaugural – Abraham Lincoln said: "Both parties deprecated war; but one would make war rather than let the nation survive; and the other would accept war rather than let it perish. And the war came." It is a big mistake to say that war is irrational. We take all the ills of the world – wars, strikes, racial discrimination – and dismiss them by calling them irrational. They are not necessarily irrational. Though it hurts, they may be rational. *If war is rational, once we understand that it is, we can at least somehow address the problem. If we simply dismiss it as irrational, we can't address the problem.*[1]

1 Italics mine, Aumann 2005, p 351

Wasted Time

Most people…complain about the meanness of nature, because we are born for a brief span of life, and because this spell of time that has been given to us rushes by so swiftly and rapidly that with very few exceptions life ceases for the rest of us just when we are getting ready for it. Nor is it just the man in the street and the unthinking mass of people who groan over this - as they see it - universal evil: the same feeling lies behind complaints from even distinguished men. Hence the dictum of the greatest of doctors: 'Life is short, art is long.' Hence too the grievance, most improper to a wise man, which Aristotle expressed when he was taking nature to task for indulging animals with such long existences that they can live through five or ten human lifetimes, while a far shorter limit is set for men who are born to a great and extensive destiny. *It is not that we have a short time to live, but that we waste a lot of it. Life is long enough, and a sufficiently generous amount has been given to us for the highest achievements if it were all well invested* [italics mine]. But when it is wasted in heedless luxury and spent on no good activity, we are forced at last by death's final constraint to realize that it has passed away before we knew it was passing. So it is: we are not given a short life but we make it short, and we are not ill-supplied but wasteful of it. Just as when ample and princely wealth falls to a bad owner it is squandered in a moment, but wealth however modest, if entrusted to a good custodian, increases with use, so our lifetime extends amply if you manage it properly.

Why do we complain about nature? She has acted kindly: *life is long if you know how to use it* [italics mine]. But one man is gripped by insatiable greed, another by a laborious dedication to useless tasks. One man is soaked in wine, another sluggish with idleness. One man is worn out by political ambition, which is always at the mercy of the judgment of others. Another through hope of profit is driven headlong over all lands and seas by the greed of trading. Some are tormented by a passion for army life, always intent on inflicting dangers on others or anxious about danger to themselves. Some are worn out by the self-imposed servitude of thankless attendance on the great. Many are occupied by either pursuing other people's money or complaining about their own. Many pursue no fixed goal, but are tossed about in ever-changing designs by a fickleness which is shifting, inconstant and never satisfied with itself. Some have no aims at all for their life's course, but death takes them unawares as they yawn languidly – so much so that I cannot doubt the truth of that oracular remark of the greatest poet: 'It is a small part of life we really live.'[1]

1 Sececa c. A.D. 60, pp 1-2

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THE STUDY OF THE CONSTITUTION OF THE UNITED STATES, BY HER INGENUOUS YOUTH, IS RESPECTFULLY DEDICATED, BY ONE WHO GRATEFULLY ACKNOWLEDGES, THAT HER TERRITORY IS THE LAND OF HIS BIRH, AND THE HOME OF HIS CHOICE, THE AUTHOR, *Cambridge, January 1840*. (1997 Conservative Book Club edition, © 1986 Regnery Gateway: Lake Bluff, IL, U.S.A.). From the personal library of M. W. Funk, hardback and just jacket in good condition.

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June 5, 1938

REPORT ON HURON MOUNTAIN CLUB

Aldo Leopold

Public Relations of the Club

The Huron Mountain property is of outstanding value for:

1. Wilderness recreation.
2. Scientific study.
3. Wildlife conservation.
4. Timber.

The wilderness and timber values belong wholly to the members by reason of their ownership of the land.

The wildlife values are shared with the neighbors by reason of mobile animals which range in and out of the boundary, and with the general public by reason of its legal title in all wild animals.

The scientific values arise from the fact that the Huron Mountain property will soon be one of the few large remnants of maple-hemlock forest remaining in a substantially undisturbed condition. All earth-sciences must, in the long run, learn how to use land by referring to unused land as a base-datum or starting point. Whoever owns such land will one day find it in demand for scientific investigations.

It is clear, then, that the Club has not only a unique property, but a large opportunity for public service in science and conservation.

Conversely, the Club property is deeply affected by what the neighboring owners do with their timber, deer, roads, resorts, fires, and fisheries, and by the laws and policies adopted by public agencies in respect to wildlife, fires,and roads.

These interdependencies clearly exclude as untenable any merely defensive policy on the part of the Club.

This report attempts to sketch a policy for the simultaneous development of both the public and private values inherent in the Club's lands.

Wilderness, scientific, and timber values are treated in Section A, "Proposed Land and Timber Policy."

Wildlife values are treated in Section B, "Proposed Wildlife Policy."

Section C deals with miscellaneous internal and administrative adjustments.

The appendix contains statistical data of possible use for future reference.

Section A

PROPOSED LAND AND TIMBER POLICY

Objectives

1. To "buffer" the lakes, streams, and lakeshore against encroachment.
2. To block out the Club holdings into a solid area if possible.
3. To preserve the wilderness flavor.
4. To preserve as large a sample as possible of uncut timber.
5. To create desirable conditions for wildlife.

Need for a Policy

The existence of a comprehensive written policy does not imply heavy expense or inflexible operations. It means that the management shall have a definite aim to work toward, and that modifications of that aim shall be made only by general consent of the members. I have the impression that lack of a clearly defined land policy in the past has been expensive in terms of both money and effort.

Scale of Holdings

The land policy here proposed can be based upon either the consolidation of the present holdings, or upon a larger holding, but not upon a smaller one. The present "ragged" boundary, if not consolidated, will probably be a source of trouble in the future.

The proposed land policy is first sketched in general terms, and later applied to a consolidated holding of roughly the present exterior proportions. Modifications to fit a different scale can be made at will.

Buffering and Blocking Out

The need of buffering may suddenly become acute by reason of the recent completion of a logging railroad within two miles of the southwest corner of the Club lands, and a logging camp within a mile of Howe Lake.

As interior owners cut their timber, it may be possible to contract for the cutover land with the stipulation that it be logged by "selective cutting."

It may be possible to trade certain blocks of Club timber for outside land, and thus complete the buffer zone.

The purchase of buffer property, and the recovery of part of the cost by selective logging of the purchased land, may also be possible.

Roads

The present club road system is sufficient to allow access to remote parts of the Club property in a single day. More or better roads would detract from the wilderness flavor without any large compensating gain. It is therefore proposed that the Club road system be not further extended.

The construction of public roads across the property should, as in the past, be opposed by all possible means. The scientific developments later discussed should greatly strengthen the "moral position" of the Club in resisting encroachment of this or other kinds.

Timber

The maple-hemlock forest in full stand is nearly devoid of game. A cutting grows game food for about 12 years, after which food plants are shaded out, or grow out of reach.

Wildflowers are scarce in fully shaded woods. They occur in greatest variety where various intensities of sunlight are allowed to reach the ground.

Songbirds in wide variety are particularly dependent on an alternation of shade, partial shade, and open spots.

All these considerations call for openings. On the other hand, the uncut timber is itself one of the principal attractions. Timber policy is hence a question of reconciling the opposing pulls for light and shade, cut and uncut.

Up to a few years ago the only known method of opening a forest like Huron Mountain was by clean cutting or "slash." At present, however, selective logging makes it possible to open the forest in any desired degree without appreciable scars. The results of selective cutting are no longer conjectural. They may be seen at the Forest Experiment Station at Dukes, 22 miles east of Marquette.

The best method of handling the Huron Mountain timber is believed to be the reservation of an interior protected area, and the establishment of a buffer zone of selectively logged areas. The smaller and the more frequent the selective cuttings, the greater the benefit to wildlife.

The fully reserved area should surround the lakes, particularly the Mountain Lake chain. It will thus comprise the interior of the property. It should also include some lake shore. The selectively logged areas will naturally lie adjacent to surrounding transportation, i.e., they should form the buffer zone already discussed. If possible the buffer zone should be large enough to sustain some logging each year. Since some of the selectively logged areas at Dukes regrow the original cut in 14 years, this does not call for a buffer zone of prohibitive size.

The salmon trout lands are too narrow and already too much altered to serve as a reserved area.

In no case should the additional roads used for selective logging be left open to motor travel.

The salability of the various species and grades of timber varies with market conditions and with the presence or absence of outside logging operations. At present hemlock is unsalable at a fair price. There also is a doubt about the permanence of the outlet for chemical wood at Marquette. With no market for chemical wood or hemlock, selective logging chances are poor. There is, however, no reason to believe that markets will always be poor, and the present depression creates an extra favorable chance for acquisition of lands.

The Club has a better chance to practice selective logging than the average lumber company because its timber was acquired earlier and cheaper and the costs of holding it are properly chargeable at least in part to recreation. At least the converse is true, i.e., complete and sudden liquidation of the timber by slashing would defeat its purposes as a club, whereas it does not defeat the purposes of lumber companies as now organized.

Science and Wilderness

The recreational values of wilderness should need no elaboration to members of this club.

The potential values of the Huron Mountain property for scientific purposes, however, are probably little appreciated either by the members or by the public. By "scientific purposes" is meant research in the organization of biotic communities, including plants, animals, soils, and waters. Such research is distinct from that aimed at practical

applications to the Club's wildlife, treated in Section B. Appendix F describes its viewpoint and the need for "natural areas" on which it can be conducted.

The size-scale of a wilderness area for scientific study greatly affects its value. A small area may be "natural" in respect of its plants, but wholly unnatural in respect of its mobile animals or water. However, mobile animals greatly affect plant life, so that a small virgin forest may appear to be natural when actually it has been profoundly affected by forces applied to animals, waters, or climate at points far distant. (Thus the deer populations determined by laws passed at Lansing, by hunters camping at Big Bay, and by lumbering operations on the Little Huron, have apparently exterminated the ground hemlock from the "virgin" forest of Mountain Lake.)

In general, a small area is valuable for studies of vegetation and soils. Birds, mammals, and waters require larger areas by reason of their mobility.

Condition of the Huron Wilderness

The Club property as a scientific wilderness area has suffered three major disturbances:

1. The original pine logging.
2. The extermination of important members of the mobile fauna (cougar, caribou, moose, wolverine, fisher, marten)
3. The alteration and transplantation of the fish fauna by artificial plantings.

It is now threatened by three further disturbances:

4. Undue increase of deer due to wolf control and outside slashings. (This is capable of so disrupting the flora as to injure recreational as well as scientific values.)
5. Elimination of wolf and otter by excessive predator control.
6. Depletion of Lake Superior fish fauna by commercial fishing.
7. Completion of a highway through or near the property.

To avert or minimize these disturbances requires the cooperation of outside agencies. Such cooperation is possible if the Club assumes a scientific function; improbable if it merely stands on its private property rights.

To preserve the remaining scientific values the following internal policies are called for:

1. Cease all further introductions of exotic animals or plants, especially in the reserved area.

2. Record all introductions so far made.

3. Reduce to a minimum all controls of mobile fauna ranging in and out of the reserved area.

These precations are discussed in more specific detail in the wildlife section.

How the research in a natural area at Huron Mountain might be conducted and financed is a question I cannot answer in advance. I can only record my opinion that demand for the use of the area, and eventually funds for using it, would develop. Most of the universities of the Lake States would be interested.

Land Plan

Map 1 shows the present boundary, ~~a minimum reserved area,~~ and two alternative buffer zones based on consolidation of the present exterior boundary of the Club's holdings. Map 2 shows reserved area and buffer zone based on the smaller of the two proposed boundaries.

The detached reserved areas are for preserving a lakeshore habitat, which is of special interest to the botanist.

Assuming that financial conditions within the Club preclude any heavy purchase program, it seems to me more likely that help could be obtained as a combination club and scientific area than merely as a club. The appraisal of this chance I must leave to the officers.

It would not be necessary for the Club to own the desired additions to the "buffer zone" if it had assurance of their being handled as a buffer zone, i.e., of their being kept free of roads and improvements, and not logged except selectively.

This would be a favorable time for the enlargement of the buffer zone because of the low timber values, especially hemlock, and because of the pressure of indebtedness on the owners.

It is obvious, though, that any advertisement of an extension in boundaries would inflate prices. It is imperative, then, that this part of this report be kept confidential.

Should such an extension be desired, it would be best to operate through a third party already in the timber and land business.

Obviously all of the land policies suggested in this report are conditioned by the Club's decision as to whether it wants or can contrive to get an extension of lands.

If there is to be no extension, but if the "reserved area" idea be accepted, then there is little timber left for selective logging.

If there is to be no extension and if the "reserved area" idea be applied only to scenery (i.e., no reserved area in the scientific sense), then there is a good deal of room for selective logging in the interior of the present holding, and an adjusted land plan can be drawn to fit these conditions.

If there can be an extension and if the "reserved area" idea is to be tried, then either of the two alternative boundaries shown on Map 1 would be logical.

The addition of the entire watershed of Cedar Creek would be still better.

The addition of the entire watershed of the Salmon Trout River is out, for its headwaters have already been slashed to such an extent as to destroy its value as a "natural area" for scientific study.

Rules for Adjustment

In the execution of this or any adjusted land plan the following general principles are recommended:

1. Pine is scarcer than maple-hemlock and should be cut sparingly if at all, even outside the reserved area. The large mature pine veterans are of special value, and should not be cut.

2. Undisturbed lakeshore is relatively scarce. Both beach and cliff shore is needed. Acquisition of more shore is desirable; cuttings or improvements on lakeshore are undesirable.

Section B

PROPOSED WILDLIFE POLICY

History

The wildlife conservation movement is divided over several basic issues, one of which is control of predatory species.

Many (but by no means all) sportsmen set a higher value on game than on other forms of wildlife, and are willing to sacrifice non-game to game species on a large scale in the form of "vermin control."

On the other hand, some sportsmen and nearly all ornithologists, mammalogists, botanists, etc., refuse to set a preferential value on game. They challenge the efficacy of "vermin control" as a means to increase game. They assert that improving food and cover is a better way to accomplish game increase, and that the way to improve food and cover may be found by scientific investigation.

I adhere to the latter school, but by reason of a lifetime of hunting and fishing am sympathetic toward the ends (if not the means) of the former.

The Huron Mountain Club has naturally experienced this cleavage of thought among its members. Actual policy, however, has so far been dictated by the sporting group. This is natural in a club founded largely for fishing, and certainly no reversal of policy which disregarded the interests of fishing would be either possible or wise. I personally believe, however, that scientific investigation is capable of building a more successful fish policy than the old rule-of-thumb formula, namely "stock heavily and kill as many predators as possible."

The fish research now entrusted by the Club to Dr. Hubbs is a search for new, more effective, and less destructive methods of fish management. The fish work is in competent hands and is not further

discussed in this report.

Definition of New Policy

The new wildlife policy which I recommend, and which I believe Dr. Hubbs is already working toward in the fish work, may be defined "in a nutshell" as follows:

Game fish can be built up, by methods now under investigation, probably with little resort to predator control.

Fish predators are of positive value for esthetic enjoyment and scientific study and are not to be lightly sacrificed to fish. The otters of the Salmon Trout River are unique, and in one sense more valuable than any amount of trout.

Deer can be built up, but not by killing wolves. Deer are limited by winter food, and to allow them to increase without increasing their natural food supply would be a calamity to the timber, the flora, the birds, and the deer themselves. Artificial feeding is no answer. It simply exaggerates the discrepancy between the deer and the carrying capacity of the range. Deer food plants can be increased by selective logging.

Deer predators, especially wolves, are of positive value for esthetic enjoyment and scientific study, and are not to be lightly sacrificed. The wolves make the Huron Mountain property more unique and valuable than deer possibly can.

Ruffed grouse are governed largely by the game cycle. Predator control on their behalf is entirely useless. The average population can be raised by selective logging and by planting white clover in openings, but the level will fluctuate violently in any case.

The forest, birds, and wildflowers are of positive value for

esthetic enjoyment and scientific study. They will take care of themselves if the timber is conservatively handled and the deer kept down to normal numbers.

The members. Much can be done to increase the total enjoyment derived from the club wildlife by encouraging members to enlarge their fields of personal knowledge and appreciation. The initiation of scientific work on the Club property will tend to have this effect.

Why Important

Quite apart from differing opinions on the right and wrong of wildlife questions, there are two reasons of self-interest which make it advisable for the Club to modify its former wildlife policy:

1. Any irritation is exaggerated when it comes from a club. The old ideas of predator-control are particularly irritating to many whose good will is valuable.

2. Too big an increase in the deer herd will bring large physical damage to the club property. The deer herd will be easier controlled if its natural enemies are present in reasonable numbers.

Discussion by Species

Deer. The Club property has a moderate but increasing population of deer. Fred Dunham's estimate of 500 last winter means one deer per 30 acres. On good deer range this is a "normal" density. However, the carrying capacity of the Club land is very low due to the large proportion of heavily-shaded foodless terrain. The browse plants are already overstrained, as evidenced by the existence of "plimsoll lines" on all white cedar bordering lakes, the absence of white cedar and hemlock reproduction, the clipping of all striped maple, the absence of yew or "ground hemlock" except on cliffs and inaccessible rocks, and the browsing of balsam along snow-plowed roads.

With the encroachment of lumbering to the west and south, the deer population will be artificially sustained on down tops, and hence may be expected to increase. This increase will intensify the strain on the Club range, perhaps to a dangerous extent. It is especially important, therefore, to maintain at least the present wolf population. It may also become advisable to encourage deer hunting by the Club members on the Club lands, and public hunting on the adjoining properties.

The artificial feeding of alfalfa hay near the clubhouse is, from this viewpoint, unsound practice, but it has been very successful in decoying a few "tame" deer to the Club headquarters, where they furnish pleasure to members. I recommend that feeding on a small scale be continued, but only for this limited and local purpose. Heavy general feeding would be dangerous and should be discouraged.

Wolves have been kept out of the interior of the Club holdings by the ingenious practice of firing snags. Fred Dunham deserves much credit for his resourcefulness in devising such a scheme, and its continuance on other than the "reserved area" (see Section A) is approved. On the reserved area, however, it would tend to upset the natural conditions desired for scientific study, and should be discontinued.

The objective of deer management is to preserve a safe margin between carrying capacity and population. The best method is to raise capacity. This can be done by selective cuttings, which, by admitting light to the forest floor, will increase the amount of palatable browse plants (list in Appendix B). The area available for selective cutting is the "buffer zone" between the central "reserved area" and the exterior boundary. This may be large or small, depending on the land policy adopted. Selective cuttings on adjoining lands will benefit the Club deer range almost as

much as those on its own lands, provided they are made gradually. On the other hand, large sudden cuttings of any kind anywhere will damage the Club deer range by suddenly raising capacity and then, after a few years, leaving a heavy deer population without food. The "deer fortunes" of the Club are thus linked with those of its neighbors to an unpredictable but important extent.

Deer research. Deer crises of one sort or another are impending all over the Lake States. No two local situations are alike, but they all consist of maladjustments between deer, feed, predators, and hunting. It is obvious, then, that deer administration must become a flexible thing, to be worked out by groups of landholders in cooperation with the State Conservation Department. The Club has an opportunity to become the pioneer in such an enterprise. The first move is to learn something about its own deer: their movements, their food habits, their mortality from wolves, hunting, etc. Such a study calls for a yearlong investigator working in the region of the Club. His work should be dovetailed with the deer investigations being conducted under Ilo H. Bartlett by the Conservation Department. Hence detailed specifications for the Huron Mountain deer research should await a conference with the Conservation Department.

The cost of the work, however, can be clearly foreseen at this time. It will cost about $1,400 per year (stipend $800, travel $400, traps and supplies $200).

Deer tagging by the Club guards (recommended in Section C) should proceed in any event, and would be a valuable start toward the larger research program.

Wolves. One of the most startling contradictions in current conservation policy is the fact that every real student of the northern forests

foresees heavy physical damage from local overstocking by deer, but nobody has as yet succeeded in undermining the governmental policy of subsidized wolf extermination. The reason lies partly in the inertia of pioneering habits of thought, and partly in the assumption that the rifles can control the deer. Yet the fact is that rifles have never accomplished really satisfactory deer-control, even in Europe. There is a widespread rebellion against blanket predator control, but it centres in intellectuals who know nothing of administration, who are rarely offered administrative positions, and who usually shun them when offered as a wolf shuns a poisoned carcass. Natural resources, then are one of many public interests which suffer from the current refusal of highly trained men to enter "politics."

Who will have the courage to "break the ice" by proposing a rational policy toward the remnant of Michigan wolves? There are three possibilities: the Forest Service, the Michigan Conservation Department, or some group of private landowners. The first two cannot lightly antagonize the "barbershop biologist," but I suspect they are ready to move if they should receive even a little backing or encouragement from some citizen group other than the intellectuals.

Who could better give them this backing than a group of landowners whose forests and deer are threatened by the unwisdom of the present policy?

By "backing" I do not mean abstract arguments, or sermons on ecological theory. I mean measured facts on deer and wolf populations, deer and wolf movements, deer and wolf foods. We end then with the same conclusion as in deer: put a man on the ground to gather the elementary data. He can be the same man as already proposed for the deer study. The local guards like Fred Dunham, with their woods knowledge of deer and wolves, can help

such a study keep its "feet on the ground."

Otter. The role of the otter as a fish-predator has already been discussed, and is being studied by Hubbs.

It may not be clear to the members, though, that to own an otter range carries (to my mind) the same public responsibility as to own a piece by Phidias or Michael Angelo. If the owner fails to appreciate the value of what he has, he is eventually "out of luck" with all thinking men. If he does appreciate it, and can help the public to appreciate it, he performs a valuable public service.

The otter has been a rarity for so long that neither science nor art has touched him. His life history, his evolution as a species, his psychology, his physiology, are virgin fields for scientific inquiry, and the interpretation of his remarkable "personality" is a virgin field for literature and art. Williamson, in his "Tarka the Otter" has made a start toward literary interpretation. Only the beaver and the buffalo outrank the otter as "personifications" of American history.

Research on otters must give place to more pressing and practical problems like the deer-wolf-forest relationship, but the Club should never lose sight of the fact that as an owner of otter range, it is the custodian of a rare and irreplaceable natural resource.

As in the case of wolves and deer, the otter is a mobile resource ranging over many ownerships. No one owner can effectively act alone. All these neighborhood responsibilities clearly dictate the need for eventual group action in the Huron Mountain region. The first move toward group action is club action.

The moral responsibility for a wise otter policy is accentuated by the fact that the Club was "accessory" to the extermination of the fisher

in 1931 (see Appendix A). This, however, is spilt milk, and need not be discussed.

Ruffed grouse, spruce hen, snowshoe rabbit. These species are grouped because they are known to be controlled in their population levels by the 10-year cycle, and the Club need do nothing to conserve them except to conserve their habitat.

The grouse habitat can be enlarged by selective cuttings and by planting openings with white clover. These improvements should, however, be excluded from the "reserved area."

The spruce hen, like the otter, is a species which is being pushed northward out of the United States. There are apparently three remnants on the Club holdings (see Appendix D). To conserve these remnants it is necessary to conserve swamp timber adjacent to jackpine upland. Since this would be automatic even under the present policy, there is no need for any action.

Fortunately, the Club holdings do not seem to be a heavy rabbit country, otherwise serious problems of damage to vegetation might arise during the 10-year peaks of rabbit population.

The Club can render a valuable service to science by starting accurate yearly censuses of these three cyclic species, i.e., ruffed grouse, spruce hen, and snowshoe rabbit. This census work could, for the present, be done by the deer investigator.

Miscellaneous. A complete list of rare species appears in Appendix D.

An important future opportunity exists for the study of wildflower habitats, with the object of working out the technique for management "in the wild." The problem is not locally pressing at this time.

It is likely that botanists will find plant rarities corresponding to

the otter and the spruce hen. This is particularly likely on the lake shore beaches and cliffs. No lake shore should be "improved" without prior botanical exploration.

Section C

MISCELLANEOUS

Registration as a "Natural Area"

The Ecological Society of America publishes a register of natural areas available for scientific study.* It also has a standing committee charged with promoting the establishment of natural areas (see Appendix F). If the Club establishes a reserved area it should list its holdings with the Society and seek its cooperation in protecting the area and developing scientific studies thereon.

This would entail no obligations on the part of the Club, and might result in much valuable help in maintaining the integrity of the property.

Cost estimate: No cost.

Library and Museum

The Club should establish a natural history library and musem for the benefit of its members and staff, whether or no it embarks on the scientific developments here recommended. This need entail no large expense; the collections would grow by gifts, and by accessions from scientific workers. Some one person, however, should be charged with maintenance and care. Cost estimate: A room or building to house the collection, plus $25 per year for materials, plus $100 for initial purchase of books.

Meteorological Station

Local weather records would be of great value to future scientific work, and probably of considerable interest to members. Probably few members appreciate the fact that the climate differs fundamentally from that further

*See "Naturalist's Guide to the Americas," Williams & Wilkins Co., Baltimore, 1926.

south in that the ground never freezes and the snow melts from below, not at the surface. This gives rise to a whole chain of phenomena in the plant and animal worlds.

Some one person would have to be charged with the duty of making and recording observations. Cost estimate: $_____ for initial equipment plus 1/20 of the time of one man.

Nursery

A small nursery for native shrubs and trees for use on cottage grounds and buffer areas would be valuable. The following shrubs could be grown from cuttings treated in hormone solution to induce root formation: yew or ground hemlock, mountain ash, highbush cranberry. The hormone is a commercial product called Auxlias. It is obtainable from Montgomery Ward & Co., and is accompanied by instructions for use. Cost estimate: 1/20 of the time of one man.

Scientific Work by Administrative Staff

The guards have a considerable opportunity to contribute to scientific studies without additional expenditure of time or funds.

Deer can be trapped at the feeding stations and salt licks and marked with ear-tags for subsequent recovery either when killed by hunters or predators, or observed at close range with field glasses. Fawns found in the woods can be likewise tagged. I will supply specifications for trap designs and for tags.

Feces of wolf, otter, coyote, bobcat should be collected as found, dried, labelled, and held for fecal analysis to determine local food habits.

Pellets of herons, owls, hawks, and kingfishers should be collected if they can be found.

Stomachs of predatory species killed for control purposes or found dead, and stomachs of game birds killed by hunters or found dead, should be preserved in formalin for analysis to determine local food habits.

Suitable containers can be had at drug stores. Appendix C gives specifications for labels.

Cost estimate: $50 for traps, $10 per year for materials. Contributed spare time of guards averaging about one full-time man, but since this is already paid for it need not be calculated as expense.

Scientific Visitors

All of the above undertakings might be vitalized, and considerable interest created among members, by inviting selected scientific workers to pursue their respective studies on its property, offering board, or board and lodging. This scheme has already been in effect to some extent. I offer no recommendation, since the worthwhileness of the system depends so much on who is invited and what attitudes exist in the members.

Student Visitors

A kind of "nature guide" service for young people is maintained by employing a student, who also directs the work of children in the highly mechanized "carpenter shop." I offer no recommendation because I have not seen the system at work. I suggest, though, that letting the young people help in an actual scientific investigation might be a less artificial way of accomplishing the same thing.

Chapter 1

David Everett

He was one of the most gifted sleepers in the world. He could sleep anytime, anywhere, and could easily achieve twelve, thirteen, sometimes even fourteen hour dreamathons. But presently this was not the case. He had slept a mere half-dozen hours over the past two days and the past week had been a poorly edited montage of conference rooms, hotel rooms, stale coffee, and second-rate first class lounges. He was exhausted and for some strange reason his mind would not stop replaying snippets of a dream that came to him during his interval of brief sleep, a dream about a man he had never met.

There is a quiet cool calm that grows in a young boy as he comes to know his father—tranquility far beyond the comfort of food, water, and shelter. He had no memory of his father—a man who packed his tackle box one day and left for a fishing trip from which he did not return. He vanished. At least that's what his mother used to say. But each time he had inquired about his father the story seemed to change a little. Eventually he decided it was safer to stop asking. As a result, slow caustic questions arose from the chaotic void left behind. And if questions for which there are no answers are left untreated long enough, they build into frantic

subconscious crescendos that undermine hope for the quiet cool calm. Most boys wrangle these questions and doubts into submission as they enter the rodeo of manhood, but the slightest fits of exhaustion and fatigue will transport the potent essence of these fears right back into the present.

The slow low rumble of combusting jet fuel summoned these subconscious vapors. Doctor David Everett felt anxious but couldn't say exactly why.

During the five decades of the cold war the United States spent one-half trillion dollars to design, build, and operate a far-reaching web of advanced military intelligence systems. Photoreconnaissance satellites captured millions of images from the Earth's surface, undersea sonar arrays tracked enemy movement in the deep, and several billion terabytes of data were archived in data-mines surrounding Washington, D.C. Once upon a time, Tennessee senator Al Gore wrote a letter to an official at the Central Intelligence Agency, inquiring if the agency possessed databases on the oceans or atmosphere that would be relevant to several environmental issues in which he had become interested. No answer. Two years later Gore wrote another letter.

That time he got a response.

CIA director Robert Gates administered the preparation of briefings on over one hundred classified systems and data sets in order to help Gore and others ascertain their scientific relevance. In-depth analysis suggested these intelligence systems could be used to monitor a myriad of global events, including global warming, ice cap density, tropospheric water content, and accurate measurements of carbon monoxide levels.

The intelligence community created an official interface between their world and civilian science by granting high-level security clearance to a select group of scientists—giving them keys to the cryptic world of US intelligence technology and its products. They named this group *Medea* and its members were selected from academia, the private sector, and government

agencies. And Doctor David Everett, a National Oceanic and Atmospheric Administration hydrologist at the time, became Medea's sixty-third member.

Everett flipped through the file for the second time—Rand Krisstenson, founding director of the Navy's Marine Mammal program, was the son of a Swedish fisherman and a native Comanche woman from the southern plains of Texas. He was raised in Finland along the coast of the White Sea, and studied engineering at the Helsinki Institute and linguistics at the Defense Language Institute in Monterey. One sepia faded photograph captured Krisstenson and his team onboard a dive boat, circa 1972—all tan, fit, with crew cut hair. He was granted an honorable discharge in 1976, dropped off record for several years, and then resurfaced as an environmental activist. Another photo was taken while Krisstenson was in his forties—sharp features, charismatic—wading through the oil-laden wake of the notorious Exxon disaster. Krisstenson had sunk a Soviet whaler and spent the high-flying '80s in a Siberian gulag, returned briefly to the United States, then renounced his citizenship and expatriated himself to a cluster of islands off the African coast.

Everett tucked the file in his seatback pocket. He was on Lufthansa flight 1580 headed to those very islands. He was being dispatched on a recruiting mission with Navy Lieutenant Elmore Stearns. Stearns sat like a statue—a six foot eight inch two hundred and forty-five pound statue—in perfectly pressed Service Dress Blues at the window seat to his left. Everett thought perhaps the term 'African American' may have fallen out of favor but he wasn't sure. In any case, Stearns' skin was heavily pigmented and he had short jet black curly hair. Everett's attempts to cultivate small talk with the lieutenant bore a paltry harvest of monosyllabic fruits, but he didn't press too hard—Stearns was clearly a badass.

Dr Everett looked around at the other passengers in the business class cabin. This was a business trip all right—pure monkey business. Why were Cross and Ladir so hell-bent on enlisting Krisstenson? He could think of a dozen more qualified specialists off the top of his

head. Yes, this was a total waste of time and tax dollars. But then he spotted a flight attendant sauntering down the aisle—well, maybe not a total waste. He smiled and she winked in reply. On most flights Everett couldn't go a nautical mile without thinking about his 1 in 50,000,000 chance of being killed in an aircraft accident. Certain sights, however, sent this condition into remission.

He started to get up but there was a bit of mismatched math giving him a sort of numerical migraine, another incongruous piece of jigsaw-puzzle concerning a nebulous study underway back at the Federal building. His Medea security clearance did not open as many omniscient portals of light as one might think. Medea programmers, researchers, and scientists were invariably left somewhat in the dark, handed only enough pieces to catch faint contextual glimpses of the true data underlying their work, but usually not enough to see the whole picture. In many cases, however, it did not require much imagination to fabricate the missing pieces. This was especially true of certain theoretical environmental disaster case studies—studies to establish protocol for both natural and man-made catastrophes. In general, these studies were nothing more than a host of variables to consider and complex logistics to plot: Clean up? Evacuation? Short-term physiological effects? Long-term fiscal effects? These studies were typically conducted when things at the office got slow. At the time of his departure things were definitely not slow. There, in the midst of some of the most volatile departmental mayhem, Medea Chief Victor Ladir had brushed vital assignments aside and given top priority to a disaster scenario case study. Twelve Medea members were allocated to devise a plan-of-action for the recovery of plutonium at sea. And if the timing of the assignment was suspect, the details of the project were even more so. The specifics of these studies were typically vague. *What if?* events themselves are, afterall, difficult to predict with any measure of accuracy, but the parameters of this study were alarmingly specific: two metric tons of weapons-grade plutonium in eighty-eight

stainless steel canisters, lost, *most likely*, within a six hundred mile radius of the Hawaiian Islands.

Everett tried to dismiss it all—but he couldn't get his mind off of what had begun as a gnawing abdominal suspicion and was now burning acid reflux creeping up his esophagus. Granted, he was probably reading into things as usual, but there was something he had to do just in case: he had to make a phone call.

He unbuckled his seatbelt, popped two cherry Tums in his mouth, and headed down the aisle towards a phone by the lavatory. The cloud cover parted and he caught a glimpse of the majestic African continent sauntering by 30,000 feet below. The wispy snows of Kilimanjaro emerged in the distance and for some strange reason a frozen leopard came to Everett's mind. He came to an impasse in the coach-section behind a British woman in a tweed blazer. She was covertly lining her carry-on bag with in-flight spoils from the overhead compartment. A few weeks prior Everett had been briefed on a new strand of vaccination-resistant malaria, and had gathered that quinine was an anti-malarial distilled from the powdered bark of the Cinchona tree, developed by the British during African colonization. Everett didn't have anything against the British—but as he watched the woman stuff her bags with a Lufthansa blanket, pillow, and several puffy padded blackout shades he recalled that those early Anglos didn't care much for the flavor of their quinine so they experimented, adding a spot of gin to the anti-malarial—and hence the birth of the gin and tonic. The globetrotting dame in question, apparently satisfied with her considerable acquisitions, granted Everett passage. He passed by the galley but stopped and turned back when he spotted the flight attendant again.

"What can I get you?" she asked, looking up with the frustration of an overworked and often-hassled waitress in the sky—a drop-dead gorgeous waitress in the sky.

"Gin and tonic, please, no ice."

She poured out the contents of a miniature bottle of Bombay into a plastic cup, added a splash of tonic, and handed the drink to Everett. He swirled the concoction together, spilling a bit as he did so, and sipped the drink that always reminded him of Christmas trees.

Dr Everett knew the first question a man asks a woman is paramount, because at that moment one of two things happens: One, a conversation is born and a foot is in the door—or two, he's dead in the water. The single worst leading question, he had deduced from modest experimentation, is *What's your name?* This question invariably receives the obvious, curt response, such as *Suzy*. Where can a guy go from there? *Gee, that's a great name* or *Oh, that's my mother's name*? Names are useless. It's critical to ask a question that actually *leads* somewhere. Everett had devoted considerable resources mastering the *Where are you from?* opening. The answer, let's say *Des Moines, Iowa* opens paths into geographical, sociological, or economical discourse. Familiarity, however, was typically a low-percentile tack for a follow-up response. *Wow, when I was a kid I spent a summer detasseling corn on a farm outside Des Moines* could easily receive *Oh, that's nice* in response, and once again, game over. Demure naiveté is a much better route: *What's Iowa all about? Did you grow up there? What was that like?* And so on. Once enough essential data has been acquired, in-depth discourse, and—if all goes well—other activities may ensue.

Everett asked, "Where are you from?"

The flight attendant said, "München."

It was at that moment that something went terribly wrong. If there was a way to underscore the commingling phonics of *München* with carnal erotomania, this woman had found it. The sultry utterance caught him off guard and he stood there in a silence that set like quick-dry cement with 'awkward moment' etched upon its surface. She began searching around for something, pulling open heavy drawers full of canned beverages, then slamming them shut with dexterous hip-check twists. Everett sipped his drink and turned to the window, stooping to

peer down at Africa and regroup. A moment later, although the battle was long since lost, Everett requested another cocktail.

"Sure," she said, pausing with a wink and a warm smile, "You're cute."

Apparently there are times when good looks can save even the most bungled attempts.

Dr Everett sipped his drink, proposed an irreverent toast, and began acquiring and disseminating essential data. Ms München, it seemed, did likewise. When she discovered he was from Los Angeles, she mentioned she'd be laying over in a week and asked for his number. The proposition reminded Everett of what he had set out to do in the first place and the spell was broken. He took a cocktail napkin and jotted down his name, a smiley face, and his ex-girlfriend's phone number, then headed off for the privacy of an aft telephone.

Everett noticed the small print at the base of the phone, but didn't want to know how much the call would cost. He took a moment to concoct a passable lie then swiped a credit card through and followed the dialing instructions. Ten minutes, eighty miles, and three credit cards later (the prospect of a paper trail all the way back to Hawaii helped resist the temptation to use his corporate card), he found a card that wasn't over its spending limit—his American Express card. The Lufthansa in-flight telephone's airborne satellite link located the correct residential number in the 808 area code and commenced accounting per the fine print at the base of the phone—five dollars for the connection, five dollars a minute for every minute thereafter. He strained to hear over the hum of the Airbus 310's Rolls Royce engines and ventilation system. A woman answered the phone in a melodious tropical whisper.

"Hello Mrs Akua, it's David… David Everett," he said a bit louder.

The woman hung up the phone.

Everett glided his green card through the phone again, and spoke more quickly this time, "Mrs Akua wait… No, I know she's not there, I'm calling to speak to you… Yes, that's right… Oh, sorry to hear that… Oh, I see… Well, listen then, uh, perhaps you and Mister

Akua would feel a bit better if you came to California to spend Christmas with your daughter… No, I haven't been bothering her, haven't even mentioned it to her, it could be a surprise… Could you leave tonight?… I thought you could stay at my place… Well I like to think of it as cozy… Oh… Oh, I see… The Hotel del Coronado?" He thought for a minute (five dollars). "All right, I'll have my travel agent give you a call with the details."

Everett ended the call and placed another to his travel agent. He bought two one-way tickets on the redeye from Honolulu to San Diego and reserved the cheapest room available at the Hotel del Coronado. He put it all on his American Express card.

Chapter 2

Narcosis

He had refused to fly in single engine helicopters on several occasions in the past so he was relieved to discover the helicopter's twin-engine redundancy. When they had lifted off the tarmac in Nairobi he was too tired to consider all the potential night-mare scenarios relating to air travel in an aging rotor-winged aircraft over the coastal waters of a third world nation—but he had covered most of them. The Bell 212 whopped over endless nocturnal waters. Dr David Everett and Lieutenant Elmore Stearns, both wearing flight helmets, sat on a bench that transversed the fuselage.

Everett was reading a *Science* article by E.O. Wilson, doodling spirals over the text as he read. He looked over at Stearns. How could a human being sit that still for so long? Everett fumbled with the strap beneath his chin and managed to pinch the skin of his neck before he was finally able to remove the helmet and ask Stearns for the time.

Stearns glanced at him, tapping his own helmet.

"The time?" Everett asked, pointing to his bare wrist, "Do you have the time?"

Stearns kept his gaze out the window and said, "Keep the helmet on."

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Just before sunrise the helicopter headed for a cluster of islands—granite flotsam and jetsam left in the wake of Africa's pre-Cambrian split from India. Everett hung from his four-pin seating restraint—sound asleep, his dreams having swept him off to the fair land of Sweden where he was delivering an acceptance speech before the illustrious assembly at the Karolinska Institute. He had been awarded the Nobel Prize in medicine for his theory on coffee, for work that had been deemed so profound that no research, patents, nor other empirical evidence was necessary. His theory went like this: When faced with uncertainty humans drink coffee.

This theory shattered the prevailing thought that humans consumed coffee for its smoky, tannic flavor and caffeinated stimulation. For example: humans invariably awake from slumber in various states of uncertainty. *What time is it? Should I call in sick? How many times have I called in sick this year?* They make subconscious retreats to coffee drinking rituals in these times of uncertainty in order to pass time until released from the grip of indecision. He found corollary examples everywhere. On the job: *What am I supposed to be doing? Maybe I need a cup of coffee?* Or, *What is my assistant doing? "Get me a cup of coffee!"*

The more acutely and deeply afflicted one was with uncertainty, the more elaborate the coffee ritual becomes. This helps buy more time. Sanka drinkers are the mildest cases. Habits of those with advanced cases include adding sugar, adding cream, adding a little more sugar, freezing beans, grinding beans, French presses, custom roasted beans, and reheating cold coffee. And the habits witnessed in those struck with the most dire cases of uncertainty were a the peculiar breed of humans who get into automobiles, drive to coffee drinking establishments, further distracting themselves by coding complex orders with foreign phrases, drinking them over irrelevant reading materials, then driving back from which they came. And judging from the

number of coffeehouses on any given street in any given city, this was becoming a global epidemic—the pandemic black coffee plague.

Everett awoke remembering nothing of his dreams, but decided the first thing he needed was a cup of coffee. He wiped off the remnants of drool that had been streaming down his chin and headed up to the galley. Not much could be seen through the windows in the faint pre-dawn light—he tried to catch a glance of the waning gibbous moon but she was nowhere in sight.

Luckily the pilots had just brewed a fresh pot. He poured himself a cup, swirled in cream and sugar, then returned to his seat. Stearns remained awake but as still and cold as Florentine marble. Everett drank and fidgeted for a while then tried to strike up another conversation with Stearns. It was a good try.

Everett dug back into his reading pile and turned to some intriguing observations reported by his friend Claus Wedekind, a zoologist from Zurich. Wedekind's research orbited around a small tablet composed of norethindrone and ethinyl estradiol, a.k.a. *the pill*. He had been conducting research with a group of genes known as the major histocompatibility complex. These genes instruct a crew of cells to patrol the body for unknown organisms—anything *different*. His initial research showed that when a female mouse weighed the options between two mates, she always chose the one whose genes were the most different. She did this by sniffing his urine. The idea, as far as reproduction with this potential mate goes, is to foster biodiversity by creating baby mice with a broad spectrum of highly diversified genes. Wedekind tested humans next. He took a group of men, gave them clean cotton T-shirts, and asked them to sleep in the shirts over the weekend. Then he recruited a group of ovulating women and seated each one of them alone in a room. He asked them to sniff the T-shirts and rate them for sexiness, pleasantness, and wretchedness. The women reacted like the female mice—they were attracted to men with genes most different than their own. But there was one small catch—

women on 'the pill' always chose the one with the most similar gene-set. The potential result: inbreeding.

Dr Everett began to fear that women-on-the-pill all across the land were falling for the wrong guy. This brought a few variables to mind, and he retrieved a travel picture frame from his carry-on. The frame was sterling with blue silken matting and real suede backing—its intrinsic value making it conspicuous. The hinged frame held two photographs and folded upon itself for transport. As Everett opened the frame he glanced over his shoulder to see if Stearns was intrigued—if he was he fained indifference quite well. The photo on the left was a surreal Monument Valley sunrise panorama—the moment the sun's zenith edged up over a mesa in the East, casting mile-long shadows and shooting golden slivers of light into the camera-eye. The other photo captured the smiling eyes of a radiant woman, leaning playfully against a freshly restored, cherry red, vintage Ford Mustang. Gauging from physical appearances, he and the striking femme fatale in the frame were certainly radically genetically diverse. When they met and fell in love, she was not on the pill. Two years later, Everett recalled, just two months after her first set of pills, it was over.

By now the unbalanced sky tilted to the east, silently announcing dawn's approach, and in time the sun rose with a slow orange-blossom boil, gracing lapis lazuli waters, verdant palms, and sand swept purity—primitive, natural, and unspeakably beautiful. Everett drank it all in, wondering about internet access and pondering the romantic quotient of a breezy, effortless yet alluring note from the tropics, but the hunt for the right words was futile and Everett knew it didn't really matter anyway—he was not a poet and she had blocked his email address long ago.

Several Seychellois teenagers watched as the chopper set down on the beach. They had conch shells and starfish on display for the only tour group to visit that month—Dr Everett and Lt Stearns. As the rotor-wash sandstorm settled, Stearns stepped out and conducted a critical survey of the landscape through his standard issue sunglasses. Everett emerged, squinting at the

white-hot sand, and followed Stearns' lead. He shuffled his feet through the sand, kicking a little sand with each step, and with each step kicking a bit harder. For some reason it felt good.

Chapter 3

Rand Krisstenson

Submissive northwest trade winds granted tranquil seas of glass. Pure glass. The reflection of a skiff glided over the liquid mirror. Krisstenson rowed as smoothly as the azure waters through which he traveled, oars dipping into blue placidity. They say no man is an island but that's not true. Rand Krisstenson was an island in every sense of the word. He was in his 50's and virile—a breathing sculpture from a time when men hunted to feed their people and fought to protect their land. His skin was as tan as the teak speargun by his side. A dog with a spot around one eye—also known as Bandit—stood guard over a bucket holding three spiny lobsters, peering over the bow then glancing back at Krisstenson.

As Krisstenson rowed, the faded ink of a bluefin tuna tattoo swam with the kinesis of his shoulder. He passed over a coral reef, shipped the oars, and moved to the bow. His hair hung down in his face as he peered into the water. Bandit stood atop a heap of anchor line and their eyes traced aquatic movement in unison. It was difficult to ascertain whether Krisstenson's movements were dog-like or if Bandit's were man-like. Another skiff approached on the horizon.

A wiry Seychellois teenager ferried Everett and Stearns across the bay. Great beads of sweat snaked down their faces in the silent heat. The air was thick with the scent of bygone thunderstorms, frankincense, and myrrh. In the distance, Krisstenson dove overboard—speargun in one hand and anchor in the other.

Everett glanced over at Stearns and was about to ask a question when—under the sting of the equatorial sun—he was distracted by the realization that he wasn't wearing sunscreen.

Anchor line slithered across the bow of Krisstenson's skiff and slipped into the depths as they came alongside and climbed onboard. Everett wavered uneasily in the bow and Stearns, taking notice, rocked the boat with a quick shuffle-step starboard. Everett balanced himself with the gunnel rails. "Ha ha," he said, "very funny." Stearns seemed to think it was indeed funny, and betraying his stance of stoic indifference to everything, he laughed.

"That's right, laugh it up," Everett said, "I'm not so crazy about the water."

"You?"

"I'm a hydrologist, not a goddam lifeguard."

And that was true. Dr David Everett did not consider himself a lifeguard in any sense of the word. Many acquaintances made the false assumption that Everett had joined the National Oceanographic and Atmospheric Association (and later Medea) because he was a Great Guardian of Life, Champion of the Amazon, or Defender of Mother Earth. But he wasn't. Everett was good at his job, but did not take it home with him. There were already far too many troublemakers carpooling in his head. If everybody else was reclined in a Lay-Z-Boy watching the great ballgame of life, Everett often thought, why shouldn't I? Because my job—by some criteria—is considered more virtuous than others, was it expected that I sacrifice my leisure as well?

"Hey!" Stearns yelled, studying Everett's face with a significant level of concern, "Am I losin' you over there, Everett? I said, how could *you* be afraid of the water?"

"It's not the water that bothers me," Everett clarified, "it's the variables."

"Variables?"

"Riptides, undertow, radioactive isotopes—variables."

Rand Krisstenson, meanwhile, had yet to resurface but the anchor line snapped taut as the last coil unfurled. Bandit tilted his head, blinked, and lifted one ear. Everett leaned over the rail and peered down into the crystal water. The anchor line led down along endless fathoms of a spectacular coral wall, and out of sight into the darkness below. The boy had remained in his skiff alongside Krisstenson's. Everett turned to him as if to ask, is this guy okay down there or what?

The boy just smiled, shook his head "no", then pushed off and rowed for shore. They waited and watched for a sign of Krisstenson. Stearns glanced at his watch, "Damn."

Bandit barked twice, scurried, leapt off the bow, and swam towards the beach. Onshore, Krisstenson waded through the shorebreak—speargun in one hand, thirty-pound red snapper in the other. He walked on without looking back.

Chapter 4

Three Magi

The hut was perched high upon a granite bluff, overlooking the sea to the south and shaded by a grove of banana trees to the west. It was a Spartan dwelling: hearth, desk, table, and a teak bed draped in mosquito netting. The hearth was built in the fashion of an alchemist's athanor and constructed of freestanding brick. Bamboo framed etchings of local flora and fauna provided the only decor. The sketches resembled those of sixteenth century European explorers—a cross somewhere between art and science. An old steamer trunk was the sole personal effect. A large Seychellois coco de mer nut, first cousin to the coconut and known locally as the *forbidden fruit,* sat upon a chopping block.

Everett and Stearns had found three place settings at the bamboo table when they had eventually located the isolated hut at the southern tip of the island. They ate a fish stew, as tasty and peppery as Everett had ever had, while discussing the purpose of their visit with Rand Krisstenson: For the past week, a Medea task force, in conjunction with the Navy and the National Oceanographic and Atmospheric Association, had been monitoring two very peculiar marine mammal aggregations. Naval sonar readings estimated that there were nearly *fifty*

thousand dolphins along the southern Australian coast. And, even more astonishingly, initial reports from Earth Watch, a nonprofit organization in Hawaii, estimate roughly half the North Pacific humpback population had deviated from their traditional migration path towards Alaska and were in fact headed south instead. The findings were as unnerving as they were spectacular and Everett felt another moderate case of consternation coming on. He dug through his pockets for the Tums. "We have no idea what could be triggering the behavior," Everett said, "habitat degradation, ecosystem instability—interspecies issues? Who knows?"

Krisstenson got up and tended the fire—epitomizing conservation of speech, movement, and expression. "Nature has never given up her secrets easily," he said.

Everett stared at the glowing embers as he ate. The dry wood crackled, melding with the sound of wind rustling through the leaves of the banana trees outside. He had never been to these islands, not even to Africa, but the setting did not feel exotic. It seemed strangely familiar, as if visited in a recent dream. He was stirred from his thoughts as Stearns fidgeted with a button on his jacket.

Everett explained that two years ago he helped a team reconfigure a Navy sound surveillance network to track whale migrations, and several people were wondering if a similar application might shed some light on the current phenomena. Rand Krisstenson offered no opinion on this matter.

Stearns watched with considerable interest as Krisstenson reached for a large machete. He slipped his right hand into his jacket and rested it on his chest.

Everett spoke on, oblivious to their jockeying and quick-draw eyes, extending the invitation for Krisstenson to return with them and see if they could start putting the puzzle together.

Krisstenson's machete came down with a thunderous blow and sliced clean through the coco de mer. He squeezed a lime over the halves, salted them, and then handed the desserts to

his visitors. Everett thought Stearns looked a bit ill—jetlag perhaps. Bandit scampered in, tongue dripping and smiling, and honed in on the last of Everett's fish. "Can your dog have some?" he asked.

"He's not mine," Krisstenson said, "and how do you know he's hungry?"

Bandit bowed down with outstretched forepaws, begging with wide eyes and an eager tail.

"Well, look at him."

Bandit lifted an ear and cocked his head.

"Sure," Krisstenson said with a smile, "he can have whatever he wants."

Everett tossed the dog a scrap of snapper and watched him eat until he felt an itch on his forearm, scratched it, and looked down to see what it was. Jesus Christ—a mosquito bite! Suddenly he felt feverish.

"Doctor Krisstenson—" Stearns began.

"Call me Rand."

Stearns smiled impatiently. "We're aware of your citizenship issue…we've obtained an entrance visa and the Navy will cover all expenses."

"Sorry," Krisstenson said in a manner which led Everett to believe he truly was, "my answer is no."

But Stearns would not take 'no' for an answer and spent the next half hour trying to persuade Krisstenson to cooperate. Everett remained on the sidelines, watching the sun set and flatten its magic orange light across the waters, considering the fact that mosquitoes were primarily nocturnal feeders.

"Doctor Krisstenson," Stearns said, his patience running out, "I work under the direct authority of the Oval Office. The President requests your assistance—"

"My final answer is no."

Stearns drew a Crossman .117 caliber airgun from within his jacket, honed in over Krisstenson and fired. A dart stuck in the wall above Krisstenson's head.

"There is enough detomidine hydrochloride in these rounds to drop a horse for fifty minutes."

Everett tried to spit out a wide variety of profanities but was too thunderstruck to expel them. Don't just *stand* there for Chrissake, he thought, do something! With no certain objective in mind, he took a step towards Stearns.

Stearns reached his free hand back in his jacket and pointed the barrel of a well-oiled military issue .45 at Everett. "This, on the other hand, drops a horse for much longer."

Everett decided to just stand there afterall.

Stearns kept his focus on Krisstenson. "I've got sixteen hundred meters of uneven terrain and moderate vegetation between here and the chopper. I don't especially want to carry your ass, or monitor your heartbeat every fifteen minutes for the next ten hours. But I will."

Krisstenson looked through Stearns as if he was not there.

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"You're out of your goddam mind!"

"I'm well within my authority."

"*Authority?* I may not be a lawyer but I'm relatively certain that dropping by someone's house for dinner, administrating unsolicited sedation, then dragging them halfway around the world is, at the very least, poor fucking etiquette!" Everett rounded a sand dune, lugging the old steamer trunk across the sand. Nighttime had fallen and millions of distant suns sprinkled their diamond light from above. Stearns made his way around the dune with Krisstenson draped over his shoulder, and they trudged through the night and through the sand like three lost magi.

"You gonna tell me what the hell's going on or what?" Everett asked.

Stearns heaved Krisstenson into the helicopter and took his pulse. "Admiral Cross says bring a man back, I bring him back. That's what's goin' on."

Dr Everett strained, hoisting the trunk into the helicopter, wondering why Stearns had bothered to carefully pack up every last one of Krisstenson's earthly possessions and load them into it. He didn't bother to ask Stearns why—by now he understood the lieutenant's forte was not answering questions.

Chapter 5

Prometheus

Polar research vessel *Prometheus* plodded through the semi-frozen Ross Sea along the coast of the highest, driest, coldest, windiest continent on Earth—Antarctica.

This three hundred foot, twelve thousand ton, double-hulled icebreaker was the most sophisticated polar explorer ever built. Winches, telescoping beams, stern-mounted A-frame, and a pair of twenty-ton cranes graced her deck. Triple Caterpillar diesels plowed her through the ancient pack-ice like a crazed carbide drill bit grinding through an endless mouthful of molars, bicuspids, and incisors. Progress was tedious at best—less than two knots. It was as if every molecule of ice served as a reminder that no man could ever call this land his home.

The horizon was dominated by the vast expanse of the West Antarctic Ice Sheet—three-quarters of the world's fresh water supply in a single mass of ice. Glaciers descended upon imperceptible slow motion migrations towards the sea where thick floating ice shelves buttressed and restrained them. There, frozen slivers splintered off and tumbled to the sea where they became icebergs. These *splinters* were twenty miles long. The icebergs adorned the seascape with brilliant ever-changing shapes and every shade of blue. Tabular, fractured, and towering

spikes—the oldest of which gleamed with surreal hues of cobalt—like Technicolor film or Easter-egg dye. Bay ice pack was stained black with basaltic earth and others dusted in a volcanic shade of mustard.

Prometheus rounded the tip of a deep blue berg the color of the Aegean at sunrise. The upward thrusting berg formed a hollow archway where the ice met the sea, like the legs of the bronze Colossus that legend has once straddled the harbor of Rhodes. On the other side of the iceberg, stretching to the horizon: the Ross Ice Shelf. Sir James Clark Ross, the intrepid nineteenth century explorer himself, described the shelf as 'a mighty and wonderful object far beyond anything we could have thought or conceived'. Inconceivable indeed—an ice shelf the size of France.

Within one of *Prometheus*' nine onboard labs, Sean Daniels, a twenty-eight year old glaciologist hailing from Seattle, watched a glacial flow chart stream from a printer. Daniels was tall and could have used a few pounds. His face was severe, full of faded freckles, yet charismatic, even photogenic. He slouched so low in his chair that the back support presently served as a headrest.

Prometheus' Captain Franz Koenigs was making an entry in the ship's log, stopping occasionally to run a fountain pen through his beard. Koenigs was an archetype perhaps, of what every ancient mariner might look like, the kind of grizzled old seadog who puffs through O'Brian paperbacks and calls everybody under the age of 60, "Son". He scripted in the glassy light of his brass oil lamp smoking a sweet aromatic blend from his favorite Larson pipe, then turned down the wick of the lamp, stood, and began pacing the lab. He asked Daniels if he had ever told him about the first time he laid anchor in Havana. Captain Koenigs was, furthermore, a relentless *portdropper*, the seafaring equivalent of a namedropper.

Daniels ignored him. The answer to this question was irrelevant. He was going to hear the story whether he had heard it before or not.

"The sun was dipping into the Gulf and the clouds all aglow crimson and gold" the Captain began, painting the scene with his giant hands, "Old-timers rolling cigars on the wharf… Fifty cent Jineteros draping from every sailor's arm… Good God, what a harbor town she was—"

"Jesus," Daniels said, "check this out." He sat up and pulled pages from the printer, "Ross slid more this week than he did in the past fifty-two."

The Captain took the pages from Daniels.

"Captain," a stout crewman called out as he burst into the lab, "Better come up and take a look."

Chapter 6

Sleeping Beauty

Stearns had arranged for a Navy transporter on the return. 'Sleeping Beauty', that's how Stearns referred to Krisstenson, certainly would have exceeded Lufthansa's carry-on baggage size restriction and made for interesting conversation at the customs booth. This transporter was the largest aircraft he had ever seen. Everett didn't know what type of aircraft it was—his thoughts were too scrambled to make an inquiry—but he imagined it was of the same ilk as those used in the transcontinental transport of a wide variety of heavy matter, including weapons-grade plutonium. Everett tried to dismiss the thought once again; he was probably reading into things as usual, but he had further reason to forward his far-flung conspiracy theory. He was acutely aware that high-level radioactive wastes had been stockpiling for over half a century with no permanent disposal method in place. Temporary slurries at over-capacity reactor plants were packed to the gills with spent fuel rods, and disassembled Cold War-era warheads had piled up wastes at military facilities all over the nation. For the past three decades the Department of Energy had been collecting fees for the disposal of nuclear waste byproducts in a proposed repository at Yucca Mountain, Nevada. Dr Everett had, in fact, been a member of the

hydrological impact assessment team to inspect the site. When, once upon a time, he had pulled over at a roadside diner en route to Yucca Mountain, a mullet-headed man stepped out of a Ford pickup truck to greet him. Said man had approached him saying something to the effect of, "Don't toucha Yucca, muthafucka!" before knocking Everett unconscious in the gravel parking-lot by delivering a fat fist wrapped around a roll of quarters to Everett's forehead. This sentiment, as it turned out, was the consensus, and thus approval labored for years to pass through legislation. Two years ago the courts ordered the Department of Energy to begin accepting waste although the repository would not be complete until 2010 at the earliest. Hence a major dilemma. Dr Everett had heard rumors of a covert vitrification plant on an uninhabited island in the Marshall atoll, coincidentally or not so coincidentally, located 1200 miles south by southwest of the Hawaiian Islands.

But he had checked an *International Herald Tribune* before they got onboard in Nairobi and there was no news of lost plutonium. There was no news of lost anything. Everett began to suspect his imagination was at it again and began to regret the call he had placed to Hawaii because, although his grasp on nuclear physics was rather limited, he did know this—his finances would undergo thermonuclear destruction if the Akua elders had a protracted sojourn at Hotel del Coronado. As engine reverberation swirled through the transporter's cavernous cargo bay, he was haunted by the zipper whisper of a telecredit invoice printer—one night's stay plus tax, minibar, phone call, room service, minibar, breakfast buffet, phone call, phone call, poolside cafe, room service, another night's stay plus tax.

And low beneath the bow of this disquieting whisper, a deeper, more polluted stream of indefinable uneasiness ran its course. Clouds of confusion drifted in, flattening the light of mental acuity. He decided to get up and go back to the lavatory and shave. He dug through his bag and found a can of shaving cream and his razor. His beard was as thick and full as any man's, but not more so. Shaving calmed his nerves. Why? He could not say. It was almost as

if he were able to scrape tension from his face. Everett went back, ran hot water, lathered, and pulled the razor up and down and across his face. But this time shaving did not work. He was about as calm and cool as a peptic ulcer. And to make matters worse, he suddenly remembered the mosquito bite and felt feverish again. He considered another shave, but returned to his seat and pulled out *Mustang Monthly* instead. He flipped through the pages nearly fast enough to make it look as if the cars were moving. This eased the tightness in his chest a bit. Cars are finite. Cars have parts, all knowable and obtainable. They have manuals that describe gear interactions, carburetion, and operations. Various periodicals state plainly the ways in which they may be repaired, modified, or improved upon. Everett had always wished he, his family, and friends were more like cars. He spotted a good looking '68 Shelby, and naturally thought of his own '68.

Dr Everett loved this car in ways that men rarely love cars. He had yearned for such an automobile for as long as he could remember, but could never say just exactly why. Everett knew the Ford Motor Company's Mustang project history from beginning to end, and every engine configuration for each model from 1964 to 1968—the only years that mattered. And as far as this particular 1968 GT-350 California Special Mustang was concerned—the first, last, and only Mustang he had actually owned—Everett knew every nut, bolt, original, restored and new-old stock part. There are two methods of payment for a car such as this: time or money. In Everett's case money was not an option—he spent time, lots of it. It had all begun with a hunt, far away from the collectibles marketplaces of Southern California. Three months into the hunt, he discovered Ida Svendell, an elderly woman from Lone Pine, California with a '68 for sale. After a quick phone call to Ida, he jumped into his Impala and hit the road. Adrenaline coursed through his veins as he scorched across the Mojave. The desert sands and the high Sierras hung in clouds of cool red mist as visions of horsepower danced in his head—all for the

price of three thousand dollars. He didn't stop for food and almost ran out of gas, gunning it to Lone Pine in three hours flat.

When he pried open the door to the old woman's garage the horses stopped dancing. The car was a piece of shit. As it turned out, every Mustang collector in Southern California had already seen it—and politely declined. First and foremost, the engine was missing. Her son had taken it out ten years prior and mounted it in his jetboat on Lake Havasu. Ida had failed to mention this on the telephone. The paint was definitely not original—someone, he assumed her Lake Havasu son, had done a camouflage number on it in the late seventies. And a mad kindle of feral cats had set up camp *within* the back seat's upholstery. Otherwise, the car was perfect. They agreed upon two hundred dollars and Everett hired a local flatbed to haul his prize back to Los Angeles.

Relaxed now, Everett reminisced through the 78 consecutive and secretive Wednesday nights he spent restoring the '68, a process that began by ordering a reproduction of the famed 427 cid V8 from a remanufacturer in Seattle. He reminisced in as much detail as possible as to prolong his state of relaxation. He had replaced the stock 650 Holley carburetors with something more serious and topped it off with a free-breathing exhaust manifold. A friend of his recovered the seats with marine quality Naugahyde in exchange for Everett's childhood baseball card collection.

A year and a half later, after begging, bartering, and only in a few isolated, completely necessary instances, stealing the remainder of the parts, he walked down the street from his house to the local Mercedes dealer and bought the paint. And although they were spraying the cars at the Daimler plant in Germany with seven coats, he bought enough paint for nine. He masked then glazed her *Apfelzucker* red with two glossy white racing stripes and Shelby-style trim. He added the Lucas fog lights on the inside corners of the black mesh grille when they arrived from England two weeks later.

Chapter 7

San Diego

It was a city to visit, not a city to live in,
but it was the city where (he) had first fallen in love
and he was held to it as though to the scene of a disaster.
Time gives poetry to a battlefield…

—Graham Greene, *Our Man in Havana*

The Naval Command Control and Ocean Surveillance Center (NCCOSC) designs and operates systems, which collect and analyze complex information for naval purposes. One of the greatest hurdles of modern warfare is tactical information overload. Hundreds of sources provide data ranging from ship locations to sea and weather conditions. Each piece of information can affect decisions and each decision can affect the outcome of a conflict. All data is essential. The NCCOSC's mission is to get systems to communicate with each other, integrate the data, and make it useful. The center, located on Coronado Island in San Diego harbor, staffs over four thousand scientists, engineers, computer specialists, and technicians.

Stearns escorted Dr Everett and Rand Krisstenson down a long corridor, its walls painted a matte shade of gray too dull for a name. Stearns stopped briefly to issue laminated security passes.

Krisstenson hadn't said much since he awoke, but Everett figured he was, at the very least, a little pissed-off.

"Rand!" Admiral Nathaniel Cross III, Commander of the Pacific Fleet, said as he rounded the corner and greeted Krisstenson with a big shit-eating grin. "Enjoy the flight?"

Krisstenson shot Stearns a telling glance, "slept like a baby."

The shook his hand like a man who needed a big favor and didn't know how to go about asking for it. "It's good to see you, Rand."

Krisstenson did not reply.

Everett was embarrassed by the Admiral's nervous reaction—one of those unabashed laughs that can be useful in awkward moments. Cross, a tough-as-Texas Californian with salt and pepper hair cropped in a manner his rank had not required for decades, pressed on with his Texan bravado, trying to make small talk as he led them down an elevator and through the labyrinth. "Sound surveillance has grown up a bit since you saw her last." They passed through security clearance and double doors. "But any-who, no need to track Soviet subs," Cross said, "all just rustin' away in harbors anyhow. Now we got a sixteen billion dollar fish finder."

The Sound Surveillance Systems Center was a culmination of much of what the twenty-first century had to offer in terms of information technology. Serious technology. Flat-panel liquid crystal displays mounted flush with the walls depicting razor sharp satellite images of US coastal waters. A Cray T3D scalable parallel processing system—a super supercomputer serving as interface between a closed network of massive parallel processing and the open seas—was encased in glass off to one side. Everett heard the faint hum of electricity passing through shielded cables and it felt as soothing as a cold compress to his forehead. 1,324 linked SGI

processors burning circles around input, computation, and output at 3.39 teraflops per second—processors that experience more in a single second than a human will think in a lifetime.

Medea Chief Scientist Victor Ladir was hunched over an LCD with a small group of Medea technicians. When Everett spotted Ladir he lost his train of thought. Ladir was fit and his face was hard, dry, and pitted like an almond. He was the proud owner of two of the most aggressive eyes found anywhere in the animal kingdom, and his mouth was small and inconspicuous, befitting his disposition as a man of few words. So few, in fact, he had the uncanny ability to pass through entire conversations in silence, yet maintain the impression that he had said a great deal. At times this reticence lent him the air of intelligence or nobility—but not always.

Ladir glanced up and vaguely addressed Everett. "Take a look." There on the LCD, a live news feed from the coast near Santa Monica. There, along Entrada Beach, two, three, perhaps even four thousand dolphins rolled along the shore, stretching to the horizon—like a great Western cattle drive at sea. The dolphins were everywhere—as ubiquitous as the water itself. Rising, breathing, falling, rising, breathing, falling. And although synchronized behavior is a particular and everyday skill of dolphins—choreographed leaps, tailbeat matching tailbeat—the display, when multiplied to such measures, was nothing less than pure magic. Throngs of spectators gathered on the beach, commuters waded in the shallows, and network helicopters hovered over the scene as if it were the Super Bowl. And as Everett stared at the television in awe, an odd mélange of unfamiliar sensations conjured within—but they vanished when Commander Leilani Akua, Director of Marine Mammal Systems, passed through security clearance and entered through the heavy double door. Her neck, where it met the silver oak leaf on her khaki collar, appeared too slender to hold her disciplined posture. Yet it did. And

despite the formality of her gait and the three gold bars upon her shoulder, a natural effervescence bubbled from within. Everett took as little heed of her entrance as possible.

Admiral Cross made the appropriate introductions. "Rand, meet Commander Akua."

Krisstenson said hello and extended his hand.

Everett thought Leilani held his handshake a bit too long.

"Hello Doctor Krisstenson," she said with a smile as reassuring as sunshine.

"Call me Rand."

"All right."

Krisstenson smiled in return. "So how does the most beautiful woman in the world find her way to the US Navy?"

"Heard it was a great place to meet men," Leilani said without missing a beat and winking in response as if they were old friends. Everett decided that he and Rand Krisstenson would never be old friends.

Cross added, "of course you know Doctor Everett."

"Yes."

Everett forced a smile, telling himself there was work was work to do. Besides, he thought, I'm not in love with her, anyway. No, in fact, I don't even like her.

Commander Akua directed their attention to a large global display, explaining that in tracking the migratory deviations, a pattern was emerging. Many whale species spend winter months in the tropics then migrate to polar waters for summer. Historically, species had not crossed over the equator, but over the past weeks several northern species had begun moving into the Southern hemisphere. The Ocean Surveillance Center's network of detector arrays tracked these mammals by listening for each species' native tongue, so to speak. Various species' vocalizations—their patterns of speech—produce recognizable footprints within

distinct frequency ranges. On the display, multi-colored illuminated pixels speckled oceanic waters, tracking the routes of various audiograms. Leilani spotlighted a large lime-green lit area in the coastal waters of western Antarctica, indicating blue whale calls in the seventeen-Hertz range. By her estimates most of the Earth's remaining thousand or so giant 'blues' crowded those very waters at that very time.

She continued at length regarding the known specifics and the evolution of this southerly migration. A member of the Medea contingent advanced a hypothesis regarding elevated oceanic water temperatures. Leilani's response had begun to wander into an esoteric arm of migratory behavior theory when, quite suddenly, the lime-green concentration representing the blue whale population disappeared. "Southern polar arrays must be down," Leilani uttered as she turned to an attentive technician. "Check it out."

Two engineers rushed into the supercomputer's glass housing as the main monitor's rainbow colors disappeared from Antarctica up the continental coasts to Arctic waters.

"Talk about rapid extinction," Everett quipped, hoping it might get a laugh or two.

It didn't.

***

After the briefing adjourned Stearns escorted Krisstenson to his accommodations in the barracks. Once there, Krisstenson took special interest in the kitchenette and the television, two things he hadn't seen in a while. His interest in television was short-lived—he turned it off and put his steamer trunk on the bed. The trunk was plastered with customs stamps from Finland, Australia, and remote outposts throughout Indonesia. He unbuckled the trunk's rusted hasp, opened the lid, and inspected its contents: an RCA 1968 Solid State portable Victrola

record player, headphones, an old green aluminum glass-insulated thermos, Wahl stainless steel hair clippers, and a case of assorted Jell-O brand gelatin.

A kettle of water began to boil. Krisstenson tore open a packet of cherry Jell-O, dumped the red powder in the thermos, grabbed the hair clippers, and headed for the door. As he left his room, Stearns rounded the corner at the end of the hallway and looked back with a casual glance. Coincidence? Krisstenson didn't seem to think so. He proceeded into a bathroom of gleaming porcelain urinals and a large common shower. Krisstenson began plugged in his clippers, then peered back into the hallway—Stearns loitered by a drinking fountain at the end of the corridor, stooping somewhat abruptly for a sip of water.

Krisstenson smiled and ducked back in the bathroom. He had noticed the slight irregularity in the laminate of his security pass when it was issued. Closer inspection was in order. He removed the pass and scraped the clipper blades across the polyurethane surface, eventually revealing a micro-transceiver sandwiched in the lamination.

He studied the transceiver for a moment then tore off two pieces of paper towel and opened a window in the shower—just wide enough for a man his size to climb through—tapped his boots on the damp tiles of the shower floor, then kicked the wall below the window, leaving a visible footprint. He set the paper towels on the floor and quietly skated on them back to a perch atop the stool in the end stall. Then he flushed the transceiver down the toilet.

Stearns' Timex began beeping intermittently—except it wasn't a Timex, it was a US Navy Reconnaissance Systems 7 micro-GPS wrist transceiver. He rushed purposefully into the bathroom but Krisstenson was nowhere to be seen. The pulse of the wrist transceiver faded rapidly as Stearns checked inside the shower. He spotted the window and the mess on the wall, then bolted back out into the hallway.

Chapter 8

Marine Mammal Systems

Navy, Coast Guard, and commercial vessels of every shape and size crowded San Diego harbor, the world's largest naval port. Home to the likes of the aircraft carrier *John C. Stennis*—boasting 97,000 tons of mobile American soil, 1092 feet in overall length, 6,000 onboard personnel, and 85 aircraft. Dozens of destroyers and cruisers were moored side-by-side, their decks clear as the cloudless twilight. Viscous puddles of diesel fuel floated translucent rainbows over the water's dark surface and the bellow of a Coast Guard cutter called from the distant tip of John Wayne jetty.

The Navy's Marine Mammal Systems was located across the waterway from the Coast Guard helipads at the Naval Air Station, tucked behind a wet-docked Los Angeles class sub. Open-top underwater pens held members of the Navy's specialized divers—sea lions, dolphins, and Beluga whales. The first pen housed Tuffy III, a large female Bottlenose dolphin. Tuffy had searched for mines and enemy divers in the Iraqi port of Umm Qasr during the Second Persian Gulf War. She was a veteran.

Tuffy watched quietly as Krisstenson slipped into the water, head clean-shaven and a trashbag slung over his shoulder. He slithered along the marine mammal pens—pens he helped build thirty years ago.

The Navy had purchased their first Pacific white-sided dolphin in 1960. Scientists at the China Lake Naval Ordinance Test Station had heard accounts of the porpoises' hydrodynamic efficiency and wanted to find out if these efficiencies could be applied to torpedo design. This effort proved futile, but the Office of Naval Research became interested in the dolphin's specialty systems—especially their sonar and deep-diving physiology.

Thus a modest facility was built on a sand spit between the lagoon and the ocean at Point Mugu, California in 1963. With newfound understanding of cetacean intelligence and communicative systems, primary interest shifted to training porpoises to perform helpful tasks. During a 1965 exercise, an untethered Bottlenose dolphin carried messages between the surface and divers operating at a depth of two hundred feet. In 1967 the facility became the Naval Undersea Center and joined forces with the Marine's efforts at Kaneohe Bay, Hawaii. Four years later, Commander Rand Krisstenson was appointed the program's first official director.

Under Krisstenson's guidance, extensive neurophysiological studies were conducted and the program flourished. He improved techniques for diagnosis and treatment for health problems of captive dolphins as well. To his superiors, Rand Krisstenson's most notable accomplishment was the development of the Nexus 7 Marine Mammal System (N7 MMS). This system deployed sea lions to locate and attach recovery hardware to distressed human divers, thereby eliminating inherently dangerous human search and rescue efforts. N7 MMS became operational in 1975 and is in operation to this day.

At the end of the pier by the sea lion pens, Krisstenson reached up, uncleated a Zodiac inflatable boat, and swam off with the inflatable in tow. He pulled himself into the Zodiac,

fished out the trashbag, and putted off in the dark waters below the *USS Coronado*, flagship of the Third Fleet. The BRAVO flags, marking North Island's munitions bunkers, fluttered in the muted moonlight and the unseasonably warm winter breeze. The white and orange lights marking the degaussing range's northern approach flickered across the bay. Krisstenson motored on, past Ballast Point, and past the sky-searing twirl of the lighthouse on Point Loma.

San Diego's city lights shimmered on the horizon like terrestrial stars. One mile offshore Krisstenson killed the fifty horsepower outboard, carefully removed his Victrola record player and a ceramic hydrophone from the trashbag, then ran a powercord and inverter from the turntable to the boat's 12-volt battery. He unwrapped a box shrouded in oilcloth to reveal a dozen vintage vinyl albums nestled inside. He flipped through the first few titles: *What's Goin' On, You're All I Need, United*—all by Marvin Gaye.

Krisstenson slid a record out of its sleeve, placed it on the turntable, and lowered the needle. Analog sound popped and hissed as the needle glided in the groove. Jazz guitar, piano, congas and strings led in Jamaican steel drums, then a soulful voice ignited the percussion explosion that begets *The World is Rated X*.

The music faded to muffled liquescence as Krisstenson lowered the speaker and hydrophone into the water. He pulled on the headphones and listened to the music echoing through the nocturnal waters below. One hour and forty-six minutes later the album ended. Gentle swells cradled the Zodiac under the last quarter of the silver moon.

Krisstenson withdrew another vinyl platter from its jacket, set it on the turntable, and poured a hot cup of Jell-O water from the thermos. He adjusted the headphones then reclined in the bow with the nape of his neck nesting on a pillow of interlocked fingers, gazing up into the night sky as Marvin Gaye and Tammi Terrell spun at a steady thirty-three and one-third revolutions per minute.

Chapter 9

Leilani Akua

She had only been asleep in her bunk for a few minutes when she got the call. Deep Ops night diving maneuvers had maintained a perfect safety record for the past eighteen months—but it ended that night when a hydrazine gas lift-bag inflated prematurely at a depth of three hundred feet and shot a Deep Ops diver to the surface, blowing by the requisite decompression stops. As the diver ascended the nitrogen that had accumulated in his blood stream did not have time to dissolve. Instead, it had accumulated in his spinal column and had left him paralyzed from the neck down. He had the bends. But that was hours ago—before he entered into the Land of Miracles.

And Leilani was the presiding angel in this land—a magic domain of hyper healing. Seemingly impossible feats of human recovery took place in this logical, self-contained universe where she spoke the language and knew all the rules. This played out in a medieval looking contraption standing in the center of a rather stark room heavily coated in gray paint—a cramped emergency room for two within a steel, airtight tomb. This was the Navy Explosive Ordnance Disposal's multi-lock hyperbaric chamber.

Leilani wore her old University of Hawaii sweats—countless washings had worn them into thin, form-fitting cotton and they had attained mythological status amongst North Island sailors. Lighting was dim, but it was easy to see that Leilani was exhausted as she peered through a window to check on the diver inside. Alone, she released the smile that she held up throughout the day. A small radio aired KOST-FM—'love songs from the coast' was their motto. She picked up a *San Diego Tribune:* the cover featured a sea of ten thousand dolphins. She read the article then turned to her horoscope. It read: 'Moon position favors romance. You will find your soulmate'. Soulmate—she liked that word.

Once upon a time, Leilani's grandfather, a *paniolo* at Parker Ranch on the Big Island, had fallen asleep on the job in a lush, high mountain pasture. He awoke late in the afternoon to the discovery that the workday had been spent in search of his whereabouts. The ranch foreman, Howard Hope, had decided a hot iron *Circle-P* brand on his hind quarters would somehow remind him to maintain consciousness on the clock. That night, Leilani's mother, Maileia, set out to avenge her father and found a sympathetic and willing warrior, the eldest son of a local pineapple farmer. He held her under the stars high over a sugarcane field and they spent the night sharing secrets and plotting fields of revenge. Then they fell asleep.

In the morning this farm boy cut two stalks of sweet cane and told Maileia of the dream he had the night before. He had dreamt he was a knight in King Arthur's court and that King Arthur was moonlighting as the King of the Hawaiian Islands in the off-season. Arthur had gathered his people for a great festival in Maileia's honor. A joust commenced and the farm boy was to compete, but he was buck-naked and had no horse. His opponent, a mystic shadow knight in heavy platemail, rode a horrific steed, a nightmare as swift as Makapu'u winds. As he drew near, the farm boy recognized him as Howard Hope, the Parker Ranch foreman. Lances raised, the crowd roared, and Howard Hope was delivered from this Earth.

Aside from its questionable overtones, Maileia had thought the dream divine, and she returned the next morning to help her mother care for her father. But news had reached their home ahead of her arrival. Early that morning, as dawn painted her slender fingernails in the East, Howard Hope was gored to death by a great Parker bull. 'That,' Maileia Akua had told her daughter, Leilani, 'was when I knew your father was my soulmate.'

Leilani sat outside the hyperbaric chamber watching the injured diver within, listening to love songs from the coast and wondering which Navy knight would slay the dragons that haunted the dreamland of her nighttime soul—sweet memories turned sour by the bitter grapes of loss and regret. Who was he? What did his dreams look like? One thing was certain: He was not David Everett.

Leilani kept her eyes on the diver within the chamber and began to compile a mental list of things she needed to do in the morning when two strong chords from the heart of a grand piano led in sweet, supple vocals as another song played on the radio. Leilani wasn't paying much attention, but a slow, dizzy sensation set in as she listened more carefully. Leilani reached for the telephone and asked the operator for KOST-FM's number. She dialed and reached a busy signal but kept trying. The song ended before someone finally picked up and said, "Sorry, you're caller eleven," then hung up on her. She called back. Five minutes later the DJ picked up the phone again and said, "KOST-FM".

Leilani spoke in her most militant manner, awkwardly filtering out emotional inflections. "Would you please tell me the name of the song that played a few minutes ago?"

The DJ flirted and asked her to sing it to him.

She really wasn't in the mood. "It goes something like—Eddie I do believe I've failed you… Eddie I know I've let you down…"

The KOST-FM DJ told her it was *Adia,* not *Eddie,* and that that was the name of the song.

"Oh, well who sings it anyway?"

"Sara McLachlan," the disc jockey told her.

"Oh—okay, well thanks. Bye."

Leilani steered her attention back through the window and into the chamber and decided to say her prayers in case she was too tired to say them when she got home, but Seaman Jordy Sommer strolled in before she began.

Sommer's downy hair agreed with his boyish face, and his back was strong, pushing his big round shoulders forward. He reminded Leilani of a happy blond bear but she'd never admit that to anyone. He handed her a can of Mountain Dew and peered into the hyperbaric chamber. Leilani kept her eyes on the chamber window, but Sommer's eyes instinctively fell elsewhere, on the thin cotton intrigue. His gaze shot back to the chamber window as she turned to face him.

Inside the chamber, a Navy diver lay on a stretcher with only a sheet covering his physique, his soggy wetsuit crumpled on the floor. A pretty, spirited, and rather buxom EMT sweated profusely as she checked his vital signs. They both appeared intoxicated. Pressure induced nitrogen accumulation results in nitrogen narcosis—a loss of critical thinking capacity, giddiness, and euphoria. Breathing the air inside the chamber was tantamount to drinking five or six beers per hour. By Leilani's calculation, that meant they had been in there for over a case of Budweiser each.

Neither Leilani nor Sommer could hear inside the hermetically sealed chamber, but both watched as the diver lifted his arm under the sheet like a great monolithic erection. The seaman slipped out a faint laugh.

"Something funny, Sommer?"

Seaman Sommer's smile vanished.

Leilani cracked open her Mountain Dew. "Many men falter on the brink of greatness because they're unable to think with the proper anatomical apparatus—" And just as she was building steam, Dr Everett rushed in. "Speak of the devil."

Everett pulled up a chair and glanced inside the stark, gray steel chamber. As far as he was concerned, all hyperbaric chambers possessed the same basic safety feature—they functioned as medieval gargoyles, posted to frighten the uninitiated from daring to venture into hallowed deep-sea cathedrals in the first place. As he peered through the window the diver flashed the EMT. "Looks like the patient is showing signs of improvement," Dr Everett said.

"Yeah," Leilani said with a sigh and checked her watch. "So what's up?"

"Can we talk?"

"Sure. Shoot."

Everett glanced over at the sailor, "Someplace private?"

Leilani reluctantly agreed and gathered her soda and cigarettes, instructing Sommer to monitor the chamber and to page her if needed.

Chapter 10

Songlines

Krisstenson drifted in the still Pacific, asleep in the Zodiac's bow. *Your Precious Love* swirled through his headphones. The boat floated over the canopy of a giant kelp forest, the leafy blades lightly whisking the boat's rubber tubing. The song ended and the needle wandered aimlessly in the glossy blank track at the end of the album, humming a steady stream of faint pops and hisses. Light ripples began to brush the water's surface as a gentle offshore breeze blew from the cooling continent to the east. The breeze rotated the Zodiac.

Then some of the most mystical waves of sound emanated from any source on Earth mixed in with the sound of unpressed vinyl. Krisstenson's eyes opened, but his body remained still. Soft and intricate fabrics of primeval whistles and resonant rumbles wove with groans, cries, and rasps. He rose and gently lifted the needle off the record. Now only ambient ocean clicks played harmony for the musician with the longest, most varied song in the animal kingdom.

Krisstenson pulled off the headphones and slipped on a pair of long-bladed fins, their black rubber fittings faded and cracked through years of salt and sun. He dug two underwater

flares out of the trashbag, took three quick breaths and a deep inhale, then slipped down through the kelp forest canopy. He began a long freefall with an unlit flare in each hand. Moonlight surrendered to the dark abyss and the haunting beauty of the song. At fifty feet Krisstenson struck a flare—scorching light erupted like the arcing tip of a welder's torch. He descended through surreal stalks of giant kelp to the edge of the forest. In the dark water below, a giant ghost took shape: a humpback whale. Krisstenson floated closer. Issa said only birds sing the music of heaven in this world, but apparently he had not heard the song of the humpback whale—audible transmissions of wave vibrations capable of evoking heightened states of bliss and sorrow. Something, possibly, like an orchestral Pietá. The singing ended abruptly and the whale hung silent and motionless in one hundred feet of water. This whale, a female of magnificent proportions, weighed in excess of forty tons and stretched over forty feet through the water. Her most notable features were two enormous flippers; smooth and pure white below and mottled black and white on top. Krisstenson leveled out twenty or thirty feet away, averting his gaze. He had been under a full minute.

The whale sang again—picking up exactly where she left off. The song swirled on with the dreamy narrative of a 1940s late night radio show. The soundwaves pulsed and the conductive waters of the Pacific carried them for miles in all directions before fading and disembarking at destinations unknown. The melodies and sweet supplications of the great whale melded into the midnight hour.

With a gentle, almost imperceptible movement of her flukes, the whale rotated her mass. Krisstenson's flare died with a fleeting sputter, leaving a pitch black void in the swirling wake.

Krisstenson struck the second flare and when it blazed, the whale's eye was within arm's length of Krisstenson's face. This whale was 400 times his size. Krisstenson's entire body was reflected within the eye.

The whale announced her departure with a roll of her barnacle-encrusted head—forty feet and forty tons moving with lightness, delicacy and astonishing grace. The humpback extended her giant hand-like flipper, consisting of recognizable, albeit elongated finger bones. Krisstenson held out his free hand and ran it along the passing flipper. She slipped off into the darkness and swirling water settled without a trace of the giant. Krisstenson was alone in the dark—pushing two minutes. He slowly glided his long fins back towards the surface.

Chapter 11

A Goose Hunt

"Come on," Everett said, "that's ridiculous and you know it."

Leilani sipped her Mountain Dew, lit another cigarette, then returned to the topic of their current conversation: the prospect of an across-the-spectrum frequency shift in marine mammal communications. The Ocean Surveillance Center's network had not, as she had previously presumed, crashed. It was and remained fully operational. "Ridiculous, huh?" Leilani said, wondering how in the hell she lost track of half the world's whales. "We'll see about that."

A wiry and blotchy skinned technician ran the graveyard shift in the electric glow of the Sound Surveillance Systems Center's flickering monitors. A paltry spectrum of rainbow lights spotted the oceanic waters on the main monitor, but blackout clouds still lingered worldwide, especially over Antarctica.

Leilani sighed a faint stream of smoke. "Open 'em up," she ordered the technician, "search high and low frequency emissions."

The technician fired up his workstation and asked the Commander what color to code the search results.

"Red," she said, catching David checking out her legs, "like somebody's face when he sees this monitor light up like a Christmas tree."

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"G'mornin' Sunshine," Krisstenson said as he opened the door.

Stearns entered his barracks uninvited, eyeing Krisstenson's shaved head. "Nice haircut." He was tired, irked as hell, and looked like shit—literally. Stearns had spent the previous night following the beep of his Timex GPS wrist transceiver. The pulse led him along a bizarre path through the Naval base and across Coronado Island. He had assumed, of course, he was trailing Rand Krisstenson. Just before sunrise, however, after scrambling through seven miles of sharp elder brush, over chainlink security fences, and through a stinky, boggy marsh, he had arrived at an immense industrial complex—the San Diego Sanitation Facility. He had been following the main sewage line. A line notorious for leakage.

Krisstenson did not speak. Stearns scanned the room, sweeping grains of sand on the floor with the sole of his shoe. "So tell me, did Sleeping Beauty go somewhere last night?"

"Met an old friend," Krisstenson said.

"Old friend, huh?"

Krisstenson nodded.

"Important business?" asked Stearns.

"No—no business. Just a little music, dancing. That kind of thing."

Stearns backed out to the doorway, "Know what I did last night?"

Krisstenson shrugged.

"Went on a goose hunt," Stearns said, "a wild-ass goose chase. You know anything 'bout that?"

"I know that geese are a lot smarter than you think."

Stearns studied Krisstenson's million dollar poker face. "Yeah," he said, reluctantly surrendering with a smile, "I bet you do." Stearns withdrew a new security pass from his shirt pocket. "Here, just in case you *misplaced* your old one."

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The sun rose at 6:14 a.m. outside the Sound Surveillance Center, but without windows it looked like every other time of the day. The pimpled technician rubbed his eyes, temporarily shielding them from the flicker of his monitor. Leilani and David slept hunched over the workstation's desktop. Most days Leilani made it a point to watch the sunrise, but this was not the case on this particular morning. It was the first good night's sleep she had had in months. In time she awoke with inspiration and a yawn that transfigured into a stretching slow-motion smile. Wiping sleep from her eyelashes, she became aware of her proximity to David and quietly slid her chair back. She watched him sleep for a moment, thinking he somehow looked younger than he had the year before. She reached into her pocket and pulled a keychain out and held it in her hands—four ounces of tourist-grade tiki-idol molded plastic with a set of car keys on the ring. She set the keychain on the desktop and called gently to David. He slept soundly. Leilani called again, tapped on his shoulder, and he finally awoke with a smile, rubbing the drool from his cheek. He noticed the keys sitting on the desk. "What's up with this?"

"I want you to take her back to LA when we're done here."

David's lips parted slightly—it looked like he tried to respond immediately, naturally, but he didn't. He spoke at last, "I—you know I want you to keep it."

"I'd love to David, but I can't." Leilani did indeed love this car—but she had her reservations. She remembered her first date with David as if it were yesterday. It was, afterall, *nearly* a perfect date. Her weather-band radio had forecasted a sizeable southern hemisphere swell, so she had suggested a walk along the beach at San Onofre. She figured nice long 'lefts' would be wrapping around the point—at least she *thought* that's what you call waves breaking to the surfer's left. She could never keep it straight and her brother Eddie had always given her a hard time about it. And the swell did arrive, lining up one perfect set after another. Oldtime longboarders were out with wiry shortboard grommets nipping at their heels.

And on that summer day, sun blazing with possibility and water sparkling with expectation, she and David set bare footprints across the falling tide line as stick-legged sandpipers scampered after crabs in the receding foam. Three miles down the coast they sat, buried their feet on a high sand embankment and told secrets under a majestic Pacific sun. Soft conversation and a few laughs carried them into the night with the warmth of a San Onofre fire-ring and sticky marshmallow kisses. The Fanta orange light and immeasurable majesty of the harvest moon lit the stars in the sky with promise. Everything, absolutely everything, was perfect.

And then it happened. There, in the cool whisper breath of the sea breeze, basking in the silent glow of moonbeams, and on the verge of the unquantifiable magic of a perfect first date, Leilani farted. There was no getting around it. The night was far too gentle to stage a dramatic cover-up. It was not loud like cannon fire nor prolonged in duration, but she had farted and there was nothing she could do to conceal that fact. All she could do was look at David and say that she had done so. 'I know,' he had said with inscrutable diplomacy, 'I heard you.'

But the evening was far from lost and deep into the night on their way back to the base they pulled into the drive-thru at In-N-Out Burger on Palomar Airport Road. Not out of

hunger—out of not wanting the night to end. Leilani could recall mentioning something about the old car ahead—just that it looked pretty cool. David seemed rather knowledgeable about it, the model, year, engine type—guy stuff—but those were the last words spoken about it.

Then, almost two years after their first date and in honor of her thirtieth birthday, David presented her with the most extraordinary present she had ever received: a car identical to the one they had seen on their first date at the In-N-Out burger on Palomar Airport road—a flawless 1968 GT-350 California Special. Initially she was convinced that his gift marked the resurgence of Romanticism itself. But over time she began to suspect the Mustang may have iniquitous Trojan horsepower stashed beneath the hood. When she had it appraised she couldn't believe how much it was worth—there was no way he could afford it! And now this whole business with her parents' dream vacation at the 'Hotel Del'. What was he trying to prove? You can't buy love. Didn't he get it? It was *over.*

"Come on." He said, "just keep it a while longer."

"And here," she said, digging a slip of paper out of another pocket, "you might want this too."

David stared at the flimsy paper as if he had just been served a subpoena. "What the hell is this?"

"An appraisal."

"A *what?*"

"I needed it for insurance," she said, "thought it'd help if you want to sell it."

"Sell it?" he said, looking like he might have more or maybe even a lot more to say, but surrendered and pocketed the keys in silent protest instead.

Leilani lit another cigarette—this was definitely not going the way she had intended—and the room was swallowed up by a heavy silence.

David yawned and asked, "Are you still on the pill?"

"What?"

"Just curious."

She stared in wonder. "That's none of your business."

"Do me a favor," David requested, "stop taking it for a while."

Leilani sat back, crossing her legs and folding her hands in her lap. "If this is some kind of jealousy thing, you need to see a doctor."

"It's not."

"Yeah, right."

"Just give it a try—for a month or so."

"And if I'm sleeping with someone?"

"Put *him* on the pill. That's more your style anyway."

Meanwhile the technician's workstation had begun to spew results. Negative Results. "Nada," he informed the Commander, "we didn't turn up a thing."

Leilani instructed the technician to try again. The urge for vindication had overruled logic. Several minutes later, much to nobody's surprise, the giant monitor did not light up like a Christmas tree. It did not light up at all. No loud red streaks, swarms, or pools of subsonic secret code anywhere.

Leilani sunk in her chair.

"Well," David said sympathetically, "good idea anyway."

Leilani turned to the technician, trying to think of some way to save face, but the technician was not paying attention. He was transfixed, eyes glued to another monitor at his workstation, "Uh, Commander, better check out this Southern polar-orbit Sat."

Chapter 12

South for the Summer

The only thing worse than spending too much money is spending too much money on someone other than yourself. The Akua elders had been at the Hotel Del Coronado for four nights now. Everett was trying not to think about just how much that really meant. He was now certain that his suspicion regarding the alleged Hawaiian nuclear disaster and subsequent cover-up was delusional and was planning to orchestrate the Akuas' immediate return, especially because he suspected he might be corralled into heading South any moment.

And this suspicion was correct.

By 0900 operations were in full swing in the Sound Surveillance Systems Center. Navy and Medea scientists, including Dr Everett and Commander Akua, engaged in speculation and there was a detectable level of uneasiness in the air. A Southern polar-orbit satellite feed flickered a few frames per second short of full motion video and had held center stage all morning: Everywhere there was water, there were whales—humpback, sei, blue, fin—Antarctic waters churned in an unfathomable stew of fifty-ton leviathans and icebergs. When they had first viewed the distorted satellite imagery at daybreak, another extraordinary element

had surfaced: dolphins—Bottlenose and Spinners, incredulously enough—were spotted trailing in the deep shadows of the larger mammals. Everett contemplated the mysterious hydrology of the icy waters of the deep southern latitudes. Extreme salinity enables water-temperatures to actually drop a few degrees *below* the freezing point. His knowledge of marine mammal physiology was limited to the exposure he had had during his two year tryst tracking migratory paths with Leilani. But even he understood that tropical species, such as the Spinner, lacked sufficient insulation to stave off hypothermia induced by the subfreezing water temperatures. He supposed their fat reserves would carry them for a week, maybe two, but not long enough to grant safe passage to the more hospitable climes of northern latitudes.

And there were further revelations perhaps even more disturbing. Medea chief Victor Ladir was on the receiving end of a satellite-linked videoconference from Antarctica. The live feed beamed in a poor connection from *R/V Prometheus*' bow observational deck as Captain Franz Koenigs and Sean Daniels sprawled charts and graphs over an already cluttered table.

"We've checked our findings against German SAR images. No doubt about it, this advance is comin' on big time," Daniels said, sketching a rough outline of Antarctica, "and that's pretty scary."

Scary? Everett thought, no shit. Eastern Antarctica is a single, stable tectonic plate. But things are different in Antarctica's wild west. Western Antarctica is marine-based—there's no land beneath it—just ice. It's a jumble of plates and active rifts. This western sheet can only exist so long as it's buttressed and supported by the fringing shelves, like the Ross Ice Shelf. These shelves bind and restrain the glaciers and ice streams feeding into them.

A discussion proceeded but progress was retarded by Victor Ladir's interruptions. He was having difficulty following along. Victor posed his inquiries slowly, as if the unhurried cadence might somehow be less intrusive. Sean Daniels, on the other hand, spoke more rapidly than some people think.

"Look at it this way," Daniels blurted in frustration, "one of the reasons we monitor the hole in the no-zone down here is due to the fact if temperatures rise enough to melt the underside of these static ice streams, we'd get a phase transition at the base and poof!"

"Poof?" Victor asked, turning to Everett.

"The separation of the West Antarctic Ice Sheet," he replied.

"That's right," Daniels said, drawing a spiral away from the Antarctic continent, "three-quarters of the world's fresh water breakin' loose and drifting north with circumpolar currents." He aimed the digital camera at his computer and clicked away—3-D imaging rendered a topographic map of the United States. "As it melted, oceans would rise fifteen, eighteen, maybe even twenty feet. Now that may not sound like much, but—" He pecked a few more keys but did not get the results he desired. Everybody sat and watched and waited impatiently. Daniels backed out through the onscreen menu and re-entered the commands and this time it began charting sea-level elevations and the corresponding receding coastlines. "Here we go, sorry 'bout that. Let's see, twenty feet would permanently inundate half of Louisiana and Florida. Most of Boston, Charleston, and New York are only four feet above sea level. Actually, just make that a big chunk of the Northeastern seaboard—I don't know what's up with this western seaboard map," he said, referring to a scrambled image, "but I'd guess the entire Frisco Bay would be history." He clicked to a world map and ran the simulations again. "Worldwide, we're talking about coastal cities that seventy percent of us Earthlings call home. Netherlands and Denmark are totally out of luck. In Bangladesh, 40 million people would be headin' for the hills. Over one thousand Maldivian islands are no more than six feet above sea level, no hills to head to there. Tonga, gone. And, let's see, looks like the Nile would back up and flood half of Egypt's inhabitable land."

Koenigs emitted a huff, "But no need to worry about that now. Temperatures aren't anywhere near those levels."

"I've prepared press releases for AP and UPI." Daniels began, "Should I—"

"Absolutely not," Victor Ladir declared, "Under no circumstance are reports to be released to anyone other than myself. I'll take findings to the NSA and we'll decide what announcement to make from there."

"Back in '76 I was runnin' a sixty meter trawler off the southern coast of Newfoundland," the Captain began, digressing into an anecdote that may or may not have been relevant, but the monitor displayed only fuzz and fluttering snow—the satellite connection was lost.

Chapter 13

Sixteen Letter Words

It was 0200 and there were still a million things left to do. Lists of lists of things to do. Estimated time of departure was 0600 so Leilani ran around making last-minute arrangements. Dashing from the dolphin pens to the trainers to the feeders to the researchers to the Admiral's office then back to the pens. But she had it all under control and would be ready. Moreover, her adrenaline was flowing from excitement and she wasn't nearly as tired as she should have been. She was going to Antarctica. Although the accelerated glacial flow had certainly become the primary national concern, the marine mammal migration remained a secondary interest and Admiral Cross had personally handed her her orders to join a Navy/Medea research and surveillance mission to the Southern Seas.

Leilani's hands were full so she sandwiched the bags against the door with her body as she dug through her pockets for her keys. She entered her quarters and her first sight, as always, was her cat—a.k.a. 'The Dew'—tumbling on his back on the rug in the entryway, inviting her to rub his belly with sleepy eyes and purry pet sounds. She set her bags down and petted The

Dew. She tossed tiny crumpled paper balls—they were all over the place—and The Dew chased them down, leaping off the coffee table and scrambling under the couch.

Leilani's Officer Quarters was a contemporary collage of abstract catastrophe. Clothes were heaped in interesting piles on the floor. Work—divided by project—was stacked in tall columns around her computer like Stonehenge, and the kitchenette was a display case for dirty dishes turned science-fair projects. Leilani Akua was a slob.

She tossed another ball and it landed in one of the bags she had set on the floor in the doorway. The Dew leapt in after it, knocking over the bag. Leilani laughed and gathered the spilled contents. One item was a small box—a small box containing a new watch. She sat down on the couch, taking a moment to admire the stunning feat of engineering. The watch, a Sinn EMZ, was constructed from pure titanium, domed in anti-reflective sapphire, and sealed with argon gas. There were only a handful of officers on the base who could afford such a watch and Leilani was not one of them. She was relieved it had arrived ahead of schedule, as it was probable they'd be spending Christmas in Antarctica. She set it aside to wrap later then went to work. She needed to finish editing a training manual so she dug right in, proofing a chapter entitled: ANTHROPOMORPHISM. As far as Leilani was concerned, *anthropomorphism* was one of the most evil words in the English language—dogmatic enemy number-one to every school of behavioral biology including, of course, cetology. Most behavioral biologists hold that in order to make non-involved, objective observations, one must not ascribe *animals* analogous equivalents of *human* emotional characteristics—that humans are an idiosyncratic breed of mammals and thus behaviors observed in *nature* do not correlate to seemingly similar human behaviors. This superannuated school of thought dictates that if an *animal* were observed jumping, spinning, and playing in the surf, for instance, it would be improper to assume it was 'happy', or 'having fun' just because a human may exhibit like behavior under analog emotional

circumstances. The observer would be guilty of anthropomorphizing. Highly educated scientists spent decades and millions of research dollars arriving at this conclusion—yet any man, woman, or child with a dog or cat knew intuitively this fear of anthropomorphism was unwarranted. Jane Goodall was one of these people—one of Leilani's favorites—and in fact Leilani had traveled north the previous weekend to hear Ms Goodall speak at the University of Southern California's Wrigley Institute. But Leilani was in no position to wage war over anthropomorphism and didn't have the time to rewrite the chapter anyway. So the bulk of the text remained as is.

She finished up as best she could, pulled off her pants, tossed them on a heap at the bottom of her closet floor then stepped into the bathroom. The Dew leapt up on her bathroom counter, sitting with his forepaws tucked symmetrically beneath him and waiting patiently for water. He slowly blinked his eyes—two giant saucers full of secrets—in the way cats do in the bliss of reposed instinctual fear. But Leilani didn't flaunt behavioral jargon or sixteen-letter words to pretend that she knew what was or wasn't going on behind those eyes. All she knew was that there was more going on in there than most were willing to admit. She crouched down and cleaned the litter box, making little purring noises for The Dew. She washed her hands and let the cold water run on and he purred back, blinking at her in the mirror and dipping down into the sink for a drink.

Leilani had only been under the covers a few minutes when the phone rang. She would have picked it up immediately had it not been for the fact that David was on base, so she lay there and waited for the answering machine to pick up. She listened to the message. The call was not from David, it was *for* David—a woman with a fake German accent who said her name was Claudia and that she was hoping to get together with David before she flew back to Munich. Leilani had no idea how or why David conned these girls into harassing her. This had

been going on all year and Claudia was the third caller this month. The few girls she had actually spoken to swore that they were really trying to get in touch with David—that this was the number he had given them. *Right!*

Leilani lay in bed, growing more furious by the minute, picturing David out at a bar—or in bed—with some cell phone wielding Jagermeister Girl, and before she knew it her alarm clock was blaring love songs from the coast and it was time to get up. She packed away a few final items, but decided not to wrap the watch afterall. In fact, she decided to keep it for herself.

Chapter 14

Isolation

Flight is a pretty big deal to people who call the most remote island chain in the world 'home', and airplanes, like so many other things, reminded Leilani of her home. She was raised in a series of two-bedroom bungalows along the city limits of Honolulu. As the city grew up, the Akuas moved down—a little further down the canal with each move. The tidal wave of Aloha prosperity (spelled t-o-u-r-i-s-m) was merely a lei-laced mirage when viewed from the shanties along the Alawai canal.

Her father was a beer drinking, Spam eating, full-blooded Hawaiian—a rich source of family pride and the subject of local lore. Primo Akua worked at the Dole pineapple cannery from 7:00 'till 3:00 and then paddled an outrigger canoe from 5:00 'till sunset, five days a week. Her mother's father had sailed into Honolulu harbor on 8 February 1885, steerage onboard the *SS City of Tokio*. He was Kanyaku Imin, a government-contracted immigrant, whose birthrights left much to be desired, including a surname. Her mother, Maileia, worshipped her Japanese ancestry, especially poetry. She taught haiku to honors English students at King Kamehameha High, and much to Leilani's chagrin, she was her mother's favorite student.

Leilani knew each and every member of her family tree as a child knows a favorite toy. Family was her religion. And although her parents were as different as the Makai and Mauka winds, they both agreed on one thing: Hell would freeze over before their daughter married David Everett. He was a mad scientist, a shameless flirt, and he spent more money than he made. Furthermore, he was a *haole*.

Leilani adjusted a pump that bathed a full-grown 14-foot Beluga whale's pure white body with water as he was loaded into the cargo hold of the C-141 transporter. It was this particular Beluga's maiden flight and it reminded Leilani of the first flight she ever took—when she departed for San Diego as a commissioned Naval officer. Nobody, especially her mother, could understand why she would leave home to serve in the United States armed services. This act was probably the most *kapu* ornament hanging on the Akua family tree. Her grandfather—a United States citizen—had been held prisoner-of-war *in* the United States *by* the United States military—for the duration of World War II.

But the Navy had, afterall, paid for her four years of college and made it quite clear that they expected at least four years in return. But of course Leilani knew the Naval indenture wasn't the only reason. Deep down she had wanted, no, *needed* to get away. The waters that surrounded her island paradise had become haunted with sorrows that would not pass.

By now Leilani had secured the Beluga whale—his name was Melville—in a transport cradle nestled within the C-141 cargo hold while sailors scurried around carrying out their orders. 'Mel', as she called him, was her favorite of all of the Navy's marine mammals. She had trained him from day one and he was an incredibly fast learner—and this is certainly not always the case: Differences in sensory modalities have made it extremely difficult for humans and cetaceans to communicate. Cetacean communications consist of complex sounds that are perceived as a unit, thus a whole paragraph's worth of information may be conveyed in an

instantaneous sonic burst. Attempting to follow cetacean speech would be as difficult as trying to study the individual picture frames of a projected film being run at ordinary speed. But Mel was somewhat of an exception, and after three months of training, fish rewards were no longer necessary—a rub on the belly was ample reward for a job well done. Out on the open sea, Mel could dive on command to depths exceeding two thousand feet and was able to hold his breath for a record breaking eighteen minutes. Melville, moreover, was Leilani's best friend.

Leilani studied Mel's eyes. Theoretically and according to just about every text she could think of, there was very little information a trainer could gather by looking into a cetacean's eyes. Leilani had always believed otherwise—not that she'd admit that to anyone else—and she was just looking for some reassurance that he was okay.

A few minutes later Leilani boarded the C-141 and headed down the aisle. She glared over at David—pecking away at his laptop—but he didn't look up. Leilani headed to the back and asked Krisstenson if it would be okay to join him. He slid over to the window and she dropped into the aisle seat, leaving an empty seat between them. Her attraction to him had been immediate and magnetic yet not necessarily sexual. A similar attraction, perhaps, to that which she felt for Mel or 'The Dew', or the same gravitational force that pulls one down from a park bench into the leaves of grass. Krisstenson closed his eyes for a moment and she realized now—upon a rather overt point-blank inspection—that he (shaved head aside) did not look at all as she thought he did. Initially, she had perceived his features as distinctly Nordic, but now she decided that it had just been his posture and musculature. His skin tone was in fact unguessable. Had she been able to peel back his tan she had no idea what pigment might lie beneath. He was an uncommon mix but aesthetically pleasing. She wondered if he had Native American heritage. As they taxied along the runway she said, "I liked your hair better when it was stuck to your head."

Krisstenson looked over at Leilani and she began to feel self-conscious. He told her that if you speak with your eyes, hair can get in the way.

"What's wrong with using your mouth?"

"Nothing." He said, "Unless you're underwater."

Leilani just smiled to play off confusion. In the awkward silence that followed she took further notice of a smooth, spherical stone hanging on a leather string around his neck.

Krisstenson became aware of her stare and offered, "A witch doctor gave it to me. He told me when the gods want a man to live forever they place a sacred stone in his breast so he'll be as strong and lasting as the stone." He winked and added, "The old man said this one oughtta be good for two or three years."

The C-141 shook, roared and strained under its own mass as it lifted off and arced over the endless blue Pacific. Leilani looked down and her thoughts drifted on west again, over two thousand lonely miles and two million lonely waves, but bedroom blue eyes corralled her back, gazing straight at her from the cover of a magazine. Someone, probably a cocky Air Force flyboy, had left a copy of General Gray's *Warfighting* and an issue of *Hustler* magazine in her seat-back pocket. She pulled out the dog-eared copy of *Warfighting* and began leafing through the pages.

Chapter 15

Sex, Drugs, & Nightingales

He adjusted his portable reading light and flipped his legal pad to a fresh page. The lithium ion battery in his laptop had run out of juice, forcing the atavistic reversion to pen and paper. They had landed in Christchurch, New Zealand and visited the US Antarctic Program headquarters for a briefing, the issuance of ECW (Extreme Cold Weather) gear, and an aircraft switch. Everett had also been able to check his email before departure from Christchurch. Several were from his mother, wondering why he had not returned her calls, but most were from his office: pertinent glaciological data he had been unable to locate before departure. And in reading his last message he discovered that his Swiss comrade, zoologist Claus Wedekind, had moved on from mice to doves. Claus was writing to inform him he had discovered that hormone levels in female doves are directly influenced by the vocalizations of males. The hormonal effect of the male dove's songs are indistinguishable from the ones that can be produced with synthetic steroids. It has been said that music is a drug, but this study proved it—music *is* a drug. Claus intended to continue his experiment by monitoring hormone levels in female rock-and-roll

groupies before, during, and after concerts and was wondering if he knew of any volunteers. Everett forwarded the email to an ex-girlfriend.

"So Doctor Everett, any hypothesis at this point?"

Everett glanced back over his seat at Leilani and Krisstenson, then turned to the bespectacled Navy glaciologist who had leaned into the aisle to ask this question. Said glaciologist was curious to hear his preliminary opinion regarding the increased ablation (loss of glacial ice) and migratory behavior.

"I try not to jump to conclusions," he said, glancing over his shoulder again. Everett really wasn't in the mood for conversation, so he turned back to the data Tina had forwarded from Los Angeles. Time, distance, latitude and bad attitude slipped into the ether, and before long Everett had plugged three hundred and twenty-eight variables that may or may not contribute to the phenomena at hand, and had outlined his intents and purposes for the mission.

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Everett rubbed his eyes, gave his cramped hand a rest from the pen, and lifted his window shade as wispy cotton vapor parted and slipped past the window of the ski-equipped Hercules LC-130—the turboprop aircraft in which they now traveled. Although Dr Everett could see only vapor, by his rough calculation they had just passed the PNR, the Point of No Return. LC-130's hold enough fuel for a one-way trip from Christchurch to McMurdo, not a round-trip. If weather on the ice should begin to sour, the decision to return to Christchurch must be made before the PNR is reached. The problem, though, was that weather in Antarctica sours more quickly than milk in the Mojave.

In time the clouds vanished and the pale light of the lithe December moon reflected thinly on the wing. The dying crescent—dogged with a bright star—revealed herself in the

East. Everett began to feel a bit better. He tried to make out as much of the moon's selenography as possible—the maria, highlands, craters, and rays that lay beneath the thin halo encompassing the C-shaped sliver. Suddenly he was struck with the realization that soon he would see Emperor penguins for the first time in his life. As a child Everett had been infatuated with penguins. He had been a penguin for Halloween when he was six years old then refused to wear anything but his penguin costume for the next solid year. He hadn't thought of penguins since he was a small boy and the thought of seeing them for the first time was both spine tingling and strange. The mystique of the Southern Continent drew nearer in consciousness and nautical mile. His mind wandered as he began doodling overlapping spirals along the spine of his legal pad. He felt restless and decided to stretch his legs.

In the back of the cabin, Krisstenson slept under the gaze of Leilani's curious eyes, but when she spotted Everett coming up the aisle, she closed her eyes, feigning sleep.

"You asleep?" he asked.

Leilani paused for a moment before opening one eye. "No." She looked over at Krisstenson—still sound asleep.

Everett sat down, noticing something on Leilani's wrist—a large-faced, heavy gauged titanium dive watch. A *man's* dive watch.

"Cool watch," he said.

"Thanks."

"New?"

"Yes."

"Oh."

"Oh?" she asked, "Oh what?"

"Just *oh*," he shrugged, "nothing."

"It's an early Christmas present," she said, "I gave to myself."

"I didn't ask you where it came from."

"Yes you did."

"No, I didn't."

"Did too."

"Did not."

"Whatever," Everett said, trying to picture the Scuba Steve who had actually given it to her. He was looking around the cabin, trying to decide if there was any point in conversation when he noticed the tuna tattoo peering out from Krisstenson's sleeve. He said, "Nice fish."

"What's your problem?" Leilani said softly as not to awaken Krisstenson. "You're so negative." The aircraft banked right and descended through dark turbulent cloud cover. Everett considered returning to his seat. "Come on—you think you could choose some squiggly line of ink, a single symbol that says this is who I am or this is what I like or this is what I stand for, forever? No way," he said, "No matter what you chose you'd grow out of it eventually."

"Some people do it all the time. It's called *commitment*."

It was at that point that Dr Everett realized it was imperative that he end the conversation as quickly as possible, so he tried silence.

"So, I guess you don't want to see the one I got last month?" Leilani offered at last.

"One what?"

"Tattoo."

"Yeah, right."

Leilani bent forward at her waist and pulled up the tail of her shirt. Fresh perfect ink adorned the small of her back—two dolphins forming a yin-yang circle: nose to tail, tail to

nose. She yanked her make-up bag out from beneath the seat and marched off towards the front of the aircraft.

"Sometimes," Krisstenson said with his eyes closed, "the best thing to say to a woman is nothing at all." He opened his eyes like a sleepy lion and turned to Everett. "If you want to understand the way animals communicate you'll need to learn how to talk to a woman first."

Dr Everett was a little embarrassed and had no idea what the hell Krisstenson was talking about, so he started to get up. "Sorry," he said, "didn't mean to wake you."

"To get close to animals in the wild, it's best to pretend like you're not interested at first," Krisstenson said, opening the window shade and looking out over Antarctica, the unforgiving continent of icy solitude.

Chapter 16

Multiple Partners

Every woman begins planning her wedding sometime around her twelfth birthday and Leilani was no exception to this rule. In fact she was an early bloomer—she began painting the imaginary portrait of her wedding day when she was ten. The groom, the church, the dress, the color of the sky, the shape of the clouds. Of course the painting was never finished, changing from year to year—some years more drastically than others. The guest list started with four people: her mother, father, brother, and her best friend. The number of invitations swelled with the years, reaching its peak—around 250 guests—sometime in Leilani's early-twenties. But friendships died, exhibitionistic tendencies receded, and intimacy became the ultimate end—invitations were rescinded and the guest list began to shrink back towards its original size.

Leilani became aware of the practice of designating a best-man and maid-of-honor when she was thirteen. She planned to amend this tradition by naming her brother Eddie *her* best man. Of course that plan changed too.

Potential grooms drastically altered the landscape of the painting as well. One year, when the candidate was a Kona Gold smoking surfer, the event took place at the North Shore's

Keole Protestant church with mountainous winter swells rolling into Wiamea Bay, the wedding party ready for rebellion in board-shorts, dread locks, and G-strings.

A few years later, when the candidate was her marine bio professor, the ceremony took place in front of the glass windows of the dolphin tanks at Kewalo Basin, with canopy clouds sifting champagne shafts of powdery light on the water below. Family friends, college friends, high school friends, grade school friends, dolphin friends, crazy cousins and proud uncles from Maui. That picture was near perfect.

But as much as she hated to admit it, the most beautiful wedding portrait her mind's-eye had ever conceived was crafted hand-in-hand with David Everett. Thomas Parker, sole heir to Parker Ranch, had mystifyingly presented Leilani's grandmother with a deed for twelve acres of his most prized land on the North shore of Maui near Hana. He had become burdened with guilt, apparently, by the wound and subsequent death of Leilani's grandfather—a death inflicted by the hand of his former foreman and a hot iron *Circle-P* brand. And as for this land, this lush sloping acreage faces a gentle mountain to the south and is covered with fruit-bearing trees—guava, banana, pineapple, coconut. A small farmhouse is planted on a knoll just above a brook. Rains fall nearly every morning on that side of the island and nearly every afternoon sees a rainbow. A few miles down the dirt road is the Wananalua Congregational Church—built in 1842, it's great white walls still standing straight, alone in a windswept pasture that slopes to the sea.

Leilani's dream wedding portrait with David was set in front of this very church. Her mother, father, grandmothers, and a few of their closest friends were the sole attendees. The portrait seized a moment at the picnic that followed the wedding, down by the shore. One of those rare snapshots that capture natural, unaffected smiles.

Leilani began rummaging through her make-up bag as the LC-130's shadow tracked across the expansive West Antarctic Ice Sheet. Unable to locate the object of her quest and

becoming agitated, she dumped her cosmetics on the seat next to her. Shit, she said to herself—it was 0600 back in San Diego, day 28 of her lunar cycle, and somehow, she thought, I left my fricking pills back on base. She began to wonder if David had subconsciously sabotaged her. She shoved her bag back under the seat, shifted gears, and began compiling a list of her immediate duties, running through *Mel's* disembarkation checklist, and before long the gravity of her responsibilities solidified as the skis of the LC-130 touched down and glided over the Antarctic International Airport—the flat top of the Ross Ice Shelf. The LC-130 slid to a halt.

The intense summer sun that rises over the continent in November and doesn't set until February had elevated air temperature to 60 degrees Fahrenheit—nothing unusual for December, the height of austral summer along the temperate shores of Antarctica. Leilani stepped down onto the ice, refreshed by the cool clean air. Several aircraft hibernated on the shelf-top, including a Sikorsky-76. After an hour-long briefing and orientation, Leilani boarded the helicopter with David, Krisstenson, and the others. The deafening thunder of the Sikorsky's twin engines ripped across the stillness that would have been otherwise and they lifted off and whisked over McMurdo Station, Antarctica's largest research base. The buildings were stark warehouse-style, corrugated aluminum, reminding Leilani of mining camp towns from her father's favorite Clint Eastwood westerns.

The helicopter banked out over the open water. Leilani looked over at David. He didn't look so great. *Prometheus,* the National Oceanographic and Atmospheric Association's double-hulled icebreaker, pushed slowly through the Ross Sea below, and it was only a matter of minutes before their helicopter alighted on *Prometheus*' stern helipad.

Chapter 17

Voyeurism

In 1937 Carl Orff composed *Carmina Burana*, an opera, or maybe it was an operetta or cantata—Leilani couldn't remember which—about a licentious posse of Goliards, a wild band of itinerant scholars who roamed the medieval landscapes of Western Europe writing poetry, drinking sweet wine, and practicing random acts of debauchery. *Carmina Burana* tells of their exploits in Bavaria, and Leilani found the chorus ringing in her mind as she entered *Prometheus*' observation deck with David and Rand Krisstenson. She couldn't figure out how the composition made the leap from her subconscious into her conscious mind; she hadn't heard it since Music History 101, but she never ceased to be amazed by music's strange magic—it had the uncanny ability to show up almost anytime, anyplace. She and the others removed their jackets, joining Captain Koenigs, Sean Daniels, and the rest of *Prometheus*' crew.

Panorama glass wrapped around the bridge providing crystalline end-of-the-earth vistas as *Prometheus* rounded an iceberg sculpted of city-block proportions. On the other side, stretching to the horizon, whales and dolphins from every family and of every species animated the sea—a mesmerizing mélange of rising and falling dorsal fins and misty-breath plumes.

Hundreds, thousands, hundreds of thousands. Leilani watched as 80,000 pound mammals launched themselves clear of the water's surface with two flicks of the flukes. The energetic breaching, the wide bushy blows, the humpbacks distinctive salt and pepper flukes, the battle scars and callosites of the slow swimming rights, and the belly-flopping folly of the fins. The enormity of the aquatic biomass, the sheer extent of it all was sensory overload. It struck her as noting shy of sacred.

"Welcome to the show," Daniels said, proceeding to bring them up to speed with the crew's latest observations.

Leilani tried not to get distracted this early in the game, but couldn't help noticing that David was noticing that Sean's eyes had not left hers—or at least some part of her—since they stepped onboard. Apparently it had been a long austral winter on a research ship crewed by thirty-six men. David stood by her side, affecting, she thought, an air of intimacy. Oh God, she thought, he's marking his territory. Krisstenson stood off and kept to himself. He had seemed incredibly indifferent since their arrival, and before long slipped off without a word.

Prometheus maneuvered around blow spouts, tail flukes and humps of the largest animals ever to live on Earth—even larger than the dinosaurs. Terns, Mollymarks, and Nellies fluttered above, and a great Wandering Albatross trailed behind, feeding in *Prometheus'* wake. Leilani watched as sun-splashed Common dolphins rode *Prometheus'* bow wake with perfect fluidity, trying to figure out, naturally—as were all those onboard—if the migration and accelerated glacial flow were related. She asked the Captain for his opinion.

"That's the twenty thousand dollar question," Koenigs said.

"By my estimates," Daniels said in reference to potential global fiscal loss, "make that a twenty *trillion* dollar question."

A pod of humpbacks corralled krill three clicks off the stern, releasing great exhalations in the waters below, then exploding through the frothy surface with mouths agape, taking the

minute shrimp into their baleens by the ton. The synchronicity and precision of their feeding endeavor was striking given the humpbacks' lumbering bodies.

Koenigs gave orders to drop anchor, focused a pair of binoculars, and began to unwind a sizeable ball of yarn about the first time he sailed into the Ross Sea. On the stern deck below, crewmembers threaded cable from the A-frame to *Beatrice*, an unmanned remote operated vehicle (ROV) the size of a riding lawnmower. *Beatrice's* hull featured a hand-painted, bodacious Vargas girl—like the fuselage of a fearless World War II bomber. Leilani scurried down to the deck to lend a hand, wondering where all of these great men—the fighters, the flyers, the painters, the lovers—had gone.

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Conducting research on the open seas costs twice as much and takes three times longer to carry out than the same experimentation on land. Adding water *and* ice to any research project costs five times as much and takes ten times longer. Twelve hours later, *Beatrice* was prepped to get wet.

The audio/visual lab, located down on *Prometheus'* C-Deck, housed the processors, hard-drives, monitors, amplifiers, coaxial cables, and radio relays that linked to *Beatrice* in the waters below. Leilani squeezed in amongst her fellow searchers and the racks of a/v equipment. Coffee flowed in a feeble fight against jetlag. Leilani glanced over at David—he looked like a zombie. She was exhausted as well and her energy reserves were quite low, largely due to the fact that she had been unable to keep down her first two onboard meals.

Daniels adjusted controls below a large monitor and radioed to the crewmembers out on deck. "I'm set." The monitors relayed video feeds from *Beatrice's* dual-mounted fore and aft cameras. Video images whirled, smeared, and splashed as she plunged into the Ross Sea, but

stabilized in the undersea cradle. Daniels guided a joystick, navigating Beatrice through perfectly clear water. The nutrient-rich waters spawn ultra-high yield phytoplankton counts where krill thrive by the centibillions and kelp forests grow like Dutch tulips in a hotbox. Daniels flipped a bank of audio switches, igniting a rack of red lights, amplifiers and a surround-sound symphony of cetacean songs, signature whistles, and echolocational clicks and chirps. "Nice," he said. "We've heard some good stuff down here, but this shit's incredible."

Leilani didn't think Sean was nearly as cool as he apparently hoped she would. Furthermore, someone—she suspected Sean—was in dire need of a shower and, given the intimate confines of the lab, the acrid BO permeated the tight quarters like a highly effective anaphrodisiac.

The Captain was equally unimpressed with Daniels' antics. He said, "Just level off and head in."

New, exotic sounds were born, like 1950s-style sci-fi flying saucers and phaser guns. Streamlined subaqueous forms sprang forth—Weddell Seals. Natives. The curious seals zoomed alongside *Beatrice*, investigating the halide yellow alien intruder—calls whirling with Doppler effect. Leilani looked over and saw David's face reflecting in the monitor and fusing with the face of a curious seal. I'm so tired, she thought, I'm hallucinating. The seals wiggled on ahead with their bizarre retro-phaser calls heralding the way. Eerie blue light filtered through the still waters and, to Leilani, the whirl of *Beatrice's* electric propellers sounded like a lonely voice calling out in a foreign land. All right, that was it, she thought, I'm not doing myself or anybody else any good at this point. She gathered her belongings and asked for directions to her bunk.

But nobody was paying attention to her. All eyes were focused on the monitor, on the dark amorphous forms that lingered in the water ahead of *Beatrice*.

A squadron of Antarctic hourglass dolphins jetted straight at *Beatrice*. Daniels twisted the joystick and threaded *Beatrice* through the tightly knit dolphins, but before he was able to

wipe the sweat from his hands, a Sperm whale—a *huge* Sperm whale—charged from behind the hourglass pod. Daniels kept his eyes glued to the monitor.

At seventeen pounds, the brain of the Sperm whale is by far the largest brain in the world. Although large brains are not requisite of large organisms (dinosaurs had micro-processors not much larger than those of sparrows), Dr Everett knew that the relevance of this data was unknowable to his mind—a mind one-fifth the size of that of the Sperm whale's. He knew that any processor is incapable of mapping the capabilities of a larger processor, and thus it occurred to Everett that neither he nor any other man or woman on Earth would ever know why this particular Sperm whale zoomed in on *Beatrice's* camera. The whale passed directly under Beatrice, but that was not the end of it. The tail flukes flipped up with a fluid and effortless stroke, smashing the remote operated vehicle to smithereens. The monitor went blank.

"Good God," the Captain blurted out.

Daniels switched the monitor off, then back on—still no image. "Shit," he said, slamming the joystick.

The moment of silence that typically follows an event gone wrong in the false hope that it might somehow undo itself transpired before ROV specialist Hal Curtis (*Beatrice* was his little girl) burst through the door, "Goddammit!"

Daniels stepped back, exclaiming there was nothing he could have done.

"Well," Hal said, "put a dipshit behind the wheel and everything ends up all dipped in shit."

Koenigs wedged between them before the exchange had a chance to escalate, "Gentlemen! Genug!" he barked, "Genug!"

They eased up, but not much. Hal Curtis was the kind of man who pulled in and pushed out great volumes of air through his nose when provoked, further flaring what were

already very substantial nostrils. He was stronger than need be and his skin was ruddy and in need of dermatological care. His skull was large and squarish and this, when coupled with his ectomorphic build, lent him a strikingly Cro-Magnon appearance.

Leilani decided to sit this one out.

"Alright, alright now, Koenigs said, "I hereby prescribe five minutes of fresh air for all hands! A low front's movin' in, so take it in while you can."

Chapter 18

Victory Squeal

Dr Everett bundled himself in his puffy US Antarctic Program standard issue ECW vermilion parka—'EVERETT' printed on a Velcro strip over the right breast pocket—and stretched as he climbed out into sunshine, platinum bands of light inlaid with gold streaked across the water and ice. The air was crisp and invigorating.

As Sean Daniels emerged a hard packed snowball exploded against his chest. Hal burst out with laughter from across the deck.

Daniels didn't seem to think it was all that funny. He tore after Hal, rage-against-the-machine style, but slipped on ice and fell chest-first on the deck. Hal laughed so hard it began to look like an appendicitis—until a fastball nailed him in the nose, courtesy of Krisstenson. He had been asleep in the starboard lifeboat and was now fortified behind it. Stearns and Daniels began launching from a port lifeboat fortress, igniting a full-blown snowball fight.

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Leilani and Koenigs watched the melee from a perch on a railed walkway just outside the glassed-in bow observation deck. "You know," the Captain began, "there's nothing better than great conversation—it has rhythm, hopping to the beat of Windy City jazz, flowing like artesian water from a mossy marble fountainhead. One of the most exceptional dialogues I can recall was held between a brother and sister, students at the University in Constantinople if I remember correctly, and whose company I had fallen into outside a second-hand bookshop on the Turkish Riviera. I had arrived from Crete only an hour or so prior…"

Leilani watched as Krisstenson charged on the deck below, unleashing two snowballs that found their target—David Everett.

The Captain took heed of the object of Leilani's attention and paused to crack a tin of tobacco. "Doctor Everett seems a rather engaging fellow."

"*Seems* being the operative word," she said.

The Captain dipped a meerschaum pipe into the tin of aromatic tobacco, tamped down the brown flakes, and began spinning a new yarn—something about relationships between men and women being a lot like shipbuilding. A pod of Pacific Spinners had hurtled onto the scene and Leilani grabbed the Captain's binoculars. The dolphins frolicked and leapt one by one—occasionally in unison—but the leaps were not especially energetic and Leilani thought, perhaps, they seemed rather listless. Koenigs repossessed his binoculars and focused on the dolphins, saying, "It takes hard work, time, and careful construction…"

Leilani got the point of Koenigs rambling and, noticing the Captain was not wearing a wedding ring, said, "So where's your ship?"

"Ah yes, my ship," Koenigs said as he lowered the binoculars. "Well, I suppose one could say hull design was *par excellence*, but the maiden voyage did not—how shall I say—well, go quite as planned. Yes, *mein schatze* and I struck a berg."

Leilani smiled in spite of herself. This guy was all right. In the distance she heard a series of faint, rapid clicks known as a 'victory squeal'. She knew that somewhere out there—she looked but couldn't spot the squealer—a dolphin had caught a fish. A swarm of gulls clustered over the water about a quarter mile off, two points on the port bow. She assumed the squeal came from the water beneath them. Vigorous dolphin-play off the bow caught Leilani's eye and she began considering their use of games as a means of social orientation. She supposed the snowball-throwing mammals on deck below were doing the same.

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Dr Everett and Sean Daniels ducked behind a lifeboat to catch their breath and fended off a barrage from Stearns and Krisstenson, but every time Everett peeked over the top or around the side, Krisstenson tagged him on the head with an iceball. It was getting ridiculous. "Cover me," Everett finally said to Daniels.

"You got it," Daniels said, prepping his ammo.

Everett ran like hell and Daniels laid cover—his first snowball caught Everett in the back of the head and the rest didn't come within twenty yards of anyone. Everett charged across the deck, getting caught in friendly fire, direct fire, and cross fire alike—one hard packed glacier ball nailed him in the nuts. He charged on regardless, diving behind the starboard lifeboat to tackle Krisstenson, but he was no longer there. He caught his breath. In another moment Krisstenson slipped back behind the lifeboat, joining him in truce.

"Jesus Christ," Everett said, "that fuckin' hurt."

Stearns launched a lifeboat initiative, but Krisstenson kept him at bay, observing Leilani watching Everett from above. "Okay," Krisstenson said, "time for lesson two."

"What?"

"When the subject seems comfortable with your presence, move in a little closer and focus your undivided attention."

"What are you talking about?" Everett had noticed the day prior that Rand Krisstenson had begun vying for his attention, as if he had something urgent to confide, but he had been relatively successful in ignoring his cryptic catechizations. This guy was weird.

A snowball hit Krisstenson in the back—he ignored it and leaned over the railing, casting his shadow upon the dolphins below. "And try to see yourself through the subject's eyes".

Dr Everett looked at Krisstenson with the curious compassion in which a man looks at another man who has lost his mind. What the hell was he talking about? He peered down on the water—the swirl of *Prometheus'* wash loosed diatomaceous dregs from the pack ice. Watching the floating diatoms had a dizzying affect so he took a step back from the railing. In the water below, just off the stern, a dolphin flipped a jellyfish out of the water with its tail. Two more were swirling circles near the surface, face to face. Everett was perplexed. "Are they, uh—"

"Yes," said Krisstenson.

"Oh." Leilani had told him once before that dolphins are the only other creatures on Earth who make love face to face, but he was never sure if she was telling the truth or just encouraging him to follow suit.

Krisstenson watched and smiled, "I'd say the Universe appears to be unfolding as planned."

Everett watched Krisstenson's face for a moment, waiting for an elaboration, which never came. "Okay then, since you've got it all figured out—why don't you tell me how this," he said, referring to the innumerable marine mammals below, "is connected with the glacial ablation."

"Everything is connected."

"How 'bout we limit this discussion to Earth science."

"Fair enough," Krisstenson said, "Quantum theory. All forms of life are constantly interacting with one another."

"Come on," said Everett impatiently, "I know you've got a thought or two of your own in there somewhere—let's hear what *you* have to say about it."

"No single man can be the knower of all things," Krisstenson said. "But it is possible for a man to stand upon the shoulders of all-knowers of single things—upon the shoulders of great poets, mathematicians, tacticians, theologians, tantric lovers, mighty warriors—and absorb the distillations and crystallizations of their thunderbolts. There is no truer nor more potent language than that of masters regarding their particular field of expertise—their insights have endured the gauntlet of time and survive as profound truths."

"Yeah, okay, whatever," Everett said, no longer paying attention.

"Do you know what your problem is?"

"No," Everett snapped; Krisstenson now had his undivided attention. "But let me guess—*you* know what my problem is, right?"

"You're the kind of guy who daydreams about a woman at work then goes out with her later that night and thinks about the work he didn't finish at the office."

Everett glared at Krisstenson, releasing only the "ff" of "fuck-off" into the dry polar air before a booming howitzer shot clapped across the water from the distance—a tabular ice chunk bigger than a fifteen story building splintered off the Ross Shelf's sheer wall and plunged into the sea. An iceberg was born. A very, very big iceberg. An ominous shadow raced from the sight of the splashdown, growing as it neared. A moment later, its true form waxed into view: The iceberg splashdown had produced a forty-foot wave. The massive wall of water slowly plowed towards *Prometheus*.

"Holy shit!" Dr Everett ran for his life.

The general alarm blared inside the bridge. Crewmembers dogged down the hatches, dashing down and aft to port, and up and forward to starboard. Koenigs brought his ship about to meet the wave bow first. His movement and commands on the bridge were executed with the deftness and precision of the Swiss timepiece in his breast pocket. Crewmembers raced in from the deck in various states of hysteria but Koenigs paid them no heed. He held the rudder firm.

Dr Everett rushed in as the great wave approached and the next moment felt like an eternity. The surge unleashed its energy upon *Prometheus*, heaving the bow up towards the heavens. The wave crest slapped on deck, washing pricey equipment and abandoned parkas overboard.

Inside *Prometheus*, anything that wasn't fastened down—including the passengers—became airborne. Charts tore, fluttering about, and a coffee mug projectile caught Leilani in the ear as she toppled on Everett. Sprinkler system pipes burst, raining down wild torrents. The steep backside of the wave dropped the bow back down, headfirst towards the churning waters below. The bow cut deep as it plunged into the water, once again spreading a cold blanket of water across the deck and into every unsecured opening.

Chapter 19

Military Intelligence

When a young life is lost, a great void—like a black hole—is left in the wake and those who had been very close to that person are likely to be pulled in. But this void spits out at opposite ends of the universe. The same dark roadway that leads one on a nightly journey to the local bar drives another to Olympic gold. And thus Leilani Akua was possessed with Olympian endurance and an unshakeable resolve. It was her job to perform under any conditions—despite anything and everything that may occur. And that was exactly what she was doing.

No, *Prometheus* did not founder. The Captain had performed impeccably under pressure—Leilani was impressed by his handling of the crisis and its aftermath—and now she was endeavoring to do the same, to perform under the pressure of strained morale. She knelt down by Mel's face and fed the beluga whale a vitamin enriched herring, wondering if it pleased him to be cared for. She often wondered to what extent he might experience emotions. Happiness? Anger? Fear? Jealousy? Joy? Just how rich was his life experience? How analytical, melodious, romantic, or curious was his inner monologue? Probably just as analytical, melodious, romantic, and curious as her own—perhaps more so. She figured his

associative skills were at least as strong as hers, but whatever was going on behind Mel's wild Beluga eyes, she thought, though unquestionably intense, was all idle speculation without the ability to actually *talk* to him.

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Dr Everett was in shock. His eyes followed Leilani's hands as she fed the Beluga, wondering what the hell was wrong with her. They had nearly *died*, for Chrissake, and she was carrying on as if nothing had even happened. Her ear was black and blue and cut a little on the top. He had dislocated his shoulder. There had been a wide variety of minor injuries to crewmembers, but the ship pulled through relatively unscathed. Krisstenson had reset Everett's shoulder immediately after the near disaster but he had begun to seriously doubt Krisstenson's medical expertise—it still felt pretty messed up.

Everett watched Leilani stuff vitamins into the mouth of another semi-frozen herring and began to concoct a plausible reason why he was needed back in Los Angeles.

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Leilani couldn't tell how deeply David had been traumatized by the incident, but decided it was best not to talk about it too much. She still had her mind on Mel's mind, anyway, and tossed another herring on his big pink tongue and rubbed his head. The mammalian brain is a specialized processor that has benefited from hundreds of millions of years of progressive development—like a space-aged three cylinder engine that has undergone constant modification along the assembly line of evolution. Billions of electrochemical combustions fire

under its hood, working to define all elements of the conscious, subconscious, and autonomous functions.

In Mel's case the engine block was a cerebral mass known as the paleocortex—an amphibian-reptilian holdover from the dawn of mammalkind. The limbic lobe, a slightly more sophisticated processor that marks the second stage of mammalian evolution, overlies this primitive core. Most of its horsepower, however, is generated from its third, larger, new and improved supralimbic lobe. A convoluted blanket of cells known as the neocortex is mounted on top of the supralimbic lobe—a supercharger of nerve cells and synapsis.

Many cetaceans, such as the Beluga and the Bottlenose dolphin, are endowed with brains that exceed humans in cortical surface area and are equal in neural complexity, but Leilani was aware that cortical mass wasn't the only factor in comparative intelligence. Other factors—like neural connectivity and sectional specialization—factored in as well. And primary sensory processing (problem solving) was the best test she knew for evaluating a mammal's mental powerplant. In the neurobiological realm this ability is referred to as *associative ability*.

The association or connecting of ideas is a measurable skill. A rat's associative ability is a ratio of nine to one, meaning that 90 percent of the brain is devoted to operate sensory organs, leaving just 10 percent for associative skills. A cat is one to one, thus half the brain is available for association. A chimpanzee has an associative ability one to three, and a human is one to nine. Humans require a mere 10 percent of their brain power for primary sensory projection. Ninety percent of the horsepower—or RAM or discretionary mental funding—is available to associate freely. But this is the point at which college textbooks typically end the construction of the mammalian pyramid—with humankind seated at the pinnacle. The cetacean brain, however, averages an associative ratio of one to *twenty-five,* and ranges all the way up to Orcinus orca, which operates at a stratospheric ratio of one to *forty*.

When comparing synaptic geometry, dendritic field density, and neural connectivity, cetacea finish on top as well. And, as far as mankind's pride is concerned, that's not the biggest blow: When dissecting the gray matter of Pacific Spinner cadavers in college, Leilani's incision diagram led her scalpel to a *fourth* cortical lobe. Cetaceans have a large-block *V-4*. This evolutionary leap marks the most significant difference between cetaceans and every other mammal, including humans. No other species on planet Earth, from any genus, during any other epoch, has ever had four separate cortical lobes.

This fourth cylinder, known as the paralimbic lobe, fits snugly between the limbic and supralimbic lobes. It acts like a superconductor, integrating the functions of the limbic and paralimbic lobes and yielding a rapid informational synthesis of integrated perceptions with a richness that would be unfathomable to man—through echo-location, for example, dolphins monitor the flow of blood, the development of unborn fetuses, and the workings of organs. Moreover, it is likely cetaceans are able to *see* emotions, misunderstandings, conceivably even detect lies.

Leilani would be the first to admit that the concept of a species more intelligent than man is a tough pill to swallow. Humans build things, wage wars, drive cars. We're *evolved.* But that's not as relevant as some suppose it to be. If we were to set Stephen Hawking's, Nikola Tesla's or Sir Isaac Newton's brain beside the brain of a babbling Paleolithic imbecile we would not be able to find a single difference in size, weight, or neural complexity. Modern technology is cumulative. Humans stand on the shoulders and rest on the laurels, trials, tribulations, errors, and endeavors of those who have preceded. Leilani knew damn well that she would perish within days in this frigid ecosystem, in just about any ecosystem for that matter, if she were left to her own devices—deprived of the shelter afforded by the ship that someone else built, food that someone else harvested, petroleum that another drilled, or vaccinations that yet another invented. The web of human interdependence is inextricable.

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Everett watched in perturbed silence as Leilani zoned out, feeding the Beluga whale and rubbing his sleek back. And her apparent ennui was far from his only source of frustration—the lack of discovery and understanding of the unprecedented migration phenomena had been providing a steady source of frustration to all onboard, especially Dr Everett. He had lined up more than a dozen experiments, but they were all—except for his proposal to monitor water temperatures around geothermal vents in the area—being held up, awaiting Antarctic Treaty Member Nation's approval. *Approval?* There was no time for goddam approvals. Too much was being held back by red tape and permission to cut it was taking time they no longer had. He watched Leilani joke around with the portly Beluga whale, spraying him with a squirtgun.

The first time Everett watched Leilani interact with a nonhuman species he realized she had a way with animals that was common in children but rarely seen in adults. The idea of stopping by the Animal Shelter on a Sunday afternoon was not even on Dr Everett's radar. The prospect was downright depressing. But, somehow, with some strange magic, Leilani had the ability to convert fluorescent lighting, '70s linoleum, and row upon row of sorry cages into the most wonderful wild animal kingdom playpen on Earth. Within minutes, cage doors were open, free-for-all pandemonium was unleashed, and blind-sided volunteer workers were ducking for shelter of their own. And there was something more to it than Leilani's child-like ability to roll around on the floor with homeless animals—Everett could not readily define exactly what it was, but there was definitely some kind of connection. And nowhere was this magic bond more obvious than when it was time to go. The last little kitten Leilani returned to its cage, the scrawniest creature there—wailing away and clutching to the cage door like Spiderman—seemed to connect with her, something way beyond empathy or sympathy. When she let him

back out, he ran right over, pushed over her super-sized Mountain Dew, and started lapping the electric green soda off the floor. At that point Leilani announced she was adopting "The Dew" and she took him home. That was all there was to it, no setting out to find a pet, no deliberating the added responsibility, no questions asked.

By now the squirtgun fight was over and Leilani was half-asleep at the edge of Mel's tank, rubbing ointment on sores caused by his transport cradle. To say that Mel was not only contented by, but also thankful for the treatment would not, Everett thought, be a stretch of the imagination. Yes, she did have one helluva touch—he could admit that much. Everett held Mel's dorsal fin as Leilani rubbed the ointment on his nostrum. Mel squawked, resting on his sheepskin-lined transport mat, which was in turn suspended by a twenty-ton crane. Water hydrated the Beluga's rotund body, outpouring a steady flow from the holes of perforated hoses. The sound of the water and the cool touch of Mel's skin were relaxing. Dr Everett was feeling better and began running numbers and symbols, searching for the illusive undercurrent responsible for this polar mayhem. He was in the midst of pulling together an elegant equation that may or may not have led somewhere when he found himself distracted again and unable to continue. In another moment the equation was lost entirely. He looked around for a pen and a paper to see if he might be able to salvage a fragment but found neither. "You know," he said, breaking the silence, "something's been bugging me." The truth was, he didn't really know what was bugging him and he had no idea what he was going to say next when he opened his mouth. But he had begun speaking and felt it was necessary to continue, so he decided to do his best imitation of Leilani's condescending relationship-therapist act—that was something that really did bug the hell out of him. "I've been wondering whatever happened to all that *we'll always be best friends* and *let's keep the lines of communication open* crap?"

"Not now, David, I'm in the middle of a thought."

"Yeah, right." Now he really was mad. First I was being silently ignored, he thought, now I'm being actively blown-off.

Leilani abandoned her cerebral pondering and consented to spar—she felt like having a good fight anyway. She said, "Everyone says that kind of stuff when they break-up."

"Right. You're still crazy about me and you know it."

Leilani screwed the lid back on the large bottle of vitamins much tighter than necessary and said, "You're out of your mind."

But then she changed *her* mind. She didn't really feel like having a fight afterall. She sat silently, then offered, "You should have considered apologizing if you wanted to be friends."

"Apologize? You dumped me."

"David, you can't spend an entire year with a girl then disappear for a month without getting dumped! Did you think I was going to sit around knitting sweaters? What was up with that?"

"I had to think a few things through."

"For a month? That's a lot of thinking David," she said, hoping for an acceptable explanation. "Did you meet someone else?"

"No," Everett said. "Let's just forget about it, okay?"

"Fine," she said, unpacking a small video camera and securing its harness and a radio transceiver to Mel's right pectoral fin.

The crane operator fired up the engine as Everett muttered something, making vague gestures with a frozen herring. Leilani shook her head in disappointment and picked up the radio transceiver. The crane hoisted Melville out over the stern and lowered him into the water. He floated off the mat, reveling in the freedom of open water for a moment before circling back and treading water just off of the stern, awaiting further instruction. Leilani manipulated his orientation via the transceiver and called out, "Alright boy, do your stuff." With that he dove

down, gliding through the Ross Sea with the small video camera and radio receptor mounted on his right pectoral fin. And in that moment, maybe for the first time ever, Leilani became fully conscious of the truly bizarre nature of her job—instructing marine mammals to perform tasks that are impossible, physiologically speaking, for humans to undertake. And even more bizarre was the fact that the thought processing mechanisms of these workhorses—in this case a fourteen foot two thousand pound Beluga whale—are yet unknown. And this thought brought her back full circle to her original thoughts on Melville's sentience. What goes on *inside* this Beluga's mind? Inside his soul?

Chapter 20

The Last Supper

He was about to eat his seventh meal within the confines of *Prometheus'* stark mess deck and hoped it would be his last. Everett watched as steamy factory-ground Colombian coffee dripped through the filtration unit of a Bunn automatic coffee maker and into its orange plastic handled pot. He was trying to think about absolutely nothing—no more hydrological, glaciological, and/or marine mammal scenarios. But that was no easy task. Typically, the deeper he dug himself into a problem without a solution in sight, the more frantically he endeavored to climb out with the answer. They had been onboard *Prometheus* for seventy-two hours now, and this floating think tank had been running in overdrive and running on empty for most of those hours. His mind was spent. Other than the gruff, unintelligible cook, he was the only one in the mess deck. The cook seemed to answer to the name Ham, but Everett had become fearful of addressing him at all. The morning before—at least he assumed it was morning—the land of the midnight sun was wreaking havoc on his sense of morning, noon, and night—but in any case, the last time he and the others had assembled in that particular room, he had made the mistake of suggesting, in the most polite manner possible, that perhaps the crisp, blackened disks he

assumed were his pancakes were ready to come off the grill. As Ham began to scoop up his cakes, grumbling cryptic emissions, Everett noticed a fine stream of drool dripping from the corner of his mouth down onto the griddle, sizzling with his dairy-free hotcakes.

He had come down to the mess deck early after leaving Leilani at the loading dock, hoping fresh-off-the-burner freeze-dried space food might somehow taste better, or at least have less time to become deposited with contaminants. When the Bunn's brewing cycle finished he poured himself a cup of coffee thick enough to eat with a fork and stirred in CoffeeMate with the end of his ballpoint pen. He cupped the mug in his hands, relaxing for a full fifteen seconds before he began wondering—for the ten thousandth time—about the accelerated rate of glacial flow. Information on ice stream dynamics was extremely limited, unfortunately, due to the difficulty of observation and experimentation. But one thing was certain—ice streams require liquid at their base in order to move, gliding on a thin film of pressurized water. Heat is not their friend. The measurements Dr Everett had conducted over the past twelve hours confirmed that rising seawater temperatures were definitely not causing the hyperactive glacial flow. Air temperatures would have needed to have risen above one hundred degrees Fahrenheit for the greater part of the past eight or nine months and even if air temperatures *had* risen significantly (local air temperatures were actually two full degrees lower than the hundred-year average), water temperatures react extremely slowly to changes in air temperature. The geothermal vents near Mount Erubus, Ross Island's active volcano, were the primary suspects, but the vents were dormant and the detectors that had been lowered into the underwater cauldrons the previous day hadn't registered anything unusual.

Chapter 21

Interlude

William of Occam was a thirteenth century Franciscan philosopher who had a squabble with Pope John XXII. He and the Pope disagreed on just how much wealth was reasonable for a man of the cloth to acquire. William felt certain that the only true path to enlightenment was paved in simple, unhindered poverty. The Pope had a slightly larger sum in mind. The argument ended, as arguments with Popes of that era tended to end—with William's excommunication. He fled to Bavaria under the protection of the Emperor Louis IV, who had been excommunicated by the same Pope one-year prior.

Traveling through the Black Forest by night, William of Occam reflected upon a law of economy for which he would become well known: *non sunt multiplicanda entia praeter necessitatem*—don't make things more complicated than necessary. The most likely solution to a complex problem is the most simple and the most obvious solution.

Indeed, to Dr David Everett, science was the simple art of reducing variables until blurry vision rendered itself in high definition, and he had been thinking of Occam a great deal over the past twenty-four hours, contemplating his law of economy known today as Occam's Razor.

Whales and dolphins were migrating south and Antarctic glacial flow was accelerating, but not necessarily in that order. That was all there was to it.

Reports of the migration had no doubt been headline news back home. Ladir had promised to have someone forward summaries, but—true to his taciturn nature—the first reports had yet to arrive. As far as Everett knew, no decisions had been made whether or not to release findings regarding the critical developments along the West Antarctic Ice Sheet, but he did not allow his curiosity to cloud his mind for long and quickly returned to considering as few variables as possible.

Everett entered the a/v lab and sandwiched himself between Leilani and Sean without a word. Nobody was speaking and everybody seemed agitated. The onboard electronics relayed acoustical and video feeds from Mel's camera, lending an eye and an ear to a sea that was alive with the sights and sounds of cetaceans. Everett found the swaying and jarring image-relay from Melville's fin-mounted camera too headache-inducing to watch. He closed his eyes, taking in only the even flow of cetacean songs colliding with seemingly erratic echolocational clicks and crackling ice. The cumulative cacophony ceased to be recognizable as 'cetacean song'—it was cetacean noise. Loud, white, non-directional, grating noise. So many sounds, layer upon layer, coming from so many species had taken on the form of audible chaos. Everett felt his forehead; it was a little warm, even hot. Come to think of it, he thought, my cheeks and ears feel hot too. He closed his eyes again and tried to listen without thinking too much.

Belugas tend to be extremely vocal creatures and Melville was no exception. And given Melville's proximity to the microphone and constant on-air presence, he served as a lead singer of sorts to the undersea symphonics. Melville surfaced for air amidst a cluster of broken ice and approached the shelf. A pod of Common dolphins streamed by—wriggling like stinger missiles, echolocating and casting lateral glances at Melville as they passed.

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The dim, unflattering fluorescent light of the a/v lab made everyone look even more exhausted than they were. Especially Leilani. The radio transmitter seemed to be malfunctioning, sending erroneous commands to Melville. Leilani watched impatiently as Sean Daniels' eyes wandered through an expansive circuitry panel, lost in a snare of wires and the dregs of lassitude. He was trying to explain the difficulty of solving the snafu at hand when Leilani snapped, "I don't care what you need to do. Just fix it."

"Cut me some slack!" Daniels yelled, tossing the wires aside and going apeshit. Daniels' sloppy-go-lucky lifestyle—as it turned out—was a façade, masking the Tasmanian madman hidden beneath those baggy pants, Argentine hand-knit sweaters, and unkempt blond hair. His vocation as a glaciologist stood a distant second to his métier as an aggro-grunge ecologist. He was the kind of guy who—if he happened along an elderly woman in a full-length mink coat—just might kick her ass. He was also the webmaster for ecohackers.org—a loose knit underground outfit whose primary mission seemed to be cracking ecovillian networks and doing as much fiscal damage as possible. Biotech, oil conglomerates, timber mills, Japanese whalers—they were all fair game. His last posting to the site was: *101 Things You can do to Fuck-up the People who are Fucking-up the Earth*.

Leilani continued to struggle unsuccessfully with Mel's radio controls as her argument with Daniels escalated. A moment later, Mel oriented his body to the left. Leilani looked up at the monitor, "Wait, hold on," she said, "it's working."

And it was.

"See," Daniels said smugly, "the bug was on your end."

Leilani did not counter; apparently she knew Sean was right. In the last few tense hours Melville appeared to be simply disobeying her commands. He passed over a pair of jet black whales with compact, rounded and bulbous foreheads. Everett thought they might be pilot whales. The Beluga seemed to survey them from above, then dove straight down between them. Koenigs entered the lab as a crazed cacophony reverberated through the waters, into Melville's microphone and out of *Prometheus'* onboard sound-system. As Melville neared the shelf, dark phantasmagoric forms hung motionless in the water ahead. A magnificent lineup, a supernatural spectacle, came into view through the video feed. A great phalanx of whales and dolphins clustered along the Ross, stretching to infinity in both directions. Each rising for air, then slowly sinking to its previous position. Everett sank in his chair, spilling a little coffee on his trousers.

The Captain asked, "Was ist das?" or something to that effect. Everett had begun to notice that the Captain's English was slipping and he was becoming progressively difficult to understand. The man previously armed with a spectacular vernacular and capable of formulating fabulous tintinnabulous phrases had, under stress, retreated to the comfort of his native tongue despite the fact that none present spoke German.

Dr Everett remained silent. What could be said? This was the most phenomenal, bizarre, and intriguing gathering of marine mammals he had ever witnessed. The vision of the astounding concentration along a monstrous ice shelf at the end of the Earth was in some ways more startling than the immediate problem posed by the ice shelf itself. Single whale encounters are rare indeed and the mystic, enchanted power of such encounters is known to evoke powerful emotional responses, including uncontrollable fits of laughter and weeping. But innumerable encounters—Rorqwhal, Blue, Fin, Minke, Pilot, Sei, Bryde, Right, and Gray—all in one space at the same time amounted to sheer sensory overload.

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Dr Everett found himself standing behind Sean Daniels with a red plastic tray, back in front of the Bunn coffee maker, waiting with the rest of the crew to dig into another round of Ham's finest. He was about to pour himself a cup of coffee, but suddenly felt something he hadn't felt in days—a nasty numerical migraine. At first it seemed sourceless, creeping up from nowhere, from everywhere. He looked around—three rows of empty coffee mugs. The coffee maker was a Bunn model 609—another whole number divisible by three. Was this numerical migraine's source-code buried in the trinity? Maybe. But wait. No, the solution didn't seem to be numerical at all. It was something much simpler. Like a clean shave from ol' Willy's razor. He looked back down at the coffee maker, at the hotplate specifically, considering the application of direct heat.

That's when it hit him—as if by magic Motrin—knocking Everett's migraine clear out of his head and forcing him to drop his coffee cup on the floor. Without giving the mess a second look he announced: "I've got it."

The crew awaited Everett's declaration.

"Come on, David," Leilani said, "If you've got something spit it out." She was in a bad mood and rightly so—it had taken her over two hours to coax Melville back onboard.

Everett said, "Oceanic attenuation."

It didn't appear to register or ring any bells with Leilani—she lit a cigarette.

"Wow," Daniels said, wrinkling up his brow, "maybe so."

Everett explained that sound converts to heat when traveling through liquid. Based on the three aerial surveys that had been conducted over the past twenty-four hours, there were approximately nine and a half *million* cetaceans in the waters along the Ross Sea at that very

moment and somewhere between ten and twenty thousand arriving hourly. He hadn't done the math yet, but he thought the release of energy just might be enough to nudge regional water temperatures up a half, maybe even a full degree. The hydrological conditions (direct conduction and high salinity) were ideal. And Everett reminded them, as the eminent Roger Payne once noted, in ocean acoustics the expected almost never occurs and the fantastic is commonplace.

Sean and Leilani debated as Everett sat down with pen and paper and began working his way out of this numerical maze. In due time Sean and Leilani settled into quasi-agreement and began working on a method to test Everett's theory—searching for a way to displace the cetaceans from the shelf, at least long enough to conduct glacial advance measurements.

"Name a species we haven't seen down here," Leilani challenged Everett.

"Not now Lani," he said, "I'm working on something."

"Orca," Daniels offered.

"That's right," she said, suddenly getting it and sitting upright, "Where are they?"

They had observed members beyond measure from every species save Orcinus orca. The orca, a.k.a. 'killer whale' was quite possibly the only species missing from this global marine mammal cluster. The absence struck them all as extremely peculiar: they're even native to Antarctica. And given the mass exodus of their primary food source, why weren't northern populations following? The Southern Seas had become an orca's all-you-can-eat sushi buffet—but where were they?

Dr Everett looked up from his thoughts and joined the brief discussion that followed. In the end it was determined that the introduction of an orca population could, theoretically, curtail this marine mammal convention. It was just a matter of capturing a couple hundred thousand orca (!) and transporting them to Antarctica (!!).

Then again, perhaps there was a simple solution afterall: Several years earlier Leilani had read Krisstenson's account of experimental transmission of recorded sounds to gray whales as they migrated south towards Baja, California. While pure-tone sounds and random noise had little to no effect, the recorded sounds of killer whales—the only predator to whales besides man—instantly evoked the grays' flight instinct. Krisstenson had utilized this study to develop acoustic harassment devices to be attached to the hulls of fishing trawlers: an attempt to reduce incidental bycatch—fishing lingo for accidentally killing things you're not fishing for, including marine mammals.

Where was Krisstenson, anyway? Everett wondered. He hadn't seen him since the previous evening. Everett had taken his mind off the math because the numbers weren't looking good. If he were to yell at the top of his lungs at the cold cup of coffee in his hand, for example, he would need to sustain this verbal harassment for eight years, seven months, and six days before he produced enough energy to heat it to the temperature he was accustomed to consuming this beverage. Everett was well aware that raising a 10m x 1km x 1km body of water along the Ross Ice Shelf just one degree would require a lot of energy, yet he had still underestimated just how much energy that would take. His assumptions were: 10 million marine mammals emitting 60db (10^{-10} watts/cm^2) audible whistles and calls. Thus in order to raise that 10m x 1km x 1km volume of water would require 10^{13} Joules of energy. Further calculation indicated that these 10 million mammals would have needed to sing their hearts out for the past one hundred years to raise the temperature a single degree. He was now convinced that his theory was as ridiculous as Koenigs had thought it sounded initially.

Leilani, meanwhile, had asked Daniels about the extent of the audio library.

"Extensive," Sean said, following her train of thought, "we've got hundreds of orcas."

"Forget it." Everett surrendered, slumping down over the remains of his breakfast. "The numbers don't work. They're not even close."

But neither Sean nor Leilani accepted his surrender; they took their conversation out into the narrow hallway.

Chapter 22

The Killers

Killer whales are friendly creatures, but *friendly* is a relative term. True, there have been very few incidents involving the Killer whales' consumption of homo sapiens, and many killers (known in formal circles as Orcinus orca) have been taught to swim circles in plexiglas tanks, jump high wires, and splash spectators with water. But the orca is unquestionably a highly intelligent being and a solid case could be made for their ranking as the most intelligent life form on Earth. It is also true that Orcinus orca is the single most ferocious predator in the sea or on land. Three hundred ninety-five pounds at birth, quickly packing on three to nine tons. Able to snap porpoises in half with a single bite. Thousand pound Great Whites take two. Needless to say, fellow marine mammals avoid Orcas at all costs.

Several hours later and back inside the a/v lab, Daniels scrolled through a list of cetacean sound bytes, clicking on: *Orcinus Orca, Pacific Northwest*. "Here's one." He played the vocalization.

Leilani inquired about playback capability.

"150,000 watts," Daniels boasted, flipping a series of switches that gave life to the hydro-acoustical sound system.

Everett entered the room. He remained convinced their efforts were in vain but was curious to observe what response the sound stimuli might evoke anyway. Orca calls emanated from *Prometheus*' hydro-acoustical system. Daniels nudged up source level knobs and the calls echoed throughout the Ross Sea. The calls, eerie and aggressive staccato waves of sound, propagated through waters near and far—as far, Daniels estimated, as six miles away. Within twenty-five minutes, the dense knot of cetaceans strung along the massive ice shelf's base began to break apart. The assembly of whales and dolphins appeared to be dispersing. Leilani was pleased—Melville seemed to be responding appropriately to her commands—and the first stage of their plan appeared to be working. They just had no idea, however, what this might accomplish. Whales and dolphins scurried off, clicking and whistling—scanning for predators that did not exist. Sean and Leilani began to stir with the excitement of watching a simple plan achieve success. God, she thought, it's working.

But by the time Mel had completed his circle, whales and dolphins began reassembling along the shelf, and within another twenty minutes every whale that had made a brief departure promptly returned—and remained.

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Time passed slowly—two more days to be exact, two more frustrating days of searching for answers and solutions that remained unfound. Dr Everett had spent this forty-hour period reworking, recalculating and re-reworking his oceanic attenuation numbers. His focus had deepened into a sort of fevered trance. Distress was in the air and began to condense and rain

down on those onboard—on Leilani in particular. Over this intensifying timeframe she had been conducting the dubious task of collecting countless whale and dolphin tissue samples, testing for every malady imaginable, and throwing every hypothesis that drifted into her head against the wall. Thus far none had stuck. Daniels' glaciological modeling failed to produce anything remotely conclusive either. But Everett's thoughts regarding the underwater acoustic emissions had come full circle. Mathematical modeling had confirmed his rough estimates—the conversion of cetacean sound to heat was definitely not enough to influence glacial advance. But he had begun to wonder if the sound was merely one element, a trigger of sorts, in a nonlinear, autocatalytic chain of events powerful enough to accelerate glacial flow. One way to think of linear and nonlinear events is in terms of falling snow. Snow falling on an open plain is a linear event. Each snowflake that falls increases the depth of the snowfall by one snowflake. Holding a few variables constant—such as zero wind velocity—the depth of snowfall given this scenario would increase in a linear and easily predictable fashion no matter how much snow falls. Snowfall in the mountains is a different story. Mountains are notorious for producing devastating nonlinear snowfall events. Each snowflake that falls upon a mountain slope increases the depth of snow in a predictable fashion up to a certain point, but there is a depth at which things go awry and the event becomes nonlinear. Variables such as the angle of the slope and the water content of the snow are factors, but there is a point when a small input—the fall of one more snowflake or the sound of a human voice—yields the potential for tremendous output, an avalanche. As far as Everett could see, there was no linear input large enough, at least not that he could see, to create the kind of glacial advance avalanche they were witnessing. But somewhere down here, he suspected, was a nifty nonlinear equation etched in hieroglyphics upon a mysterious slope.

The team had agreed on one thing, however: driving the cetaceans from the Antarctic waters was their primary objective. If the sound waves were a link in a chain reaction of sorts

affecting glacial flow, that was going to be the only way to know for sure. Everett had already thought of the most likely and most effective means to get the mammals out of Antarctic waters. He wondered why Leilani hadn't mentioned it. There was no doubt it had crossed her mind—afterall, she had invented the process. Whatever the reason, he thought, I better keep my big mouth shut. He figured she was holding out to see if a less drastic means would surface.

But how much time did they have before the shelf collapsed? Dr Everett didn't know. Daniels didn't know. Nobody knew. Three months? Three weeks? Three days? It was impossible to estimate until they were able to get out there and take readings on the shelf itself. But the chopper had been rendered inoperable due to damage the rotors sustained by the rogue-wave disaster, and would remain out of service until new parts arrived from Christchurch.

In due time Krisstenson resurfaced in the geological lab as if he had just stepped out to grab a quick bite to eat. Where the hell had he been? Everett had not seen him for the past two or three days. He had shown up for neither meetings nor meals, and in fact it occurred to Everett that he had not seen him eat a single thing since their meal at his island home. Krisstenson did not offer any explanation as to his whereabouts but inquired immediately if there was cold-water diving gear onboard. The Captain said they had none.

"The Aussies still have their dive house set up on the bay ice by McMudhole," Daniels offered.

Krisstenson handed Daniels an old phonograph and inquired whether or not he could patch in another audio source. Everett had no idea that Krisstenson had been aware of their sound experiments in the first place.

"Audio source, yes," Daniels said, "but fossil, no." He popped open the top of the phonograph in amusement. "We don't have a means for analog conversion. But," he said in reference to a CD-ROM drive, "this plays audio CD's."

Krisstenson studied the plastic encased hard-drive and depressed a button, sliding the CD-ROM tray open. He asked Daniels if he had any Marvin Gaye.

Daniels didn't know.

Everett rubbed his forehead, wondering what hell this was all about.

"Neil Young?" Krisstenson asked, "or how 'bout Miles Davis?"

"Probably," Daniels said, "I've got tons of good stuff." Daniels was obviously puzzled as well, but hesitant to question Krisstenson's modus operandi. He opened a cabinet—it was filled with dozens of black nylon CD cases, each holding one hundred CDs.

Krisstenson leafed curiously through the endless plastic pages filled with Daniels' home-fried CD collection, confused by the nondescript silver disks with band names and album titles scribbled in magic marker. He pulled out a CD and asked, "Let me hear this one."

Daniels slid the CD into the CD-ROM drive. The album began—aggro stage-diving early '80s punk. Maybe not. Krisstenson pulled out another.

The musical interlude struck Everett as a total waste of time. Sand was freefalling through the hourglass at terminal velocity and they were playing Name That Tune.

Daniels fired up another CD—a sour batch of bubblegum pop—some dancing-boy-band Everett could not identify.

Krisstenson listened carefully for a moment. "Better try a few more."

Leilani looked at the CD's over Daniels' shoulder, "Do you have any Sarah McIntosh?"

"You mean Sara McLachlan?"

"Oh yeah, that's right."

"Yeah, hold on, think so," he said, pulling out another case and flipping towards the back pages.

Great, Everett thought, shutting down his laptop, Daniels *and* Leilani, grape Kool-Aid drinking disciple numbers one and two reporting for duty.

Leilani found two albums—*Fumbling towards Ecstasy* and *Surfacing*—she picked up *Surfacing* and asked Sean if she could borrow his Discman. She said she was calling it a night.

"Sure," Sean said, "I'll bring it by your room when I'm finished here."

Yeah buddy, Everett thought, I bet you will.

Chapter 23

Eddie Akua

A child's mind is constantly barraged with strange new words—flying through his or her consciousness and leaving faint trails of intrigue in their wake—like dusty angel footprints or the blur of hummingbird wings. Some sound funny, others exciting, but many are daunting and stir intimidation. It takes time, context, and reiteration before these strange new words are integrated into a budding adult's vocabulary.

When Leilani was sixteen years old one of those words made a vague descent and alighted upon her—*melanoma*. It sounded like many of the other sweet and gentle words already forged upon her mind—like *mellow* or *melon*.

But given the context, this new word couldn't be all that good.

On a bright, sunny Fourth of July so many years ago, young Leilani was netting jellyfish in the Alawai canal with a group of neighborhood kids. This particular activity took place twice per year: on the Fourth of July and Chinese New Year. They set the jellyfish on the cement and stuck tiny red Chinatown fire crackers inside their gelatinous bodies. Then, of course, they blew them up.

Leilani's mother called her back to the house. Leilani's twin brother Eddie wasn't home—that always gave Leilani a hollow feeling—like a three-hour movie without popcorn or a Coke. A magical, almost telepathic link exists between twins. This comes from doing time together in the amniotic pen. Maileia sat her daughter down for a talk, and being sat down for a talk was never good. Somewhere in that conversation her mother said it—melanoma—Leilani couldn't remember exactly where, afterall, at the time she had no idea what it meant, but she said that Eddie was sick, very sick, and that he needed special care that could only be found on the mainland.

Intuitively, teenagers understand a wide variety of concepts. Mortality is not one of them. Looking back now Leilani wondered why someone didn't just spit it out and say that her brother would soon be gone forever and tell her to make the most of the time remaining or she'd regret it for the rest of her life. Because that didn't happen—Leilani spent the remainder of the summer at the beach, cruising in her best friend's car, and losing her virginity. Eddie had asked for a couple of their mothers' books, saying they seemed like the best kind of medicine that he could think of. Maileia loaded up her entire collection in a giant trunk and offered to fly Leilani to Texas with the books to visit Eddie before school started back up. But Leilani declined and her mother went instead. There were only thirteen days of summer left and she would see plenty of Eddie when he got home.

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Leilani wasn't really calling it a night but she took five minutes to lie in her bunk with the shades down and the lights off, listening to Sarah McLachlan's *Adia* through headphones on Sean's disc player. She had assembled three tubule tipped darts and an unwanted crossbow stood in the corner, but that business could wait. The eerie desolation of Antarctica was

wearing on her. Her internal clock was functioning like an alarm clock accidentally set to ring in the PM. Time stood still then disappeared all together. How many days had they been down there now, anyway? How long had it been since she had seen a sunrise? Or sunset? The constant and distant roar of ice floes moving against one another created the permanent sensation of being imprisoned inside a conch shell, and these headphones served as a conjugal visit of sorts.

She had already decided *Surfacing* was one of her favorite albums and she had only heard the first four tracks. She wondered if McLachlan wrote her own lyrics. Eddie used to say that the only songs worth listening to were the ones in which the singer actually wrote the lyrics, otherwise they were sung out of emotional context. Roberta Flack and Johnny Cash, however, he had always maintained, were exceptions to this rule.

Sean had brought over *two* sets of giant black earmuff-style headphones and a supped-up twin port headphone amp so, in theory she supposed, they could listen together. She hoped that she had not been rude or ungrateful when she declined his company.

She was acutely aware of the fact that she was failing as the commanding officer on this mission. There was a means to clear the cetaceans from these waters right there within her grasp and she wasn't about to use it. No way. This neglect left her stranded in court-martial territory. They could probably get one or two hundred thousand tons of the compound down here within forty-eight hours. But the Admiral couldn't read her mind, fortunately, and she doubted anyone else would think of it. She decided to wait and see what Mother Nature had in store, or what Rand Krisstenson was up to. At least it would give her a moment's rest from the spotlight, allowing her eyes to adjust so she might spot an alternative course of action.

What is it that's so otherworldly about listening to music through headphones? The sound was incredible, totally enveloping her mind in song and only song, shutting out and shutting down the other senses. Yes, she decided, to saturate the body and soul in pure music

had more to offer than any bath or mineral spring. But after soaking her soul for awhile she acknowledged it was time to get back to work—and when it got down to it she was kind of irked about the music, anyway. She had been doing pretty well lately and hadn't thought of him in days.

She hadn't even told David about Eddie—he didn't even know she had *had* a brother—and of all the people in the world, she had wanted to talk to David about Eddie the most. She wanted to tell him everything she could recall, his silly stories, precocial wisdom, courteous smile, and compassion rarely found in adults—let alone twelve year-olds. How he skipped school to stay home and read the books *he* thought he should read, how he surfed that old plank from grandpa's canoe every day with the spinners that fed around the point. She figured David wouldn't have believed that part—haoles never did—but it was true, they surfed right alongside him. And that Eddie named those dolphins and carved their names on his board. Yes, she had wanted David to know every single thing about him, but she knew she couldn't handle it—the talking about Eddie, that is. Because eventually she'd get to the chapter where he was lying in that hospital bed over there, all alone.

Chapter 24

Snow Angels

They began to die. Everybody knew it would begin soon, but nobody wanted to talk about it, especially not Leilani. She spread her legs a bit, bracing herself in the bow of the twenty-six foot tender, looking down upon the slow, bizarre death surrounding her. Silent dolphins—*thousands* of them, all non-native to polar waters—floating upon the water in every jumbled position except the surfacing, breathing, and swimming positions. And the sight of those yet remaining alive wasn't much comfort, for it was almost as if every sluggish surfacing and every lugubrious breath would be their last. Common, Spotted, Spinner, Bottlenose. Their bodies were gaunt and emaciated, having melted away over the past two weeks as they fought frigid waters that, as the valiant Ernest Shackleton observed, is open to all and merciful to none. Their lifeless bodies inevitably struck the bow as the tender waded and thumped through the devastation. Indeed the effect on Leilani was so devastating that she had no choice but to disassociate herself from the moment, thinking of the dolphins as snow angels, floating on their backs in toasty blue snowmobilesuits, catching snowflakes on their tongues and awaiting the perfect moment to splash their flippers, etching wings upon the water.

Leilani raised the crossbow to her shoulder, sighted in on the rich blue features of an Atlantic Bottlenose, and fired a bolt. The bolt missed, snicking impotently into the rippled face of a small wave. Leilani looked back at Hal as he turned the tender back to pick up the bolt that now floated upon the water. His face had not indicated whether he thought she should have been able to hit her past three targets. She appreciated this. When Hal reached over and dipped a net into the water to retrieve the errant bolt, Leilani was overwhelmed by the unmistakable stench of the plume of a great whale.

Whales do not floss. The essence of forty billion ancient and decomposing krill expelled from a giant mammalian vaporizer is a stench of the highest order and never forgotten. Thirty meters starboard, the long, sleek bluish gray head of a sizable sei whale settled back down as the misty plume drifted and rained down upon the tender, blanketing Leilani and Hal with heavy, stinky dew. Then again, maybe he was a Bryde's whale—they were tough to tell apart. In any case Leilani figured his next breath would be taken on the port side of the tender, so she turned, hoisted the crossbow back to her shoulder and waited.

Over the past two days she had collected tissue samples from numerous dolphin species and several of the lesser whales, but had yet to obtain a sample from a member of the Balaenopteridae family—the big ones: humpback, rorqual, fin, sei, and of course the great blue whale. She cocked the bow, carefully nocked another tubule tipped bolt, and waited. Sure enough, fifty seconds later the sei resurfaced twenty meters port. Leilani released a bolt which flew through the second plume directly into the receding back, a few meters ahead of the dorsal fin, finding solid purchase in the whale's epidermal, then dislodging with the tissue sample as the mighty whale plunged into the waters below.

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What was happening? Parasites? Infection? Confusion? Disorientation? Biomagnetism? Self-destruction? Cetaceans are some of the few mammals—besides man—that take their own lives when ill. This act, known as stranding, is common, especially amongst pseudorca and pilot whales. They strand by pushing themselves up on a beach during a declining tide. The larger species thus crush themselves under the sheer mass of their own weight, bursting their internal organs against the sand. In most cases, however, the sun heats their absorptive skin and they effectively cook themselves from within. Many suffer from worm infestations in the middle ear, brain parasites, or other maladies. But there is a primary difference between man and cetacean insofar as the execution of this act is concerned: in cetaceans, pair and pod bonds are so strong that the healthy follow the sick ashore. Mass strandings are the norm. In 1946, along the shores of Mar del Plata, Argentina, 835 pilot whales stranded together. Could this calamity in the southern seas, Leilani wondered, be some kind of global stranding?

She carefully removed the one-inch tissue sample from the bolt tubule and set it in a biopsy tray. Leilani had once spent an entire summer gathering biopsy samples from the dwindling Beluga population at the mouth of the St. Lawrence River. The high concentrations of DDT, mirex, lead, mercury, PCBs and benzopyrene along this particular stretch of water had long been suspect as the culprit in the Belugas' almost entirely successful vanishing act there, but there were, naturally, geniuses who felt the data was inconclusive and that biopsy and analysis were necessary to prove the far-fetched hypothesis. It was by far Leilani's worst work-related experience and this element of her assignment down south was no less miserable.

After another hour or so in the lab she retired to her bunk. Excedrin PM only seemed to be making the insomnia worse—she had had but a paltry few quality hours of rapid-eye movement since arriving and it did not look like this night would be any different. Yes, the omission of sunrise and sunset was highly disconcerting. Antarctica was a strange land time had forgotten.

She climbed up into the top bunk, crawled under the heavy wool blanket, and lit her pomegranate travel candle. She opened her journal, but her shadowy thoughts wandered and were too elusive to commit to paper, so she skimmed back through past thoughts, lovers, losses, hopes, and dreams. She watched the slender blue flame flicker for a moment, then looked out her porthole at the red aurora above the collage of ice and prayed for the snow angels in the water below. Leilani had never actually made or seen a real snow angel. In fact she had never even seen snow until her thirtieth birthday and that prompted her to turn to see what she had written. She wasn't surprised that she hadn't actually written anything over that weekend—she never wrote when things were going well. She had, however, recapped those events in the week that had followed. The Sierras would have been much closer, but David had insisted that her snowflake debut fall upon a canvas no less grand than that of the Grand Canyon. She was glad she wrote it all down because she wanted to remember that drive across the twisty ribbon of Highway 163 for the rest of her life—her man, the painted desert, and stoic cacti rushing by in consecrated silence.

Leilani turned the page. This reminiscence was just a distraction anyway, wasn't it? Somewhere, somewhere not too far below the surface of her subconscious mind, she knew what emotions these little snow angels, these haunted messengers of the deep, really evoked—but she refused to become fully aware of them and lay there in the candle light as if she were trying desperately to keep a secret from herself. She was about to blow out the candle and tuck her journal under the pillow when she came across a chronicle of a variation of a recurring dream. She knew she was headed further into already troubled waters, but read on anyway. Reviewing the written text of an old dream, even a dream merely a few months old, Leilani thought, is one of life's truly eerie and bizarre experiences. It reads like fresh, pure fiction, seemingly foreign and totally unknown to the dreamer/writer/reader. She never had the faintest recollection of ever having had the dream. Was this universal or unique unto herself? she wondered as she read:

12 July

I had a dream that Eddie, Dad, and I spent the day at Makapu'u'. The floorboard of Dad's Toyota had finally rusted through. Eddie and I laughed all the way around Diamond Head as blacktop sped beneath our feet. We rounded Hanauma Bay and wound up the windward coast, past giant tour buses packed with bright white and lobster-red snorkelers. Glassy rollers pounded the beach at Sandy's.

We reached Makapu'u' and found most of Eddie's friends, including Terry Kelly, already in the water. I swam while Eddie paddled out. I got out and lay in the sun and let saltwater dry on my skin—I miss that feeling. The Spinners that fed in the cove were out rolling around in the surf with the boys, like gray ghosts etched in the faces of the curling waves. God, they loved Eddie.

I haven't seen anything like that here in SD. I've been watching the guys surf the break at Scripps pier most Sundays. Once or twice a month, a pod rolls through, but they don't interact much—nothing's the same over here.

Anyway, while Eddie was showing off for the girls on the beach, I went off for a walk around the point with Terry Kelly. When we got back Eddie was gone.

Leilani felt herself drifting off to sleep. She said an *Our Father*, a *Hail Mary,* prayed for her family, Mel, and all those aboard *Prometheus*—including David. And then she said a special prayer for her brother and the souls of all the other beloved who had departed.

Chapter 25

Close Encounters

Prometheus' hull scraped restlessly against its mooring along a makeshift pier—a peninsula of solid, sheer edge ice that jutted out into the open sea. McMurdo station sat in the frozen background.

An eight passenger snowcat tracked off along the fringe ice, driven by Martin Donner, a burly Australian researcher in his mid-forties. The thermometer on the dash read 15 degrees Fahrenheit. Krisstenson sat in the back, pouring a cup of hot Jell-O water from his thermos.

"Hope you don't mind," Martin said, eyeing Krisstenson in the rearview mirror, "we took the liberty of filling your tank."

"Thanks," Krisstenson said, "but I don't need a tank."

"Ay?"

"Thanks, but I don't need it."

The Australian scrutinized Krisstenson's arcadian expression in the mirror. "Whatever floats your boat, mate."

Out on the barren expanse of open ice, the Australians had set up a corrugated aluminum dive house in the fashion of an over-sized ice-fishing shack—floorless with exposed beams, twin potbelly stoves, and a huge sliding door. The walls served as yet another testament to the isolated psyche of an all-male crew dispatched to a lonely continent at the end of the Earth—the ice shack's walls were a veritable pin-up gallery of robust femme fatales—raunchy centerfolds and a mélange of strange, low-resolution internet fetishes. Krisstenson and Martin entered as another Australian of considerable mass known as Dink operated an auger inside. The auger looked like a heavy-duty forklift, but had a drill bit (with the diameter of a manhole) instead of a lift. The bit bored down through the ice—six feet thick—sloshing out water as it broke through to the underside.

Martin gathered a toolkit, a few other valuables, and gestured for Krisstenson to follow him outside. "Don't know why," he said, "but it happens every time. Think they like the sound of the auggy."

The auger churned slush and whirled off water as the bit pulled out of the hole. Once the bit was clear from the ice, water exploded like liquefied shrapnel—scores of Emperor penguins launched forth, shooting up and out, hitting the ice in a high speed waddle out through the sliding door and along the fringe ice. Some remained upright, stumbling in the clumsy frenetic chaos of the emergence excitement. Others face-planted and tobogganed along on their bellies.

Krisstenson smiled and watched as he pulled a dry-suit over thick layers of polypropylene and polar fleece. Martin checked his watch and informed him that he'd probably stay warm for about twenty minutes. Krisstenson paid little heed, adding the hood and an 18-millimeter neoprene facemask to his suit.

Martin handed him a dive light. He was apparently uncertain if his words had been heard, so he spoke louder. "Sure you don't want a spotter?"

Krisstenson drew in slow aspirations and released one long breath after another at the water's edge. He began to alternate three quick breaths followed by three long ones.

It was now apparent that Martin was being ignored, so with a perturbed twitch he added, "Just stick by the yellow line and—"

But Krisstenson slid in before he finished, sinking through the six-foot tunnel of pure ice. Delicate and intricately patterned platelet ice formed on the underside of the thick ice roof, separating above and below with a sparkling fantasia of snowflake crystals. Solid shafts of light beamed down through small holes in the ice, through water so clear it looked holy.

Prometheus was moored four miles south by southwest and the warbled sound of looped jazz—Miles Davis *On the Corner*—piped thinly throughout the Ross Sea from *Prometheus*' hull-mounted hydrophones. The looped rhythms cut through the water and against the grain of knotted and super-saturated whale songs and dolphin clicks and signature whistles.

Two Bottlenose dolphins, a mother and her calf, joined Krisstenson in his descent along a weighted yellow line. After a full minute, the music ended and the dolphins clicked along the line, whistled, and dove below. At one hundred and twenty feet into Krisstenson's freedive, only velvet blue light filtered into the swelling darkness.

Chapter 26

Sweet Dreams

Dr Everett could pass out anytime, anywhere, and could easily sleep in excess of ten hours in a single stretch. And for some reason he could not quite comprehend, he had been getting a great deal more slumber since he and Leilani had parted ways. Everett enjoyed a good dream more than going out to the movies—and lately, more than just about everything else. And, as previously stated, he was capable or thirteen and fourteen hour dream marathons. Thus it was not unusual that his sleep was so deep that he did not hear his alarm clock. And despite the intense beams of polar summer sun that bore through his porthole, he slept and dreamt on.

As a small boy he dreamt almost exclusively of Mustangs or girls, and on this particular morning he dreamt of both. That had always been a source of concern for his mother. Not the dreaming about girls—that seemed normal enough—but this Mustang business had bothered her considerably. And rightly so. Not long after eight and a half pound David Everett was born, his father, Henry David Hewson, had purchased a used 68' Ford Mustang. Everett's mother, Connie, could never remember which model, but he bought it at an auction at the Hertz Corporation. In any case, in late-December of 1972 Connie returned from work and discovered

the car in the garage with the pink-slip taped to the dash. They never saw Henry Hewson again. The following spring Connie sold the Mustang to cover several missed mortgage payments. She had never told her son the truth about his father, much less the car, and he had probably only ridden in it a dozen times or so. Surely, she thought, he was much too young to remember. Needless to say, Everett's obsession with vintage Mustangs was a great source of anxiety for his mother. And when Leilani had phoned her, overflowing with exuberance about the incredible birthday present David had just given her, Connie had fainted.

Dr Everett awoke to an eerie silence. Only the distant hum of *Prometheus'* triple Caterpillar diesels reverberating through the engine room sounded from below. Although he had been dreaming, he forgot the imagery before gaining consciousness. But he did feel the lactic acid that had accumulated in his legs from a night spent running-in-place from the good witch that had, no doubt, haunted the lost dream. His attention returned to the dry stillness amplified by the diesels' low drone. He found the utter desolation of the Southern continent unnerving. Thoroughly unnerving. Other than those onboard *Prometheus,* they had not seen the faintest sign of humankind since they left McMurdo. He tried to fall back asleep and eventually he did, only to awake fifteen minutes later. He picked his clothes up off the floor, put them on, then meandered down to the a/v lab and found Leilani, Daniels, and Stearns watching a telecast from Melville's video feed.

Daniels sang, "'Mornin' Dave!" about 10 decibels too loud for his liking and handed him a cup of coffee. Leilani didn't take her eyes off the monitor.

Daniels slid another disc into the CD-ROM drive and slid the cross-fader from Detroit Drum and Bass to scary German Jungle.

"Got 'im," Leilani said, spotting Krisstenson on the monitor.

Stearns watched the monitor over Leilani's shoulder, and said, "wow," under his breath.

Everett asked what was going on.

Neither Commander Akua, Stearns, nor Sean Daniels had much in the way of answers to this inquiry but all relayed their accounts of Krisstenson's past eleven dives. Stearns account was limited to the facts and only the facts: the unfathomable depth and duration of each dive. The deepest dive—lasting nearly four minutes by his watch, was over two hundred feet. Leilani advanced an interesting hypothesis about what Krisstenson might be up to. Daniels, however, offered only wild speculation, chattering incessantly and quickly gave Everett a real, non-numerical induced migraine headache.

Krisstenson dropped out of frame, but Leilani guided Mel back on track.

Sound blasted and Daniels lurched to the audio rack to mute the volume. One speaker crackled and hissed—it was blown. "What was that?" Everett thought the bellow sounded familiar.

The roaring ceased, but the cetacean symphony continued. Krisstenson proceeded on down into the deep—that's when Everett witnessed something that would alter the course of his life.

Chapter 27

The Blues

The largest blue whale on record, Jim Nollman states in *The Charged Border,* was a female harpooned in the Antarctic in 1928 measuring one hundred and six feet. Her weight was later estimated to be one hundred and sixty-five tons, about equal to twenty-five hundred average-sized women. As a baby, this whale had a daily intake of five hundred gallons of a milk richer than cow's cream, resulting in a weight gain of two hundred and fifty pounds per day during the first few weeks of life. Nollman also writes that biologist Roger Payne remarked that because this female was the most prodigious individual of the most prodigious species ever to inhabit Earth, she was also the biggest living organism for which we have evidence anywhere in the universe.

Common comparisons for perspective on the size of the blue whales include that fact that they possess hearts the size of a Volkswagen Beetle, that they are as great in length as Boeing 737's, and that a child could easily crawl through their arteries. A less common comparison is the fact that a male blue whale's penis is over ten feet long.

Everett watched the monitor in silence, wondering when the hell Krisstenson was going up for air. The fluorescent lights above hummed with their constant electrical flicker. Leilani got up, turned them off, and shut the door to the hallway. The glare that had reflected off the monitor and into Everett's eyes disappeared. They watched in baited silence.

A tightly knit pod of pilot whales held motionless in the waters below, singing weightlessly around a depth of 100 feet. The whales did not desist singing, but did cast diminutive lateral glances in Krisstenson's direction—there are no words delicate enough for these slight glances and subtle interactions that transpired as a result as Krisstenson passed through the pilot whales and on down below.

At one hundred and fifty feet, Krisstenson and the Navy's Beluga whale descended upon the rarest wildlife encounter on Earth. A blue whale. Herman Melville said that if God came back to this planet, he'd come as a whale. It looked as if He had arrived.

Krisstenson was a mere speck alongside the leviathan. He hovered by the whale's broad flattened head, floating down across the glassy basketball-sized cornea, avoiding direct eye contact. Melville circled three fathoms starboard and above, looking down along the bluish-gray median dorsal ridge and into the dark recess where his tail fluke was but was not seen. Everett was speechless, as were all paying witness.

Two full minutes into Krisstenson's subapnea, the whale raised his U-shaped nostrum, giving a glimpse of the yellow cold-water diatoms running the length of his belly. Then, without warning, the whale unleashed the deepest, loudest roar in the animal kingdom—the most powerful sustained utterance known from any living source. Artillery fire at close proximity produces a one hundred thirty decibel percussion. Dynamite blasts at one hundred fifty-five decibels. The roar of the blue whale produces one hundred eighty-eight decibels—and this bellow lasted for over thirty seconds.

Krisstenson rotated and faced the mighty being.

Everett was in a state of aesthetic arrest. He was in complete awe of this magnificent encounter, and at the moment something inside him clicked, the gears of some internal mechanism began to turn. He wasn't sure—he wasn't sure of much at that point—but it did indeed appear as if the whale had acknowledged Krisstenson's presence with a slight, yet seemingly deliberate extension of his colossal flipper. Krisstenson pushed off the flipper and floated backwards. The blue whale vocalized again and the call echoed through the endless ice strewn waters.

That was followed by silence, total silence. Not a single call, click, song, or whistle. The sudden stillness of every whale, dolphin and porpoise floating, surfacing, breathing, mating, dying, or otherwise swimming through the Southern seas was as astonishing as it was unnerving. In another instant the blue whale mobilized its mass as one might mobilize an army of ten thousand soldiers and Krisstenson kicked long strides towards the surface. As he ascended, figures began to emerge from the void below, slowly at first, then building steadily. Legions of whales and dolphins rose from even greater depths, descended from the surface above, and trailed off to points unknown.

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Cetaceans criss-crossed the video monitor in an endless stream of confusion. How often, as Harriet Eisman observed, have we been in the presence of magic, whether brought on by nature, music, meditation, or another person, and sat dumbly wishing to be able to receive what is truly offered? Everett watched Leilani as she stared at the screen with the wonderment and awe of a child at the circus. It was at that moment that Dr Everett realized they were in trouble. He could see that she didn't have any more of an inkling as to what in the hell was

going on here than he did. He turned to Daniels and Stearns—they might as well have been sharing cotton candy or crying over scary clowns.

What had happened? Were whales following in the blue whale's wake? If so, where were they going? Had Krisstenson influenced this behavior? Was someone or something else inducing this behavior? Or had Everett begun to ascribe anthropomorphological imaginings to the exchange he had just witnessed. He scratched his chin, thinking maybe he needed a shave.

Nobody said a word for quite some time until Stearns declared, "Critical enemy vulnerability."

"What?" Everett asked.

"Hit us where it'll hurt the most." Stearns said cryptically, then stood abruptly and walked out.

"What the hell's he talking about?"

"Who knows," Daniels said, "but I've got a feeling Krisstenson knows what's up. I bet they recognize pollution, wonder about vanishing food sources. Maybe they just want the rest of the planet submerged so they can see what the hell's going on."

Everett sighed, "Give me a break."

Leilani citied the complexities and mysteries of the marine mammal mind. She did not support Sean's position overtly, but did not refute his claim either.

"That's a logical stance for someone who deems astrology holy gospel," Everett said, "but believe me, the probability of these mammals possessing some kind of agenda is about the same as the probability of planetary alignment affecting whether or not you'll fall in love in the grocery store checkout line."

Chapter 28

Ancient Mariners

I do not know whether I understand your meaning when you say *Astrology*. I do not know all the influences which go from body to body. I do know that if man is not affected in some way by the planets, sun and moon, he is the only thing on Earth that isn't.

—Robert A. Millikan, Nobel Laureate

The sun banked as low as he goes on Antarctic summer nights. Solar winds and the Earth's magnetic field brewed up twilight shimmer. The green, red, and purple velveteen hues of aurora australis warmed the cold muted silver of aluminum structures as Leilani walked through McMurdo station with Dr Everett and Rand Krisstenson. They shuffled along the slippery streets, exchanging quiet glances beneath the invisible interlunar moon. The only sounds were those of crunching snow under Vibram soles and heavy vapor breaths meeting the crisp arid air. Meanwhile, marine mammals were headed back towards northern waters en masse. Had this strange migration run its course? Would this mark the end of the glaciological disturbance? Leilani kept telling herself to relax. For the time being there was little she could really do—it

was just a matter of waiting to see how satellite glacial trackings factored with the cetaceans out of the equation. And hoping to see if Krisstenson knew things she and the others did not. Krisstenson had agreed to offer insight into his sub apneic experiment with the stipulation that it was conducted over a drink at a local bar. But Leilani couldn't wait, so she stopped and pulled him by the arm. "Alright," she said, "how about a little explanation?"

"Explaining cetacean communications in English would be like translating Beethoven into words and sentences," he said. "It can't be done."

They walked on. Leilani was intrigued by his mystifying illumination, and made it clear that that explanation would not suffice.

"Maybe it's kinda like praying," Krisstenson offered. "All you have to do is think—and believe, of course—whatever it is you want to say."

They approached a stark corrugated aluminum-sided building. The sign outside marked one of McMurdo's transient dormitories: HOTEL CALIFORNIA. The name (inspired by a line in The Eagles' song by the same name: *You can check out any time you like, but you can never leave*) refers to the ungodly Antarctic maelstroms, which leave dormers stranded in their rooms for weeks at a time, awaiting departure. In the basement of the dormitory was one of McMurdo's three bars. David held the door for Leilani as she walked in, and it made her mad to feel happy to be back in his company again.

The saloon was a veritable shrine to partying poets, mostly of the opium impaired Romantic variety. Coleridge, Carroll, De Quincey, et al. The walls were painted with a contemporary interpretation of *Kubla Khan's* pleasure dome—complete with Alph the sacred river and a damsel with a dulcimer. A few vintage hookahs hung from the rafters.

The pub was windowless, wrapping the interior with a darkness resembling typical Northern Hemisphere night. The bar itself was an old stainless steel countertop lifted from one of McMurdo's labs. Leilani smelled hot butter and heard a popcorn popper popping corn in the

corner and suddenly everything was alliterating onomatopoeia and she decided that this whole *Kubla Khan* party theme was inducing some kind of weird poetry flashback. She didn't want to stay long, but they had disembarked for a drink at Krisstenson's request, and she was willing to stay as long as he was holding court.

A quiet looking bartender draped in a serape and thick locks of Jim Morrison hair washed a glass and seemed to be the sole inhabitant of his own private world. At the end of the bar a large man mumbled, "I'll take another." It was Stearns. He looked up as Krisstenson entered and said, "Make that a double."

The bohemian barkeep poured a healthy glass of whiskey—the rich, dark liquor quickly smoothing the sharp cubed ice edges. Stearns joined the others at a table.

The bartender approached Leilani, presented her with a bowl of popcorn as if it were caviar or a dozen roses, and asked her for her order. She inquired if he had any Mountain Dew.

"Mmm," the barkeep said, "sorry, don't believe so, just 7-Up, or perhaps a bit of orange soda."

"How 'bout red wine?"

"Stocks are a bit low, but I believe we still have a bottle or two of Buckfast back there."

"That's fine," Leilani said, wondering what Buckfast was.

Krisstenson added, "Bring the bottle."

Bring the bottle is often an overture to all kinds of trouble, and in this case, it was. It didn't take long, not long at all, for the wine to start getting to Leilani; thin polar atmosphere squeezes oxygen from the air, plunging the unwary into inebriation with lightning speed. Leilani poured herself another glass and got up from the table to take a look around. God, she thought, Mom would love this place. Her mother had taught her more about poetry than she cared to recall—how poetry reflects the soul of civilization, tossing tiny but potent darts at a reader's heart. She really was obsessed and the décor served as a ridiculous reminder of it all, but Leilani

had to admit that the pub was rather, well, romantic. She picked up a spidery hookah off a little De Quincey shrine, then checked out an annotated edition of Coleridge's *Rhyme of the Ancient Mariner*. She wondered how her little one, who 'on Mountain Dew hath fed' was doing back in San Diego. She began to worry that Seaman Jordy Sommer, hadn't been feeding him or giving him fresh water or playing with him enough, or maybe that The Dew was hiding in the clothes piled on the floor of her closet and that Sommer wasn't able to find him. She finished her second glass of wine, trying to read some painfully personal rhyming verse scribbled on the wall when the bartender approached with a cautious smile and—referring to the verse—asked, "What do you think?"

"I like it," Leilani said. "It's refreshing."

"Thanks," he replied with a more confident smile, then shuffled off.

Leilani's mother had always asked her to read her poetry and tell her what she thought. But for every ounce of poetry she gave to Leilani, she gave a pound to Eddie. And he was a real pro—he would always begin by paying the piece a genuine compliment. A real gem. Then he would usually let her know—once again, and in the most polite way possible—that it probably sounded a little too similar to so-and-so and that she should try to find her *own voice*. That drove her crazy. A writer can sustain no greater wound than one inflicted by an arrow flung from the lips of an insightful reader, informing her that the voice flowing from her pen is not that of her own. Leilani stared at the verse scribbled on the wall, yet saw and recalled and thought of other times and other places. Once, just as Eddie was waxing his board to paddle out, their mother suggested that he stay home and compose renga with her. Eddie picked up his board told her that if you can walk on water, you don't need to write poetry, you are poetry.

Chapter 29

Out of Africa

Trouble is usually something out of Africa.

—Julius Caesar

Within two hours, three empty bottles of Buckfast Abbey Tonic wine, eight shot glasses, and a bushel of stray popcorn kernels had accumulated on the table. Everett watched Leilani snatch another handful of popcorn—but only a few kernels arrived at her mouth. God, he thought, she's *drunk*.

The night was promising full scale disasters so Everett had switched to pints of some heinous tasting, room temperature ale. He polished off a pint and watched as tiny islands of suds drifted down the inside of his glass. Once settled at the bottom of his glass, the tiny bubbles began to pop. This brought Leonardo da Vinci to mind—his curious tossing of grass seeds into the small waterfalls near his home and sketching the intricacies of water in motion. From there his thoughts flowed downstream to Daniel Bernoulli's Law of Hydrodynamic Pressure, and before he knew it, Dr Everett's thoughts were bouncing off the West Antarctic Ice

Sheet like heat-seeking soundwaves and he was back at work. Now that his suspicions of a cetacean acoustically induced, autocatalytic chain reaction had deepened, it was a matter of figuring out just *how* that might be occurring. He sustained this quasi-work trance until the conversation turned to freediving and he vaguely overheard Leilani tell Krisstenson that she met a guy last year who freedives over three hundred feet.

Guy? Everett wondered.

Freediving, as Everett gathered from their conversation, began as all things begin—with women. In the 1800s Japanese female *ama* divers began diving for shellfish in water as deep as 150 feet. They pioneered the practice of hyperventilating to extend bottom time. Hyperventilating—blowing off excess carbon dioxide in short rapid inhalations and exhalations—tricks the brain into thinking it needs less oxygen. Leilani was well versed in the lore of ama divers and informed Krisstenson that Japanese poets described the sound of the ama's piercing, orgasmic breaths as *iso-nagiki*, elegies of the sea. The history lesson continued. In 1913, using a one hundred pound rock as a ballast, Greek diver Stotti Georghios retrieved an anchor from the *Regina Margherita* from a remarkable depth of 200 feet. In 1976 Jacques Mayol became the first human freediver to reach 330 feet. Then, on 12 October 2003, in Los Cabos Bay, Mexico, Francisco "Pipín" Ferreras descended to a depth of over 557 feet and returned to the surface on a single breath of air.

"And that's pretty wild," Krisstenson said, "considering the fact that—"

"Nitrogen narcosis," Leilani said frankly—she had no idea she was interrupting and apparently thought she was answering a question.

"What?" Everett asked irritably, trying to snap Leilani out of her stupor.

"Loss of thinking capacity," Leilani rambled, "giddiness, euphoria."

Everett thought he saw Krisstenson smile. That was only the third or fourth time he had seen him do so. Interest in Krisstenson had surged following his mysterious dive. It was as if

some distant star had gone super nova, swirling stardust into creation, with Rand Krisstenson burning bright at its center and those planet-like beings onboard *Prometheus*, captivated and held by some strange gravitational force, began slowly orbiting around Krisstenson in veneration. Dr Everett felt the tug of his mystery as well, spiraling closer in hopes of soaking up whatever insight he might rain down.

The bartender switched off the lights behind the bar. Everett was beginning to feel a little loopy. He wondered if *he* was drunk. It was probable, but he didn't *feel* drunk. No, no it was something much worse. Actually, he felt rather alert—more conscious and aware than he had felt in quite some time. *Too* conscious. He stood abruptly from the table and it was at that moment that Dr Everett realized he was hearing voices. There, within the claustrophobic confines of his head, he was besieged by an acute onset of strange and erratic voices. He decided he better have a little more to drink. He hurried over to the bar and began to worry about that mosquito bite again. Maybe, he thought, I picked up goddam malaria afterall. He ordered a double gin and tonic. And to make matters worse, he had to take a leak, but was afraid to see his pee—he couldn't stop thinking of that dazzling African memoir (he couldn't remember the title) Leilani read to him which described a man dying from blackwater—the colonial term for malaria. They called it blackwater because your piss turns black just before you die.

Stearns had been acting a little odd as well; his interest in Krisstenson seemed especially keen. Stearns asked him to explain the significance of the music insofar as the marine mammals are concerned.

Krisstenson slid a table-top candle back and forth between his hands, bathing his face and hands in warm orange ablutions of light. "Why do people like music?" he asked, "Or cry tears?"

Everett had overheard this discussion from the bar and liked Krisstenson's answer—music and tears—two of science's great mysteries. This took a little edge off of his present

anxiety. Of course he had no idea why he or anybody else cried, and most of his direct experience with the unquantifiable power of music was limited to driving in his car, lip-synching top-forty hits, and slipping into alternate career-track rock-star fantasies. Everett began feeling a little better as he considered the enigmatic nature of music and tears—at least he was calm, but he decided to listen from the safe distance of the bar.

"I could tell you that music integrates the functions of the brain's left and right hemispheres," Krisstenson imparted to Stearns, "or that it has the power to evoke psychic states in which individuality, time, and space disappear—or that music enables the inflow of cosmic energy and mental flights into invisible worlds. But I don't know if any of that's true."

Stearns nodded and Leilani said, "Wow."

Everett figured that was about all she was capable of saying at that point—she had said it about twenty times in the past hour—but 'wow', he agreed nonetheless. Yes indeed, Everett thought, there was probably more to music than meets the ear.

The bartender sauntered over with a reassuring smile greater than would be expected of a lone man tending a slow bar in Antarctica at three o'clock in the morning and handed Leilani an old Chouinard carabineer full of keys. "Lock up and leave the keys at the chapel next door," he said, "slip them under the mat."

Leilani accepted the keys absentmindedly and turned to Stearns, expanding to the best of her present ability on Krisstenson's explanation, "The cetacean auditory system is predominately spatial, and thus more comparable to human eyesight than speech—they see with their ears. We have no way of quanta, quanta—" she burped a tiny puff of air, "quantifying it exactly…. But I bet they like music because it might look like digital paintings or liquid architecture or something like that."

A gust of wind rattled the aluminum building and flickered the candle's flame in the draft. By the time Everett was ready to return to the table he was relatively certain that he had

reached the point constituting legal insanity. He reached behind the bar and took a swig of gin, no longer bothering with the tonic. Strangely enough however, the gin tasted like whiskey. Holy shit! He went back to the table, sat down, and put his arm around Leilani. She didn't seem to mind.

Stearns asked, "Then what's the deal with Marvin Gaye?"

Krisstenson shrugged, "Rhythm? Harmony? Leilani's right, they respond to all kinds of music. Marvin just works best. Duets especially. Neil Young and Linda Ronstadt seem to work well too. Cetaceans respond best to the tones and nuances of men and women vocalizing in harmony."

In the silence following Krisstenson's statement Everett could have sworn he heard Stearns mutter, "Don't boolshit me brotha, gotta be more to it than that." But when he looked over, Stearns lips weren't moving. He was just sipping neat whiskey, staring at the candle on the table. No, Stearns' lips weren't moving, but whatever freaky Antarctic abominable snow-ventriloquist hiding behind Stearns, behind the bar, or in his head, went right on speaking with Stearns' voice. "Uncle Tommy was a roadie for the guy—I ate a hotdog with Marvin at a Motown picnic in '78. Should I tell him? He'd think that was pretty cool. Naw, better not." Everett turned around to Leilani, "Um, are you listening to this?"

"To what?"

The voice spoke on: "Yeah, there's gotta be more to it than that—couldn't be coincidence—all that wasted oil and fish full of mercury—*Marvin just works best,* my ass—and how about that NBA All-Star game I took little Bobby to? I'll remember that for the rest of my life."

At that point Dr Everett was certain of two things—he had never been to an NBA All-Star game and he didn't know anyone who went by 'Little Bobby'. Stearns or whoever continued, "Marvin sang that Anthem, God *damn* did he. Standin' down there on the court

with the stadium lights shinin' off those bigass sunglasses. But he didn't just sing it, can't say what it was exactly, but somethin' happened. I could feel it. Think everybody could."

Krisstenson cupped his hands around the candle, projecting the soft, yellow flickering light on his face. Stearns took notice of the candle and seemed to return from whatever thought he had drifted off to.

Everett wondered if he could speak. Then yet another voice—a sexy whisper—tickled his ear. Wait, was Leilani whispering in his ear? He turned to her and opened his mouth, but nothing came out. *The Exorcist* came to mind. Jesus Christ, he thought, that movie scared the hell out of me. Everett's thoughts and fears seemed to be his own again and presently he found Leilani sitting in his lap. And he was right, she *was* whispering in his ear, referring to the rocket-hard boner poking her in the butt. Good God man! Dr Everett wondered, how long've I been wielding this thing around the bar? He tried concentrating on other things to help cool the rise in his Levi's but Leilani was giggling soft intrigue into his ear, thwarting his efforts.

"Okay, I've got a crazy question, "Stearns said to Krisstenson. "Hypothetical situation here—let's say we have some kind of disaster, an oil spill or something—or what if someone accidentally lost a couple tons of weapons grade plutonium in the South Pacific?"

"What did you say?" Everett said, regaining his voice and losing his boner.

"Just talkin' hypothetical situation here—is there any chance a whale could comprehend the impact of an event like that?"

Krisstenson cast an inquisitive eye towards Leilani—she rolled her eyes and quipped, "Believe me, if an incident of that magnitude occurred I'd know well before he did."

Dr Everett knew he had heard Stearns correctly and understood the implications of what was said. He was at once relieved and reeling in distress. He was relieved because he now believed his not-so wild guess had been correct and that he had not evacuated the Akua elders out of sheer paranoia. He was distressed for the obvious reasons—this was a disaster scenario

from hell. He intended to corner Stearns and discuss this in private as soon as he regained his faculties.

"Wake up!" Leilani said, socking Everett in the shoulder.

"Hey!" he said, striking a Karate Kid pose and making a funny-looking fight face.

"You're kinda funny when I'm drunk," she whispered, slipping him a sly smile—a smile he hadn't seen in quite awhile. "Let's go back to the ship."

Dr Everett was tanked. The gin or whiskey or whatever the hell he had been drinking had firmly taken its hold. He was tanked all right, but not too tanked to know a good idea when he heard one. "We're calling it a night," he announced, hopping up from his chair.

Stearns was back digging for booze behind the bar. Krisstenson searched his parka pockets, pulled out his hair clippers, and handed them to Leilani. "Shave his head," he said, nodding towards Everett.

Leilani accepted the clippers and the accompanying command as if it were an ordinary request. Everett wasn't sure if he had heard correctly, but decided not to inquire—it had been a very strange evening. He took Leilani by the arm and walked out the door into the bright Antarctic night.

Chapter 30

One Plus One Equals One

She was drunk and she knew it—given the nature of their mission, this was a court-martialable offense. But she hadn't been drunk in ages and it felt great. Leilani watched a tuft of hair land on the turntable and spin into the harmonic sounds of Marvin Gaye and Diana Ross—wow, she thought, I'm *really* drunk.

Krisstenson had apparently left the turntable and a box of records in David's cabin earlier that afternoon. Why? She hadn't a clue. Leilani sat behind David, pushing his head forward with one hand and wielding the clippers with the other, blowing trimmings from her fingers and holding the clippers in front of David's face as he mumbled along with the words. She cut wild criss-crossed tracks like a riding lawnmower without a driver, but after awhile, after enough criss-crosses crossed over other criss-crosses, the crew cut began to even out. She looked around David's room and was comforted to see he was still a slob too: bags half-unpacked, clothes on the floor, Q-tips and other missed shots all around the wastepaper basket. The Extreme Cold Weather Gear from the giant orange duffel they had been issued at the US Antarctic Program headquarters was everywhere except inside the duffel: headwear, footwear, handwear,

underwear, glove liners, fleece, down, polypropylene, and white rubber moon boots. Sitting on the bedside table was a familiar sterling silver picture frame holding two photographs. When Leilani spotted it it changed everything. She smiled and looked at David to see if he had noticed her noticing, but he hadn't so she decided not to say anything and just be happy instead. David picked up a tuft and frowned, seemingly becoming aware of the state of affair with his hair—it was all over the place. Leilani laid her free hand on the nape of his neck and he apparently forgot or ceased to mind.

Leilani had become curious and wanted to know if warm memories were present elsewhere, so she looked around, studying the surfaces more hopefully. But it was pretty dark and the only thing she spotted was something peeking out of his pocket—her tiki-idol keychain. She grabbed it and said, "Is that a tiki in your pocket or are you just happy to see me?"

He snatched the keychain back and began tickling her.

"Stop!" she shrieked, "and give it back, I wanna show you something."

"That's funny," he said, "I wanna show you something too."

"Oh yeah?" Leilani said with a sassy smile, "Take a number buddy." She dove for the keychain but didn't get it. They fell back on the bed, and she tumbled over on top of David and pinned his arms down. He didn't resist much.

The subtle scent of his shaving cream tickled her nose and memories purled like a spring, then washed over her like a river. She stretched their arms out on the bed and her face sank closer to his. He pressed his lips firmly into hers. The kiss became kisses and fell into a waterfall of kisses. She had grown accustomed to the hum of *Prometheus'* triple diesel engines housed two decks below. But now, with his lips pressed against hers, she became acutely aware of their subsonic vibrations, and felt as if David's heartbeat, her heartbeat, the tides and the bluemoon were coursing through her in concert with the engines. She rolled over and pulled him down on top of her so his body made contact with hers in as many places as possible. And his kisses—

remaining faithful to her memory as well—began emanating rings of sensation from where they alighted, like the rings of pebbles tossed into a pond. Their lips sealed and Leilani hadn't felt the need for breath for quite some time. The remaining items of clothing fell to the floor and a mad rush of blood surged from her brain to her toes. It had been a while. But it didn't take long to fall back into love, pushing and pulling and panting to make up for lost time. Magic thunder crackled through mystic mountain canyons and Leilani passed through the mist—through the undulating dreamland ether that divides yesterday from tomorrow.

Chapter 31

When in Doubt, Lie

He knew she'd be pissed. It was just a question of *how* pissed.

Legions of blues, grays, seis, and fins rolled along the Ross Ice Shelf. They were back in full force—leaping, breaching, and tail-fluke smacking. And the shelf itself had become a hotbed of activity. Two additional research vessels had made the southern crossing and three helicopters twirled overhead, dragging their long shadows across the secret sea below. Research teams plodded across the shelf-top like ants on a blueberry snowcone.

Everett reviewed glaciological charts with Daniels. The reports were much worse. Red alert worse. The plastic evergreen tree and boxes of Christmas ornaments that had been loaded onboard in the event that *Prometheus* and her crew would remain in the Southern Ocean over the holidays were still stowed and there was every indication to believe they would remain so, despite the date approaching on the calendar. Daniels determined that the glacial advance had increased another quarter percent over the last six-hour period. At this rate the result, as he put it, would soon yield a floating popsicle bigger than Mexico and row, row, row your house, gently out to sea.

The reports also verified the suspicion that somehow, in some fashion, the cetacean's presence was a catalyst in the acceleration of glacial flow. How? Everett had a few new theories, but nothing remotely conclusive. He began wondering if the vocalizations might be reacting with methane gases frozen in polar sea ice. The stakes had risen. The mood onboard reconfirmed the verdict that there would be no festivities or merriment in Antarctica over the holidays.

Daniels had attempted several inquiries regarding Everett's hair, or lack thereof, but Everett had effectively cut him off before he got far. Leilani had been asleep for over nine hours. Everett hoped she might sleep through the rest of the day as well.

Medea Chief Victor Ladir had arrived with Admiral Cross earlier that morning and demanded Everett's notes to prepare proposals for an emergency meeting in Washington and a briefing for the Secretary of Defense. They had considered consulting the Antarctic Treaty Nations committee in Geneva, but Ladir had persuaded both Medea and CIA official to maintain secrecy—at this point treaty nation involvement, he had told them, would only limit our ability to take decisive actions. Any proposed action, therefore, would rest primarily upon the shoulders of those onboard *Prometheus,* those in McMurdo, and intelligence teams back in the continental US. But one thing was clear: In light of the newfound evidence, aggressive steps would be taken to drive the cetaceans away from Antarctica.

Everett wished he had had more time to think the whole thing through; he already regretted one of his proposals. He found himself preoccupied with this regret, not to mention remembrance of the voices he had heard the night before. Drunken madness? He hoped so. This was a horrible time and place for a psychological disaster. In any case, he was unable to focus on the job at hand—reviewing the charts with Daniels—so he decided to go scope out the medicine cabinet he had seen in the infirmary.

But Leilani entered before he had a chance to get up. Her cheeks were flushed a gentle shade of pink, crossed with the creases of two intersecting sheets, and her long strands of raven hair had not yet met with brush or comb. The whites of her eyes offered evidence of a solid night's sleep.

"Well," Leilani said, with unconcealed disappointment as she peeked through a porthole, spotting the whales and dolphins that had returned overnight. Her composure slipped further when she saw of the *USS Liberty,* a 460-foot Arleigh Burke class Navy destroyer—her decks lined with steel barrels. "What are they doing here?" she asked.

Everett figured this might lead to the conversation he did not want to have. He ripped the analysis up off the table, whipped it over to her and said, "check it out," adding, "They're meeting in Washington to review our proposals for—"

"*Our proposals*?"

"Well mostly mine, I guess," Everett admitted, "I had to fly by the seat of my pants."

"And?" Leilani said, watching Everett fidget in his chair.

"Listen Lani, they need viable solutions—"

"What *kind* of solutions?"

"Every kind I could think of. Predatory sound propagation… Distress call propagation—" He cut himself off and considered lying by omission, but decided the sooner he confessed, the better. "I did mention CM-44—"

"Jesus Christ David. Tell me you didn't."

"CM-44?" asked Daniels.

"Tell him," Leilani ordered, lighting a cigarette with a smile—not a happy smile.

Everett began to explain that CM-44 was simply creatine monohydrate, a substance found in human skeletal muscle, but Leilani did not allow him to complete this explanation.

"That's right," she shrieked, "a substance of which *I* and only *I* understand the limitations, liabilities, and proper fucking deployment!"

And this was true. Three years prior Navy divers were experimenting with creatine's ability to increase the dive-table performance of human divers. Theoretical and preliminary studies led naval physiologists to believe that oral ingestion of creatine prior to and immediately following deep descents could reduce the necessary decompression intervals between dives. During testing, however, a small container accidentally spilled into a pen holding three Bottlenose dolphins and, much to her horror, Leilani made a tragic field observation. The compound critically affected the respiratory function of the penned dolphins and in less than two minutes they had drowned.

As it turned out, the micro-particles quickly entered the dolphin's respiratory tract through the blowhole or mouth, but as further tests revealed, they were adept at identifying the danger, communicating its whereabouts amongst one another and, when free to flee, quickly departing the affected waters. Leilani then led a research group that developed the compound as a countermeasure against the Soviet's marine mammal program. The powder was to be deployed in naval ports, industrial harbors, or any other area where marine mammal counter-measures were necessary. Waters, in other words, that had to be protected from an enemy force's marine mammals, mines, or human divers.

"Goddammit David, how could you?"

Daniels interrupted, requesting clarification, "So it's dolphin repellent?"

"That's right, dolphin repellent, whale repellent, seal repellent—if it swims and breathes, it repels it," Leilani said, "but we scrapped it because it carries a fourteen percent fatality rate." Daniels got the point—and it was clear that he was not happy with Everett either.

"Come on, a decent plan today is better than a perfect one tomorrow."

Leilani stormed out without another word.

Everett dug a roll of Tums out of his pocket and pretended to review the charts for several excruciating moments before Koenigs entered and announced that the helicopter was back up and running. It was time to make aerial observations and take measurements over the ice—and Medea chief Victor Ladir wanted to ride along.

Chapter 32

Moving Parts

Dr Everett ran his hand over the short fur on the top of his head as he watched de-icing fluid spurt out along the frozen rotor blades of the brawny Sikorsky-76, weighing the fact that the average helicopter has two thousand two hundred and sixty-three moving parts. That's a lot of variables.

Victor Ladir and Sean Daniels boarded the helicopter ahead of Leilani, while Everett lagged behind to inspect a few cosmetic blemishes on the fuselage and take a long look out at the water.

"Let's go, David!" Leilani yelled over the rotor wash.

Everett reluctantly boarded. The heater was blasting hot air into the cabin and felt as if it had been doing so for quite some time. He began perspiring as he peeled off puffy layers of insulation. The others followed suit. He helped Leilani pull her arms out of her jacket sleeves and Ladir managed to elbow him in the forehead as he anxiously and rather frantically dug out of his own jacket. The helicopter strained under its own mass as the rotor foils cut through the air. Everett studied the pilot's reflection in the windshield and was comforted by his friendly

expression and air of confidence. The pilot pulled back on the collective and they lifted off and whisked over the sea.

The water and ice below looked like blue lakes and streams running over a world of white. Dr Everett decided to think of other land-based things for a while and his thoughts drifted over sundry terra firma, through predictable mathematical mazes, then drifted on up to Southern California and he began to wonder what surprises the Hotel del Coronado held in store for him today: Pay-per-view? Room Service? A massage? Or worse yet, drycleaning! But yes, his hunch about a purported nuclear disaster appeared to have factual underpinnings. He planned to question Stearns about what was going on as soon as they returned and then, once he had sufficient ammo, confront Ladir. He glanced over at Ladir—there he sat, his all-consuming eyes silently devouring all that flashed before them—like the miraculous little white porcelain swirls that whisk feces down into the bowels of the Earth. Everett now suspected this feigned tranquility was as misleading as cigarette tobacco additives. Yes, he thought, I'll find out what he's been hiding behind those spooky eyes as soon as I've had a chance to talk to Stearns.

A few minutes later, the Sikorsky banked over the Ross Ice Shelf, 520,000 square kilometers of pure ice. Leilani leaned into the cockpit to lend Sean a hand with the aerial surveying camera. Her thermal polypropylene shirt hiked up, exposing the fresh ink etched upon her sacrum. Everett noticed Sean's eyes noticing the tattoo and suddenly had the distinct feeling he was losing his mind again. The voices were back. Jesus Christ, he thought, what the hell's wrong with me? This was definitely more than your standard batch of malaria. A million variables flashed though his mind: Ebola? Echinococcosis? West Nile Virus? Bleeding bot-fly cysts? Ham's saliva pancakes? That cocktail waitress from Miami? Oh no, he thought, this is *very bad*. He was a little too close to throw a good punch, but figured he could elbow him pretty good from where he was sitting, probably even hard enough to pop out a tooth or two, but decided to watch Sean's mouth for a moment to see if his lips were moving. They weren't. He

could hear him talking, but his mouth wasn't moving. And it's a good thing that it wasn't, because the last thing he thought he heard Sean say was, *God, I'd love to fuck the shit out of her.*

He called out to Daniels over the engine noise, "What did you say?"

"Nada buddy—I didn't say anything."

Daniels looked a little nervous, even guilty—maybe he was lying—but nobody else seemed to hear anything, and presently the voice subsided.

Daniels called up to the pilot, "Let's head south along the fringe."

The chopper purred along, skimming the edge of the shelf. Dr Everett was troubled by the cruel tricks his mind seemed to be playing on him, but what he saw below pushed his troubles to the distant background. He had heard the statistics on an hourly basis since their arrival, seen the numbers on scores of pie and bar graphs, and watched untold hours of video footage—but from this lofty vantage point, he could, for the first time, comprehended the enormity of this marine mammal congregation.

In the Ross Sea below, whales, dolphins, and porpoises stretched to infinity in all directions, densely packed along the edgewater. The concentration of biomass along this remote edge of the Earth was alien and, had it not been there before his very eyes, totally inconceivable. It was the most breath-taking spectacle imaginable. How ironic, he thought, that they end up here, in the very sea in which whaling had reduced most species' populations down to within a monofilament line of extinction. A few miles ahead another thin line, a thin black sinuous line as though pen-drawn on bleached parchment, jutted inland from the sea and across the barren top of the shelf. As they drew nearer, it assumed the shape of a distant, lonely highway.

But it wasn't.

Everett watched the black line widen with every second of their approach until it became as wide as a football field. The helicopter hovered over the fissure with its nose pitched

into the wind, affording those aboard a good look down into the void—a void that cut inland across the ice as far as the eye could see.

Daniels turned to the pilot and said, "Let's see how far inland this thing goes."

The pilot gave the stick a steady-handed nudge and they sped off along the fracture. Once completely over the shelf, the sea having faded behind the whirring tail rotors, nothing was visible but the great mass of ice, stretching to the horizon in all directions. Everett looked out over the ice, unnerved by its vastness, utter barrenness, and stillness. Nobody spoke, which added to Everett's uneasiness, as they watched Daniels operate the aerial surveying camera. Daniels took his first set of readings from the camera and put words to the obvious: "This is not lookin' good."

Leilani was speed scribbling in one of her spiral notebooks, but Everett pretended not to notice or at least not to care. If there was one thing on Earth he wished he had never seen, it was the wild hand-written pages of Leilani's secret spiral notebook. He despised that damn thing in more ways than any words in any journal could ever describe.

Everett was not the type of man to pry into the private affairs of others, but this policy only went so far. On the last of a string of forty-eight consecutive Southern California weekends that he had ventured down Interstate-5 to visit Leilani he had become intimately acquainted with this journal. On the Saturday of that particular weekend, Everett had been lying on his back on the great open expanse of hot blacktop of the Naval Command Control and Ocean Surveillance Center's parking lot. It was time for the '68's maiden oil-change. Although Leilani had said that she could handle it herself, he wanted to do the honors. He crawled out from under the chassis and went to the glove compartment to check something in the manual and that's when he found it. On several occasions he had seen the dog-eared notebook sitting on her bedside table, warmly imprinted with invisible ink of intimacy. It had never crossed his mind to

read it. But at that moment, sitting in the passenger seat of the cherry-red '68 that he had built for love's sake, he felt compelled, perhaps even entitled, to read it.

Big mistake. And the timing couldn't have been worse, for at that very moment in time Everett had already planned to ask for Leilani's hand in marriage. This is a fragile time for most men—even more so for Dr David Everett. A roundtrip ticket to Honolulu had already been purchased to ask (beg) for a blessing from Primo Akua. A modest ring was tucked in a small box beneath his bed and was in fact still there. But back then, sitting in the NCCOSC parking lot, the more he thought about it the more he realized Leilani Akua was the most secretive woman with whom he had ever shared a toothbrush.

First of all, she never offered any information whatsoever about the men in her past. When asked, she said that it was none of his business. Secondly, she had never even once inquired about any of his previous relationships. A détente of sorts: *I won't ask you so don't ask me* or *I don't want to know and neither do you*.

It was this undeclared vow of silence that led Everett straight past the private property sign and over the spiral fence that bound the journal. He sat there in the parking lot and read. The first revelation was the number of men. Wow, there were a lot of them—and scores of Scuba Steve fantasies to boot. But those weren't the numbers that bothered him. The problematic number-bearing entry read:

Few days pass here without thinking of you. The waves wrap in around the jetty by the pier, and break over a sandy-bottom. You'd love it. I know it sounds crazy, but I watch the guys out there hoping somehow I might see you. I thought leaving home might set me free. But I was wrong.

It was the *date* of the entry that bothered him—a date almost one full year after their first date. It would have been far better had he discovered that she had had one hundred lovers. One thousand lovers! That he could have dealt with. This was far worse. At first Everett wondered

if he was just reading into it too much. Maybe it was just a girl thing. Girls collect things and stick them in old shoeboxes—pictures, letters, concert ticket stubs, dried flowers. Maybe this was just an old memory that had arisen and the journal was just some kind of shoebox in which to store old memories. But then again she did seem to spend an inordinate amount of time staring at waves on the sea, and at surfers on waves on the sea in particular. He had attempted several inquiries about her fixation on surfing but she dodged the subject, saying something bogus like 'waves interest me because they're physical manifestations of released kinetic energy,' and then quickly digressing—before he had a chance to refocus—to sine waves and how the glass harmonica produces these pure, crystalline waves of sound and how it was Mozart's favorite musical instrument. Then further digressing into Freemasonry's influence on Mozart's music and the fact that Mozart's father was a mason as well, and so on and so on. They were cheap and obvious attempts to derail the conversation into topics corollary to his interests and sometimes her diversionary tactics worked. But in the end there was no doubt about it: she was and had been in love with another guy all along.

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Twenty miles inland, the fissure led the helicopter deeper into the vast emptiness of Antarctica. Two hundred miles further the rotor blades continued whirling at a steady 320 revolutions per minute and ferried the searchers along the fracture in the Ross Ice Sheet like a misdirected news traffic helicopter monitoring a traffic-free transcontinental highway.

The pilot glanced down at the fuel gauge and announced it was time to turn back. Daniels set down his camera—he'd seen enough anyway. He said okay and turned to his fellow passengers with a preliminary report. "The good news is that the overall integrity of the West

Antarctic Ice Sheet looks much better than I anticipated," Daniels said, "and at the rate it's separating, we still have many months, maybe a year, before the entire sheet breaks off."

"You call that good news?" Ladir said, breaking the silence he had maintained throughout the entire flight. Everett had almost forgotten that he was onboard.

"Great news compared to the bad news." Daniels said, "looks like this fracture bifurcates the entire shelf." He squinted into the searing sun, looking out over the ice. "I'd say we may have less than twenty-four hours before this bad boy craps the biggest 'berg on Earth."

Ladir asked what in God's name he meant by that. Everett already knew.

"Listen Vic," Daniels said. Daniels had apparently decided that he did not like Victor Ladir, and had begun addressing him in a progressively condescending tone. "They nearly shit their pants down here last February when Larsen B collapsed, twelve hundred square miles of ice broke off in thirty days. But if it would've gone all at once—which it could have—we would've surfed a two-hundred footer all the way to Japan. And by my estimates, this one is over twice as large—maybe even three thousand square miles."

And those large numbers prompted Dr Everett to come up with a smaller yet very critical value: There were more than five hundred researchers and support personnel stationed in McMurdo. Given the limited aircraft availability, it was high time to begin a speedy evacuation. He tapped the pilot on the shoulder, "Excuse me, may I use the radio?"

"Buckle up folks," the pilot said, staring up at the twirling rotors. "Got a slight problem here." He spoke into his radio mouthpiece as he scanned the heavily crevassed ice for a landing site, "Heads up *Prometheus*, this goddam trunion is slippin'."

Slipping trunion? That didn't sound like a *slight* problem but Everett tried not to panic because he didn't want to scare Leilani—at least that's what he told himself. And was it his imagination or were they losing altitude? The pilot looked calm, but that was his job. That's when Everett heard him say, "Mayday *Prometheus*, we're goin' down."

David turned to Leilani and she to he, but their mouths unable to utter a word and in an instant the horror was over. The helicopter set down in deep snow with a firm jolt, but not the crushing impact that he had been expecting.

The pilot killed the engines immediately and the rotor wash snowstorm slowly dissolved into the swirling winds. He unbuckled his seatbelt, looked back into the cabin and asked everybody if they were okay.

Daniels didn't look so great but said, "Yeah," anyway. Ladir didn't say anything, but his face spoke volumes: he was not okay. Everett and Leilani looked at one another and nodded—they were fine. Fine, that was, until the snow covering the 600-foot deep crevasse beneath the helicopter gave way. The chopper tumbled in, freefalling forty or fifty feet before jamming into a narrow hourglass section of ice.

Everett wrapped around his seatbelt and his face impacted with his left kneecap. His lower lip burst like a ripe tomato. Leilani, Sean, and Victor's torsos followed similar rotational arcs, but terminated with less dramatic impacts with their knees. The pilot bolted forth headfirst, resulting in an intricate web of rosy-cracked glass from the point of impact on the windshield. The helicopter's crumpled nose pointed straight down into the crevasse—and its passengers hung from their seatbelts like sleepy bats.

"Holy shit!" Daniels was the first to break the silence that came with pure terror. Accelerated pulses and rapid breathing became visible as they mixed with the frigid, dry, and unexpectedly fresh air that entered the punctured passenger cabin. A ruptured fuel line streamed jet fuel through the creaking fuselage and out through the cockpit.

Everett's lip was bleeding profusely. He turned to Leilani, pleased to see she was relatively unscathed.

Very little light reached this depth of the crevasse, but enough for everyone to see Ladir's eyes darting from one ice-pressed cabin window to the next. His breathing seemed to accelerate

with the movement of his eyes. Everett had been unaware Ladir was claustrophobic. He tried to calm him with reassurances of safety that he knew were speculative at best.

But Ladir wasn't listening—he was just breathing and looking for light and blue sky that wasn't there. He pressed one hand against the ceiling, attempting to unbuckle his seatbelt with the other, accidentally elbowing Daniels in the ribcage in the process.

"Hey!" Daniels shouted, "settle down."

"What are you doing?" Leilani reached out from across the cabin to restrain him but he was not within her grasp.

"Well I can tell you what I'm not doing—" Ladir sat still for a moment, looking a bit uncertain about his next move, "I'm not staying down here."

"Get a grip!" Leilani shouted, "They know we went down, they'll be out here within the hour—"

"Hour?" Ladir reached for his seatbelt again, "You think I'm—" And at that moment he found the seatbelt release buckle, except that it wasn't his. Ladir pressed himself securely into his seat with a one handed handstand on the ceiling, but when he released the buckle it was Daniels that needed the security. Daniels tumbled into the cockpit, smashing clear through the red spider-webbed windshield. The unconscious pilot fell out into the crevasse. Daniels' flight path shadowed behind, but his leg hooked through a seatbelt shoulder harness, dangling him outside the helicopter like an inverted Cirque du Soleil trouper.

A soft distant thud echoed through the crevasse as the pilot impacted at the bottom of the crevasse.

Everett ripped off his seatbelt and scrambled down into the cockpit.

Leilani called out to him but he moved more quickly than her words.

Daniels appeared unable to speak. Blood rushed to his head and fat squiggly veins rose to the surface and streaked across his forehead and around his temples. Everett had climbed

halfway into the cockpit when Daniels' horrific screams began echoing and disappearing into the crevasse as jet fuel dripped down his body and trickled across his face. "I can't hold on!" he yelled, spitting out the high-octane fuel. "Jesus! Help me!" he spurted, flailing his arms in vain.

Everett secured good footing and reached down, "Give me your hand."

Daniels fought his body mass, attempting an inverted sit-up.

"Come on! You can do it!" Dr Everett looked down into the dark past Daniels, wondering what had possessed him to climb down to this precarious perch.

Daniels reached his hand up but his leg slipped quite suddenly from the seatbelt and he fell.

Leilani screamed, "David!"

Everett nearly tumbled out along with Daniels as he lunged and snagged Daniels' pant leg—clutching with all his might—but a pant leg wasn't much to clutch to.

Daniels screamed, flailing everything. "God, Dave, don't drop me!"

"I've got you." That was probably a lie, but he thought he could get a better grip if Daniels just settled down a little. But he didn't settle down and indeed began slipping from his grasp. The fuselage groaned in the crackling ice.

Everett yelled, expelling all that was within, summoning strength from depths rarely reached. Nonetheless it was still not enough.

That was when Everett felt a shifting beneath his feet. The helicopter began to rotate, slowly at first then picking up momentum as it swung, pivoting nearly one hundred and eighty degrees—dropping the tail section below the cockpit.

Leilani screamed again as Everett and Daniels tumbled back into the cabin, landing on top of her and Ladir. The impact of bodies upon the back wall of the cabin sent the helicopter sliding another three or four yards into the crevasse, then wedged in once again.

Chapter 33

Mexican Bullfight

It had been two full years since her brother Eddie had died and teen-aged Leilani had scarcely mentioned his name. She responded to her mother's *Remember when Eddie…* and her father's *I wish Eddie was here to see this* with uncomfortable stretches of silence and abrupt departures on totally unrelated trains of thought. She was locked in a state of utter denial and unable to deal with the fact that Eddie was gone.

And as Leilani watched David tear back the cowling to expose the helicopter's engine compartment, she worried what would become of her parents if she too were to perish. She looked up past David now, figuring that the sun had dipped low on the horizon up above, glazing the great white expanse with misleading hues of summer dreams as the temperature inside the crumpled cabin continued to fall five or ten degrees per hour. Ladir had fainted from an apparent anxiety attack an hour or so earlier and remained unconscious. Nobody had bothered to check on his condition. He had claimed to be suffocating, but lack of oxygen was about the only thing he didn't need to worry about. Leilani had tended to David's lip and the lacerations on Daniels' face and arms as well as she could given the circumstances. She thought,

thank God there was KrazyGlue in the toolkit, a hydrocarbon-based resin similar enough to Dermabond to do the trick. Daniels hadn't spoken much since the incident and was undoubtedly in deep shock. She and David had fallen silent only moments ago, after hours of sundry conversations, when he began doing whatever it was he was doing. She watched as he unscrewed a plug and viscous motor oil began streaming out. He gathered the oil in a Mountain Dew can.

"I'm cold." Daniels finally broke the silence.

Leilani did not acknowledge or respond to his request to commiserate—there was no need to risk the ignition of hysterical babble—and his statement hung in the dry air until it fully evaporated and he slipped back into the shared silence.

David squatted down by Daniels and asked, "Do you have that lighter?"

"Yep." Daniels handed it to him.

David took the lighter and the can and began to climb up the seatbacks towards the cockpit.

"What are you doing?" Leilani asked. "This place is drenched in fuel, you know?"

"Yeah, I know," he said, struggling into the cockpit. "Just a second."

Daniels told Leilani she shouldn't drink Mountain Dew.

Leilani ignored Sean's nonsense and watched David nervously.

David reached out through the broken windshield and placed the soda can on a relatively flat shelf on the wall of the crevasse, took out the lighter and lit the oil around the lip of the can. The flame trailed down into the can, igniting a twelve ounce smoke storm.

"Mountain Dew," Daniels continued, paying little if any attention to David's efforts above, "is a Pepsi product and Pepsi sponsors bullfights in Mexico."

David climbed back down into the back of the cabin as a dark, rich stream of smoke rose up and out of the crevasse. "What are you talking about?" David asked, sitting back down by Leilani's side.

"Nothing," Leilani said abruptly, trying to dismiss the conversation and sliding a little closer to David than she had been before.

Daniels proceeded to give him a re-run of the Pepsi lecture, anyway—including assorted footnotes and atrocities from other villains of industry, such as Proctor & Gamble.

Leilani was worrying about her parents again. Were they still in San Diego? She wanted to ask David about that whole weird Hotel 'Del' extravaganza again, but decided to wait until later—she prayed silently instead. She prayed for the pilot, a man whose name was unknown to her and whose life had passed before her very eyes just hours before. She said an *Our Father,* a *Hail Mary*, prayed for David, Sean, Victor Ladir, Mel and all those back onboard *Prometheus*, her family, and said a special prayer for her brother Eddie and the souls of all the other loved ones who had passed on.

Daniels finished catechizing and all fell quiet. Leilani leaned against David and he put his arm around her, enveloping her in a warmth that exceeded his body heat. Yes, despite everything, Leilani thought, it felt good to be in love with David again.

But it was definitely getting colder. Much colder.

Chapter 34

Encryption

Francis Beaufort was born in Ireland in 1774. At the age of thirteen he began his career in the British Navy as a cabin boy. He received eighteen wounds in the Napoleonic Wars, was struck in the groin by sniper fire, promoted to Rear Admiral, beknighted, and wrote over two thousand questionable letters to his sister. Sir Francis Beaufort, Rear Admiral in Her Majesty's Service, was a busy man. Beaufort had achieved immortality—of sorts—by creating the Beaufort International Wind Force Scale that is in use to this day. The scale, using values from zero to seventeen, provides visual cues to aid in assessing wind speeds ranging from calm to a full-blown hurricane. Thus the faint stream of smoke rising vertically from the crevasse somewhere on the West Antarctic Ice Sheet was a clear indicator that the atmospheric conditions constituted a Beaufort wind force value of zero.

"How long have I been asleep?"

"What are you talking about?" Leilani asked in a cracked, raspy voice.

"Wasn't I sleeping?" Everett asked, his own voice none the better.

"No, we were talking."

"Oh yeah?" Everett said, trying to collect his thoughts. He could have sworn he was asleep, and that he had been dreaming that he, Stearns, and Sean Daniels had confronted Admiral Cross and Victor Ladir regarding lost plutonium. "What were we talking about?"

"Are you serious?"

Everett, Leilani, and Daniels huddled together, insulating themselves with clothing, seat cushions, and headboard liner. Ladir slept on the floor with his chest beneath Leilani's knees. He had woken briefly, complained of the cold, and then resumed his policy of antiverbality. At that point Daniels had emerged from quiet shiverings and berated Ladir for the rash actions that had resulted in the pilot's death and quite nearly his own. Ladir refused to apologize or admit to any wrongdoing. Daniels began expressing himself at length, confiding to all those seated in the wreckage that Fuckhead over there—referring to Victor Ladir—was a piss-poor excuse for a human being—an immutable imp, a smashed snail on the sidewalk of life. Daniels' voice trembled and he went berserk, slinging vitriol with indifference to the kinetic energy he was expending and it began to look like he just might kill Ladir before hypothermia or claustrophobia had a chance. But Ladir ignored him and fell back into clammy-faced slumber. Eventually Leilani pulled him into their huddle.

Everett held Leilani under his arm. She was shivering. Her body temperature was definitely dropping more quickly than his own. In the still, flat light of the crevasse he had lost track of time, but he figured they had been down there for at least nine or ten hours at least. The fuselage had become a human icebox, but was definitely not acting as a preservative insofar as the perishability of its contents were concerned. He was tired, listless, and, despite the US Antarctic Program standard issue garments, knew they were all slowly freezing to death. He wanted to keep conversation moving, so he asked Daniels to tell Leilani the Gillette story he had told him the morning prior. Yes, Daniels was a man on the lookout, an environmental hellraiser, a *Adbusters* aficionado, knower of industry evils, and could speak at great lengths in this

arena. The previous morning he had accosted Everett in the bathroom. Dr Everett had been up the whole night through—slicing and dicing his way through mathematical models—and he lay in bed that morning unable to sleep as numbers raced around his head like the twenty-four hours of Le Mans. He thought shaving might help so he got up and happened to arrive at the same time as Daniels, just waking up from a full night's sleep, shaving kit in hand. Daniels whipped out some old clunker of a great Western death blade and upon inspection of Everett's choice of blade, asked him how he could use a razor made by cold-hearted killers.

Everett hadn't the faintest clue what he was talking about and said that the Gillette Sensor Excel was the best razor on the market, even better than the Mach-3 Turbo.

"Are you kidding?" Daniels had said, "Get with it, Dave—those guys nick little white lab bunnies then douse them with shitty creams and aftershaves, testing for skin irritability and other irrelevants."

It did sound horrible and Daniels was beginning to look a little fanatical so he had asked him where he bought replacement blades for the Outlaw Josey Wales looking model he was wielding.

"*Replacement blades*, are you serious?" Daniels had unfurled a long leather-sharpening belt and explained, "This thing will last fifty or sixty years, maybe longer."

Jesus Christ, Everett had thought as he watched Daniels sharpen his razor, what a pain in the ass. But then he tried the blade out and it was amazing—perhaps the most luxurious shave imaginable. Daniels told him he could keep it if he promised to never use Gillette products again. Everett promised.

Daniels' spirited retelling of this bathroom encounter apparently annoyed Ladir and he squirmed away from Leilani's side to fend for himself in silent protest. Nobody minded. Daniels was on a roll, and Everett was bored as hell but grateful for Daniels' ability to keep

them all awake. But when Daniels digressed into a riff on quantum physics, Everett perked up. The prospect of quantum computing was, as far as Everett was concerned, pretty exciting stuff. He had in fact been invited to Los Alamos several years prior for a demonstration of the 7-qubit quantum prototype. And over the past few days he and Rand Krisstenson had had several discussions which had all eventually led back to Quantum Theory.

"When the earth is out of balance," Daniels said, "when destructive forces reach critical mass, the asynchronicity is felt—at the subatomic level—by every single living being and the earth awakes like a dormant volcano. Sporadic eruptions begin. At first glance these eruptions may appear unrelated, but beneath the surface lies a common pool of molten magna."

Leilani was intrigued.

"There are six billion humans on earth," Daniels continued, "less than five percent of which live in the United States of America, yet that five percent consumes over *thirty* percent of the earth's resources. Did you know that?"

Leilani said she did not.

"Most people don't. Pose that question to a Brit, an Afghan, a Brazilian, and chances are they won't know either. But they sense it. They feel it. They feel the consumption, the loss, the inequality—without actually seeing or having a conscious awareness of the loss. And it's not just that they feel cheated, like Americans are consuming more than they are, they feel *endangered*. They know who we are—we're consumers. When fears grow that the US economy may falter, you never hear reports that we're not saving enough, the great fear is over *consumer confidence,* that we might not *consume* enough. If you really want to show you're a true American, climb onboard an airplane, fly someplace you don't need to go, and buy unnecessary consumer goods."

When Daniels segued into his commitment to the anti-globalization movement, the rift widened between him and Leilani: her opinion of America and Americans was significantly higher than his.

Politics, Everett thought, I'll sit this one out. After a few mild exchanges Leilani agreed to disagree, but Daniels wouldn't let it go.

"Only twenty-five of us showed up in to protest the IMF meetings in Washington. In 2000 we were 30,000 strong. Today, over two million of us have taken to the streets."

"Taken to the streets?" Leilani said, "is that what you call a traveling circus of anarchists?"

"Don't hate 'cause you can't relate," Daniels said. "Do you really see us as *an attack on democracy*, he said with a mocking English flair, "Or a *threat to global prosperity*," he added with a cross-eyed Texan drawl.

"I just see a bunch of silly people rioting in the streets."

Daniels shot back, "A riot is the voice of unheard people."

Everett emerged from a semi-somnambulistic state. "What was that?"

"I said a riot is the voice of unheard people."

"Mmm," Everett said, "interesting."

And so the debate continued. Daniels went on for over an hour. But he began to digress with a strong argument for consumption-based taxation, and although Everett thought it sounded like a good idea, he returned to pondering quantum mechanics.

In time Daniels ran out of steam and the four fell silent again, but no matter how hard Everett tried to follow his thoughts through the multifarious quantum world, the straightforward realm of readily divisible whole numbers was begging for his attention. He divided 500 by 30, then multiplied by an estimated variable. That is, dividing the number of researchers in McMurdo by the seating capacity of an LC-130. Just how many Hercules ski-

equipped LC-130's could they get to the icy continent within the next twenty-four hours? That was the unknown variable—but there couldn't be more than five or six.

Yes, Everett was worried about evacuating those back in McMurdo. The rift in the Ross Ice Shelf was as wide as the Mississippi. Big Wednesday was imminent. The need to begin evacuation was immediate. He asked Daniels to give the radio another try—he had already made three attempts to no avail. Daniels agreed, climbed back up into the cockpit, and the silence fell again. But it was somewhere in that silence that Everett heard a deep pop from above. He held his breath and strained his ears, looking up past Daniels in hopes of hearing it again.

But he didn't hear anything. He did notice, however, that the smoke had trickled to a trite smolder and it was time to go fill the can again. "Be right back," he told Leilani, lifting his arm from her shoulders.

As Everett stood he could have sworn he heard another pop but decided it was just his imagination. He resumed his crawl up towards the cockpit, climbing clumsily over the spongy seats and past Daniels. He retrieved the can, refilled and relit it, then returned to his perch with Leilani and asked, "What time is it?"

She glanced at her watch and said, "About ten minutes past the last time you asked." She gazed back at the watch, admiring the lustre of the titanium and exquisite design. She unclasped the watch and placed it in the palm of her right hand, gently displaying its beauty by the fingers of her left. "Remember what I said about this watch?"

"Yeah," Everett said.

"Well I lied."

"Figured."

She said, "It's for you."

"Right."

"I'm serious," she said, turning the watch over to show him the engraving on the back of the case. It read:

Merry Christmas David!
Love always, Lani

Everett read the engraving in amazement. "Wow," he said, "I can't believe it." He was stunned, speechless, overwhelmed. The watch's flawless sapphire face gleamed as did his eyes.

Leilani smiled with contentment as she fastened the timepiece on David's wrist—but the contentment slowly gave way to a source of underlying agitation. "But you know," she said, "I was so pissed-off the night before we left I decided not to give it to you."

"Pissed-off?"

"You know what I'm talking about."

"The night before we left?" Everett asked, "I have no idea what you're talking about."

"Does *Jagermeister Girl* ring a bell?"

"Jagermeister Girl?"

"You know what I'm—"

"Hold it!" Everett said, looking up towards the cockpit, "Did you hear that?"

"Hear what?"

"That!" he said.

"I heard it!" Daniels said, emerging from his catatonic trance, "Listen."

Leilani listened intently. "Yes," she said finally, "I hear it."

A fast sequence of pops became clearly audible.

Everett scrambled back up into the cockpit.

Daniels asked, "What is it?"

It was a roaring twin-rotor Navy CH-46 helicopter whopping over the ice above, and, presently, hovering just above the site of the crash.

Chapter 35

Bedtime Story

Hundreds of frantic scientists executed what would be their last 'bag drag' of the season. Perhaps forever. Dragging duffel bags from aircraft to research facility and then back to aircraft had become the fashionable and highly practical means of luggage transport at McMurdo. This particular drag, however, was decidedly more frenetic than usual. Researchers scrambled into snowcats loaded down with hard drives, ice-core samples packed in dry ice, cryobots, and laptops. The snowcats filed up to the ski-way on top of the Ross Ice Shelf where three anxious LC-130's awaited departure. The windsock over the McMurdo automatic weather station flapped carelessly in the breeze.

Onboard *Prometheus*—docked at the ice pier near the edge of town—Koenigs stood at the helm, staring through his binoculars and smoking a pipe. Not in reverie, just for the nicotine. Everything had been going wrong and it appeared as if the trend would continue. Barometric pressure had been nose-diving two millibars per hour for the past four hours. The Captain trained his binoculars in on two islands, one snow white and the other barren black rock, bearing 050° at twenty nautical miles. The islands serve as a McMurdo weather indicator

known as 'Herbie Alley'. If the islands disappear from sight in whirling snow, there is less than an hour before the meteorological equivalent of an atom bomb known as *Herbie* arrives. A printer on the bridge began to squeal. Koenigs puffed, set down the binoculars, and retrieved the sheet spitting from the weather-facsimile. Strangely enough, the chart didn't reveal so much as the slightest swirl of a low-pressure system. He picked up the binoculars and looked back out—the islands were visible, clear as day. He tapped the barometer—still falling like a rock. Something, needless to say, was very wrong.

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Dr Everett felt the onset of a stomachache. He was hungry. Not physiological hunger, per se, but rather the hunger from being pregnant with embryonic ideas in dire need of nourishment. He had felt the desperate need to get back to work and see what he could muster in whatever time remained. He attempted to review the glaciological data that had been forwarded from his office, but found himself inexplicably unable to get Rand Krisstenson's encounter with the great blue whale out of his head. Where was Krisstenson, anyway?

Maybe, Everett began to think, my methodology has been too myopic. He doodled spirals on his notebook, following a seed planted by Krisstenson and watered by Sean Daniels. Everett backed out to the far edge of the universe, allowed his eyes to adjust to the darkness, then refocused his thoughts, following the thread through the solar system, back to Earth, down to Antarctica, across the vast expanse of the Ross Ice Shelf, inside an ice cube, inside a water molecule, then maneuvering the innards of a spacious atom. If an atom were the size of St. Paul's Cathedral the nucleus would amount to nothing larger than a pinhead suspended somewhere above the endless pews, with electrons zooming all the way up and down the long dusty nave, across the broad transept, past lancet windows and flying buttresses, and way up

high into the spire vestibule. Everett's focus submerged deeper yet, straight into the suspended pinhead, into the atom's nucleus, into terra incognita, watching quarks and gluons dance their curious dance. The dance floor, the strange subatomic land of entanglement, was far from Everett's preferred realm, the realm of binary elegance. On this androgynous dance floor zeros were no longer just zeros and ones were no longer just ones. They were both simultaneously, universally interconnected.

Everett held this thread for another minute or two, then decided he needed some fresh air. He was feeling—for exactly what reason he could not tell—a very intense need to be outdoors.

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Everett kept a cautious eye on the Captain's back as he crept past the bridge.

"Doctor Everett!" the Captain called out as if he had spotted him with eyes in the back of his head. "Where do you think you're going? You are to get your rest."

"I've been resting all my life," Everett countered as he entered with a modest smile. "Besides," he said, "I'm the doctor, right?"

"Ah yes," Koenigs said with a preoccupied smile and an eye on the islands in the distance.

Koenigs whisked from one instrument to the next maintaining a careful watch and insuring all was in Bristol fashion. Upward curls of blue smoke wafted from his pipe as he carried out his duties. The tobacco streamed rich with latakia and fragrant burley, infusing the bridge with the congenial comforts of a gentlemen's club.

"That smells pretty good," Everett said.

Koenigs seemed to take the comment as a personal compliment. "Do you smoke?"

"No," Everett replied, a bit distracted by the zip of a barograph. The Captain opened a drawer full of pipes, several of which appeared to be new. At last he snatched up an overgrown Douglas MacArthur looking corncob job and offered it to Everett.

"No. Thank you," Everett said, "really, I'm fine."

"Funktionlust," the Captain said with indifference to his objections. "Do you know this term?"

Everett indicated that he did not.

Koenigs rubbed flakes of tobacco between his fingers, sifting them down into the giant corncob bowl. "There's no English equivalent," he said, tamping down the tobacco then adding a second layer with care and deliberation. "Funktionlust," the Captain explained, "is the pleasure one derives from doing something you do well. I've skippered craft large and small, sail and steam, for better than forty years. Sailing has never failed to bring me this pleasure." He sprinkled a few flakes of loose tobacco on top of the bowl then extended the loaded pipe to Dr Everett. "Are you as fond of poetry as your young ladyfriend?"

"Ladyfriend?" Everett asked, accepting the odd looking pipe reluctantly. "Is this part of the mandatory bed-rest plan?"

Koenigs struck a hefty cedar match. "You're a bit like me, Doctor Everett," he said, holding the match before his face as if a direct order to raise the pipe to his lips, "you think too much."

The match ignited the loose curls of tobacco on the top of the bowl. Everett drew in smoke in awkward puffs. The initial combustion, Koenigs explained, was a false-light. He repossessed the pipe and tamped out the embers with his thumb. "Now you're ready," he said, handing him another match.

Everett relit the pipe—uncertain as to why he had stopped and started again. Koenigs drew a fountain pen from his breast pocket and began scribbling something on a napkin. Everett

took the opportunity to stroll about the bridge, inspecting the curious navigational fittings and instruments. He smoked heartily and the pipe grew hot in his left hand, so he switched to his right.

But the smoke started to get to him a little—he was feeling pretty lightheaded—and the Captain was focused on his duties, so Everett decided to follow through on his plans to get out into the fresh air. "Thanks for the smoke," he said, "I need some air." He handed the Captain his corncob pipe but the Captain refused to take it.

"I like you Doctor Everett," the Captain said in reference to the slobbery tip of the newly christened pipe, "but not that much. It's yours." He pinched a quarter ounce of tobacco out of his pouch, added a book of matches and the napkin on which he had been scribbling, and bundled it all into a package that he handed to Everett.

Wow, that tobacco's got some kick, Everett thought, stepping out onto the deck. He reached the jackstaff at the bow and leaned against it. He tilted his head back to draw in a breath of fresh air and, looking up, noticed the Stars and Bars—twoblocked and flapping in the wind like a forgotten ideal or misplaced reading glasses. He felt strangely patriotic. And for Everett this feeling was strange indeed. Despite his position as a government employee, Everett had never voted, never even registered to vote. He had always suspected politics were ninety-nine point nine nine percent hot air and he did not possess the patience to decrypt slick semantics, couched deception, and expensive subterfuge.

But standing there on *Prometheus*' deck in the frozen purity that is Antarctica and watching the fifty stars on a field of blue tranquility flapping in the wind, a sense of patriotism washed over Everett like never before. A pure patriotic rinse that left his eyes misted and twinkling with visions of diamonds the size of dandelions, perfectly matched pearls, and more gold than El Dorado. These treasures, clearly visible to Everett only now that he was far enough away to see them—isolated at the uninhabited end of the Earth—were the priceless jewels

known as true Americans. Those hearty Sons and Daughters pasteurized and fortified by Atlantic crossings, revolutions, wagontrains west, and two World Wars. But Everett had never joined up with a westbound wagontrain, never waded oil-laden waters with Rand Krisstenson, never taken to the streets with Sean Daniels, nor marched into battle. Everett felt a deep thirst to join ranks and swim in this nutritious skim milk of lean fighters, to enlist with peoples of all nations of the world for that matter—to swim unencumbered by the cream, the fatty waste product that had miraculously risen to the top and emerged as no-swimming-sign-posting-politicians. He suddenly realized that feeling political was synonymous with not accepting things the way they are. He began to feel dangerous. And he began to feel *endangered*.

Everett realized he was feeling pretty loopy, but recharged and chock-full of zeal, so he marched aft from the bow in smoke-induced contemplation, noticing—for the first time—the meticulous keep of tackle, lifeboats, and all the lines flemished down on deck. And then it occurred to him that a number of men, a dozen or so who made up the crew, had been hard at work to make their present endeavor possible, and that he had scarcely given them a second glance. Granted, most hailed from Koenigs' hometown, Hanover, and spoke only German with scant bits of broken English, but why should that matter? And come to think of it, nobody else in the Medea or Navy ranks seemed to pay any heed to them at all—save Krisstenson. Although it was not clear whether or not Krisstenson spoke German himself, he spent time in their company—playing cards, drinking kirsch, and mustering on deck to help tend the lines.

Everett worked his way back and, looking up at Old Glory flying high on the sternstaff now, his face bathing in Fanta orange light, decided, yes, I'm feeling rather patriotic and pipe tobacco suits me well. In the sky high above the ensign, the old moon held the new moon in her arms. The light of the newborn crescent gave Everett a glimpse of the full moon to come and he felt warmth in the knowledge that Leilani was alive and well, two decks below. He took in another breath of crisp air and headed down *Prometheus'* gangway. He was making his way down

the slippery plank and was pleased to spot Rand Krisstenson seated on his orange duffel on the ice below.

Krisstenson appeared to be surveying the great penguin rookery along the fringe ice when he said, "Rand Krisstenson." Penguins were everywhere—tens of thousands. The air was ripe with the scent of regurgitated squid and excrement. Everett wasn't sure if he had heard Krisstenson correctly and called out, "Talking to yourself?"

"Not exactly," Krisstenson said without taking his eyes from the penguins—and apparently not caught off guard in the least by Everett's furtive approach. "Rand was my father's name as well."

"Oh," Everett said, watching the Emperors and realizing he hadn't had a chance to bond with his childhood friends since their arrival, either. Come to think of it, he thought, I haven't done a lot of things I could have done.

Krisstenson rose and cast a gaze out over the ice towards the two small islands—the one of white ice and the other of black rock—and a Sooty Albatross and the dusty grayness of the horizon beyond. "My dad used to tell me this story when I was a kid," he said. "The idea was that saying a dead man's name aloud could bring his spirit back to help the living."

"Sounds like the kind of bedtime story every kid should hear," Everett said.

"Well," Krisstenson said with a smile nearly large enough to be considered a laugh, "it had a happy ending."

"Happy endings don't exist," Everett shot back. "If time is infinite and mass is finite—which they are—every happy ending has a sad sequel."

Krisstenson looked off into the distance with a fleeting expression. He squatted down and scooped snow into his bare hands. "I didn't attend a day of school until I was sixteen years old," he said, packing the snow. "My father took me out on his boat every day—he told me he could teach me more on the water than I could learn in a classroom. On my sixteenth birthday

he said he had taught me all that he knew—he died a few days later." Krisstenson gently lobbed the snowball at Everett, "Maybe he was afraid I'd learn words like *mass* and *infinity*." Everett punted the snowball with his boot, kicking it into a thousand ice pebbles. He and Krisstenson fell silent as they watched the Emperors—some of the most visually stunning creatures on Earth. Graphite feathered backs and wings, carbon capped heads, and glossy black eyes. The tear-shaped electric orange patches on their cheeks faded to splashes of vibrant yellow, off-setting the dramatic slopes of their long beaks. And their bright white chests shimmered like transfigured raiments in the great flood of midday light. The birds stood regal and upright—and if they were to remain still, Everett thought, frozen in the splendor of their arresting beauty, they would retain this regality forever. Of course they were not frozen. They moved, haphazardly falling, tumbling ungracefully and flopping into the water, slipping on the ice. Their struggles appeared terribly human. There was something oddly disappointing about the realization that his boyhood heroes were in fact so mortal. And the chicks, especially the chicks. They were the most ridiculously adorable round downy stuffed animals. Yes, stuffed, Everett thought—they must be stuffed—created by some toy maker prodigy—because these chicks were far too angelic to be real. Their black fur caps, puffy white cheeks, black dot eyes, miniature Emperor beaks, and baby wings hanging uselessly around their plump bellies. Their appearance was unbelievably fragile, awkward, and all but totally helpless. Yes, the story of the Emperor penguin, the noble wingless diver, was a story Everett knew well but decided was a story he no longer wanted to recall. He said, "I never knew my father."

Krisstenson watched a tern swoop down from the sky and glide over the surface of the open water and offered, "No man ever does."

There was, Everett thought, something very comforting about being in the presence of Rand Krisstenson—a certain harmony to his tenor that seemed to make talking, thinking,

maybe even breathing a little easier. Everett hoped that he and Rand Krisstenson would be old friends some day afterall.

An LC-130 took off from the shelf above and disappeared into a copious bank of clouds that had begun to accumulate on the horizon beyond the small islands. Everett grew uncomfortable with the silence, so he made small talk to pass the time. The signal flags on the mainstay began to ripple, flap, and pop erratically in the shifting wind, halyards clanged against the stays with tinny pings. Soon enough the Aussies' snowcat approached from McMurdo.

"May I ask you a question?" Everett asked.

"No."

"No?"

"I can't read your mind," Krisstenson said, zipping his jacket as a crisp breeze moved in across the ice, "but I know what you're thinking—and that's a question you'll have to answer for yourself."

"You think you know what I'm thinking?"

"Do you have a pen?" Krisstenson asked.

Everett pulled a pen from his pocket and handed it to him.

"I knew this guy once," Krisstenson began, turning away from Everett to write something down, "who knew more than he thought he knew," he said, turning back to Everett with his pen. "Who could have done much more than he did—but he didn't, and in the end he found himself alone on an island in the Indian Ocean, fishing with a dog."

"Oh," Everett said—he didn't know quite how to respond—this was getting pretty personal. He wanted to change the subject so he asked, "Well, how 'bout lesson three?"

"Lesson three, huh?" Krisstenson said with a smile. "Never talk to a woman on the phone."

"What?"

"Never talk to a girl on the phone."

"That's lesson three?"

"That's right."

"Come on, be serious."

"I am," Krisstenson said, "Well okay, you could call her up to make plans, ask her out, simple logistics and such. But never have an important conversation over the phone. Speech is the slightest, weakest, and most easily misunderstood mode of communication. There are modes of communication, and I'm not just talkin' about body language, or eyes, or of the revelations held in any one of the million variations of the smile. There are levels of connectivity way beyond all that stuff—" His voice trailed off as he heard a loud, squawking squabble that had broken out amongst a dense cluster of Emperors near the center of the rookery. "Say the first word that comes to you mind."

Everett said, "Love."

"How did you choose that word?"

"I didn't. You said to say the first word that came to my mind, so I did."

"Is it possible that I placed that word in your mind?

"I don't know. I don't think so."

"There are over two hundred thousand words in the English language," Krisstenson said, "What is the probability of guessing the word you chose?"

"Five ten-thousandths of one percent."

"Excellent," Krisstenson said, then proceeded to show Everett his right hand. 'Love' was written across his palm.

Everett stared for a moment, trying to figure out the slight-of-hand he must have missed. "How did you do that?"

"What's the single most powerful and readily harnessed force on Earth? A latent force with the power to move mountains, win wars, and light nations."

"Fission?"

"No," Krisstenson said with a chuckle, "it's love."

"Whatever!" Everett howled, "I thought you were being serious."

"I am. Never underestimate the power of love—everyone knows the saying, few understand its truth."

The diesel snow crawler drew within earshot and disrupted a minor state of meditation that Everett had begun to slip into.

The cat arrived and Martin popped open the door with a skeptical smile and said, "Let's make this quick."

Krisstenson asked Everett if he'd like to ride along.

"Thanks," he said, "but I better get back to the lab."

"Trust me," Krisstenson said, nodding towards *Prometheus,* "You're not going to find answers to your questions in there. Hop in."

Chapter 36

Satori

The great advantage of living at home while you attend college is that you are afforded the opportunity to learn things about your parents that you couldn't or shouldn't understand as a child. But that is the only advantage.

What is the reasonable number of times a reasonable person may reread the same book? Twice, three times, four? Leilani didn't know—but when she was a sophomore at the University of Hawaii she had decided that her mother had crossed that line of reason by a very wide margin. Maileia, Leilani had discovered, kept a secret book in a bathroom drawer. This book was antiquated, bound with silk-wrapped boards, and fit neatly inside a bamboo slipcase. Illustrations were etched with feather-light brushstrokes—birds of passage, cherry blossoms, and delicate lines of sensual pleasure—the text was old-world kana and kanji.

From time to time Leilani would discover her mother tracing her fingers over the whispery brushstrokes of these ancient symbols. The calligraphy was no more decipherable to Leilani than that of the cracked hieroglyphic enamel of an old ceramic teapot, but she had

always assumed the soft, intriguing lines leaned more towards eroticism than botany or ornithology.

But something had begun to trouble her. She noticed, quite casually at first then by careful observation, that her mother appeared to be reading the same *page* over and over. Indeed, the red ribbon marker never left this passage.

One evening after class, Leilani decided to drop by the Japanese department for a visit. Somehow she had expected to find a woman behind the desk, but instead found a man—a very good looking man. She had carefully unwrapped the book from her sweatshirt and unsheathed it from its slipcase, asking if he would translate the text.

"Certainly," he said, flirting a little as he examined the silk binding. "Well now, this is beautiful. Where did you find it?"

"It's my mother's."

"Oh, I see," he said, pointing to the page, "this poem here?"

"It's poetry?"

"Of course, Chiyo," he had said, "Kaga no Chiyo." And then he translated the poem:

"I wonder in what fields today
He chases dragonflies in play
My little boy who ran away."

Leilani had felt a bit queasy. "So um, this Chiyo," she had said, "her son ran away?"

"No, no," the handsome professor clarified. "In eighteenth century Japan," he explained, "little boys stuck gum on the end of long bamboo poles to catch dragonflies, a bit like fishing. This particular verse, rather perfect I think, is purely metaphorical. Chiyo had written this after her only child, yet a young boy, passed away."

Leilani did not respond. She began to experience emotions that were not meant to be had in front of a stranger. She picked up the book and walked out without another word. She

got on her bike and rode, just rode, aimlessly into the unexpected night. And before she knew it, she was down at the lab at Kewalo Basin.

It was so odd to see the dolphins in the tank all alone under the stars with nobody else around. Daylight was charged by feedings, cleanings, timed exercises, and demonstrations. Trainers—almost exclusively women, and for some reason almost all blonde mainlanders—whistling, singing, baby-talking, rubbing, clapping, and cheering. But the night was still and perfect and Leilani could actually hear the water swirling gently in the tank as the two Spinners circled to the window to see who had come at such an odd hour. Although they clicked as a sign of recognition, there was something missing, and for the first time in two years Leilani thought that they looked lonely. She sat down on the rickety wooden step at the base of the tank—stirred by a sense of drowning in loneliness under the pale gray moonlight—and composed a verse of haiku for her mother. She had intended to give it to her, but in the sober daylight of the morning that followed, she decided against it and sank back into the heavy quicksand of inexpressive silence.

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Leilani adjusted the tape that held the IV in her arm, perturbed by the fact she had this much time on her hands to be haunted by haiku and home. She was perfectly fine, save the modest repercussions from hypothermia and dehydration, but Koenigs had insisted that she, David, Sean, and Victor spend the next twenty-four hours in the infirmary. Ladir had begun complaining immediately and hadn't stopped since. His energy was limitless—like a jumpy little gerbil—and his phobic tendencies were on permanent display now that the mask of reserve had been torn away.

David had planted a delicate kiss on her cheek and snuck out not minutes after Koenigs left. She considered making a break for it herself—but the more she thought about it, what was the point? The evacuation of McMurdo had commenced. They too would be underway soon. Their mission was a broken voyage. It was over. As for the events of global significance that were or were not poised to occur, they had lost their pertinence. What could be done now? Mother Nature was bushwhacking her own path through the jungle and what would be, would be. As far as Leilani was concerned the mission had become one of survival for the officers, enlisted, and civilians who remained on the Southern continent. Or maybe, she began to think, I'm just out of my league? Her doctorate had given her an entrance level rank that most enlisted never reach, and her stripes weren't earned while serving in ship's company—many officers were quick to remind her of this fact.

Leilani lay there in her discontent and exhaustion-induced insecurity and drifted off to the nasal dissonance of Ladir's whining.

Chapter 37

Sturm und Drang

Antarctica's notorious gravity-driven katabatic winds pelted granulated ice pellets against the corrugated dive house. Everett stood over the hole, waiting for Krisstenson to resurface, looking out towards the islands that were no longer visible—*Herbie* was on his way.

"This guy's a goddam nutcase," Martin said, checking his watch for the second time in under a minute. "Look," he barked at Everett, nodding towards the strange, thick whirling stratocumulus pools to the north. "This shit's about to get real. It's time to go."

Krisstenson resurfaced with a long, controlled expiration and drew air deep into his lungs. His lips had begun to turn a metallic shade of blue. Everett crouched down for a word, but Martin's impatience had been stretched far too thin for niceties, "Come on fella," Martin said, "out you go."

A gust of wind shook the tinny dive hut. Centerfolds fluttered on the walls. Krisstenson treaded water in the drilled-out hole in the ice peering down into the water. It was apparent that Martin could not tell if Krisstenson was unable to hear him through his neoprene hood, or,

once again, if he was simply being ignored. The situation began to make Everett very uncomfortable. He sat down on the ice and handed Krisstenson a cup of Jell-O water.

The Australians were irked and quarreling amongst themselves. "Aw, shag'm," Martin said, "we're outta here."

Everett pulled them off to the side and said, "Just do me a favor and chill-out for a second," then he crouched down on the ice next to Krisstenson as he drank his Jell-O water. "Come on," he said, "we gotta go."

"Find Ladir and Cross," Krisstenson said. "Ask about the plutonium, Cross will know what he needs to do."

"What?"

"Just find Cross, he's knows what he needs to do. I'm staying," Krisstenson added, "you need to go on without me."

"What?"

The Australians turned to Everett, expecting him to break the impasse, and while they were anxiously waiting for acknowledgement and permission to haul ass, Krisstenson slipped back down into the water.

Martin had had enough. He crossed to the door as a distant wind belched a screechy hiss and in an instant the storm was upon them. The hiss had caused Martin to pause at the doorway and Everett looked up as the Beaufort 11 blast uprooted the makeshift shelter and whipped it across the ice. Herbie had arrived.

The two Australians were broadsided by interior walls. They rebounded off the walls like children's toys flung out of a tree house to be lost and forgotten. The auger toppled over on its side, obstructing the hole in the ice. Everett looked up from his seat on the ice, amazed that the structure had been ripped from the Earth and hurled overhead without so much as scratching him. His focus trained on the auger and he was rushing towards it even before he had fully

comprehended just what that meant, yelling, "Help me out over here!" to the Australians scattered over the ice. But they were in no condition to help and did not respond.

Everett strained against the auger with all he could summon. This was not enough to move four tons of steel. His feet slipped out from beneath him and dropped him to the ice. He leapt up and fought the wind as he scrambled to the snowcat—but the keys were not in the ignition. "Come on dammit!" Everett rifled through the snowcat but was unable to find the keys. The dolorous winds wailed and ice popped like breaking bones. He ran across the ice to Dink—Dink's body parts were twisted in ways a living body cannot be twisted. He tore through his pockets but they were empty.

Martin regained consciousness as Everett neared and asked, "What happened?"

"Keys!" he shouted, sprinting forward, "Where're the keys?"

"What?"

"Keys to the snowcat dammit!"

Martin looked over at the toppled auger and tried to leap up in a burst of panic, but his right femur was snapped, "Ahhh! Shit!" He reached for his leg, "There's a spare in the toolkit!"

Everett tore back across the ice and dug a set of keys out of the toolkit. He fired up the snowcat, slammed it into gear, jammed his foot on the accelerator, and charged towards the auger. He rammed it head-on and blasted it off of the hole. Everett catapulted forth, smashing through the snowcat's Plexiglas windshield and flying over the hood before falling on the ice. He rolled over and pulled himself across the ice to the hole.

Wicked winds howled at a sun that could no longer be seen and icebergs crackled and tumbled to the sea with callous indifference. Everett stared helplessly at the empty hole in the ice and found himself doing something he had not done in a very long time. Dr David Everett had always prided himself on his hard-earned sense of self-sufficiency. But the grave forces to which he presently found himself subjected—indeed the gravity of the entire predicament in

Antarctica was a weight so oppressive, that he yielded to utter helplessness and prayed, “Help me, Father.”

Chapter 38

Ontogeny Repeats Phylogeny

When Leilani had officially ended her relationship with David Everett, she sent him a sort of going-away present—a three-volume set of the first edition, 1927 English printing of Van Gogh's *Letters to Theo*. Leilani told him that his only chance for survival as a sentient human being was a very large, self-administered dose of solitude and the requisite courage necessary to wash it down—adding that great artists wear their hearts on their sleeves, and it might help him with future female endeavors if he found *someplace*—anyplace—to wear his.

Dr Everett had no idea what she had meant by any of that. And on top of that, the books were old, musty, and it was obvious she hadn't even bought them for him—there was an inscription to *her* on the inside! The inscription read:

HAPPY BIRTHDAY L! CHECK OUT THESE LETTERS, THEY'RE AMAZING!

It was signed:

LOVE, E

Everett wondered who the hell 'E' was and how they had both fallen for Leilani Akua, a shameless gift re-giver with a defective memory cache. Hell—he had decided—would freeze over before he'd give those damned books the time of day.

Months later, however, after hearing something about a Van Gogh exhibit at the Los Angeles County Museum, he thought maybe he'd check it out. And as a Prince of Serendip would have it, he found the perfect opportunity to do so. He had met a fine young (very young) lady one morning as he crossed the bike path at Venice Beach. Said young lady was sporting Rollerblades and a G-string bikini. As it turned out, she was an intern at Sotheby's art auction house in Beverly Hills, so he asked her if she'd like to join him for a visit to the Van Gogh exhibit.

Looking back, Everett thought, the Van Gogh exhibit was a great idea for a first date. Having an emotional breakdown and crying like a total wuss was not. They had arrived at the museum without tickets. Poor planning. The show was sold out for the rest of the weekend, even at $17.50 per ticket. Hundreds of people were lined up outside waiting to stampede in for a peek at old paintings. What was this guy all about? Rollergirl had explained that his portrait of Dr Gachet sold for eighty-two point five back in 1990, and that the 'Vin-man'—that's what she called him—would likely be the first artist in history to have a piece of painted canvas with his name in the corner to 'break nine figures'.

A street hustler toting a laminated *I need tickets* sign scalped Everett two tickets for eighty bucks. Two hours later, when they finally reached the front of the line, he splurged an extra ten dollars for two headset audio tours so he could tune out the remainder of Rollergirl's art-auction economics.

Everett made his way through the crowded galleries passing by the seventy-some paintings as quickly as possible, trying to stay ahead of her. He had no idea how it worked, but

the CD-ROM audio tour actually *knew* when the Van Gogh-goer passed from one gallery into the next and began playing the appropriate introduction to that particular group of paintings. He was passing through so quickly though, that the CD-ROM laser-reader began skipping and malfunctioning. But a few paintings seemed to jump out and pull him in—*Starry Night, The Yellow House,* and an iridescent self-portrait—force-feeding a moment or two of awe and contemplation. Wow, they were beautiful. Everett felt a little weird. But what had Leilani been trying to get at with this whole Van Gogh thing, anyway? Hell if I know, he had thought, and I don't have time to try to figure out her little game anyway. He was heading out of the final gallery towards the exit, but the final painting stopped him dead in his tracks. He was unable to move, unable to express his thoughts, and unable to comprehend what he was feeling—for the first time in Everett's life he found himself under aesthetic arrest.

The CD-ROM audio tour had finally had a chance to catch up, and low and behold, the narration was describing the painting before his eyes. The canvas was heavy and foreboding, a muted gold field of wheat under darkened skies and vexing faceless crows, at the moment a storm is just about to unleash itself. Three paths cut through a field of wheat, flattened under the fierce wind. Two paths divert off of the canvas. The third buries itself into the wheat. It is called *Wheatfield with Crows.*

So there he was, sandwiched in the middle of a crowded gallery, sobbing like a lost child. Good God, he had wondered, what's happening to me? And it was at that point that he noticed Rollergirl watching him from across the gallery. She turned away, pretending not to notice.

He discovered later that night, after purchasing the hardcover edition of *Van Gogh's Van Goghs* in the museum bookstore, that Vincent had walked out into that very field two weeks after completing the painting, shot himself in the stomach, and died two days later.

Thus it did not come of much surprise to Everett when *Wheatfield with Crows* crossed his mind as he crossed the wicked ice, making his way to nowhere. He had tried not to ask himself but felt as if he needed to know what was buried beneath the surface of Krisstenson's fate, to find some clue, perhaps, buried in a snow-covered field long after harvest. Was it suicide? The tipped auger, granted, had sealed Krisstenson's fate. But it did seem as if he had premeditated his destiny. Afterall, he did say: *I'm staying, you need to go on without me.*

Squinting at the cruel icescape through the ripping wind, struggling to lift the frozen clumps at the end of his legs and place them one in front of the other (they didn't really feel like feet anymore) Everett realized that he had never really experienced such complete solitude. But oddly enough he did not feel alone. And he didn't really mind the frostbite either—in fact it tickled a little. Walking had actually become so ridiculously difficult that it gave him something to laugh about in what was otherwise one of the more dismal walks imaginable. And even more dismal when considering the events that had just transpired.

Everett had been unable to tear himself away from the ice beneath which Krisstenson had vanished, crouched in the wind by the icehole's edge in a state of total helplessness and despair.

Martin the Australian with the broken leg, however, had naturally been eager to depart. Everett hoisted the Australian up over his shoulders, carried him to the snowcat, then carefully laid him across the back seat.

But once inside, another significant obstacle had presented itself: the snowcat no longer functioned. The collision with the auger had rendered their transport inoperable and as far as the Australian was concerned, Everett was to blame. He did his best to assure the Aussie that he would get them out of their current predicament, but Martin seemed to develop a kind of post-traumatic stress Tourette's syndrome—he began swearing uncontrollably. At first the profanities had been directed solely at Everett and his inability to operate the snowcat, but then

diverged off towards select international clientele including friends and family back in Sydney, Dink and other compatriots, the Russians inhabiting the Vostok Station on the South Pole, the radio station operator back on the Australian base who—for some undeterminable reason—could not receive their transmissions, and then on to the radio operator's friends and family back in Melbourne. The rage grew and grew and Martin had become progressively violent with his expletives until—mid-sentence between 'this fucking' and 'shit'—Martin Donner died.

Everett had spent another hour or so sitting out the howling storm with Martin's corpse sprawled across back seat of the snowcat. Although he finally recalled how to navigate using his new watch as a compass, that technique requires actually being able to *see* the sun—and he could not. The clouds that had fallen and clung to the snow and ice like a needy child, diffused the white directionless light. Up, down, left, right—all white. It was beautiful and serene, really, and had it not been one of the more unpleasant situations in recent memory, Everett thought, his snowcat shelter with windows of white silence could pass for a quaint little cottage in heaven.

In time the winds had subsided. Everett suspected he had passed into the eye of an extratropical storm and there may be more to come. But the muscles in the back of his neck had constricted, shooting sporadic shivers down his spine. His core body temperature, he deduced, had fallen below 97 degrees, and he had become oddly consumed with foreboding premonitions, visions, and sounds of the distribution of CM-44. He couldn't wait. He was presently able to make out minor topographical references in the distance so he set off on foot.

Before long the winds freshened as feared, whipping and shifting—south by southwest, south, then south by southeast—lifting ice-BB's off the frozen sea and firing them from every vantage point possible.

Dr Everett did his best to toggle the hood of the US Antarctic Program standard issue vermilion parka around his face, but his motor skills were crumbling. The Emperor penguins

came to mind and at length he decided that he was grateful to have seen them afterall. The shiverings became progressively convulsive and although despair infiltrated his heart, circulating and distributing distress signals to every cell, he had yet to experience the sad state of being alone. No, in fact it did feel strangely as though there was another walking by his side. He began plugging variables into a relatively simple equation to keep his mind busy, estimating values the best he could given the circumstances:

$$TWC=2\{[(-32WS/25-TS)/(2+1.5WS/25)]+25\}$$

The first time through he got negative thirty-one. He wondered if he was over-estimating the winds. He ran the numbers again and got negative twenty. That was probably more accurate, he thought.

Everett plodded along, bowing his face to the spitting wind, factoring wind chill equations to help maintain consciousness. His mental acuity was dimming. Soon he found himself unable to perform elementary arithmetic. His mind was numb. Every breath hurt. The dry icy air scorched his lips, mouth, throat, and lungs.

The jagged fringe ice along the Ross Sea—at least what he could make of it through the blowing ice and snow—reminded him of his boyhood travels across the rugged Finnish terrain along the White Sea and the caves along that far northern polar coastline with their petroglyphs of abstract beauty, painted by the ancient Finns four thousand years before Christ. One petroglyphic sequence relays the story of a hero who learns to make weapons as a small child. He hunts small game in adolescence, then moose, then bear. When the boy reaches manhood he stops hunting to become a rattle maker, an interpreter of animal signs, and a healer. And when the man grows old and dies, he travels to the center of the great mystic spiral where he meets his god and maker—a great blue whale.

But as Dr David Everett plodded across the frozen expanse, advancing mere inches at a time, he realized there was one distinct, deeply disturbing element of that particular memory—he had never even *been* to Finland, much less inside any petroglyphic caves along the White Sea.

Chapter 39

A Little White Cloud in Heaven

I hope it is true that a man can die
and yet not only live in others but give them life,
and not only life but that great consciousness of life…

—Jack Kerouac

He withdrew the corncob pipe from his pocket and reached back in for the tobacco, but dropped the pipe in the process. Everett stumbled in an attempt to rescue the pipe, but realized he no longer had the ability to bend over and collect it. He shuffled off across the ice covering the Ross Sea on a slightly different bearing—a tattered sloop underway with no way on. He figured his body temperature was somewhere around 93 degrees, but in the moment he jumbled the Celsius and Fahrenheit scales and could not recall the value of homeostatic human body temperature.

He felt sorry for having left the pipe behind—it was a fine gift. He pressed on across the directionless ice squinting at nothing and troubled by a word that, now that he had thought

fondly of Koenigs, would not leave him alone. *Funktionlust*, that was the word and the trouble came from the fact that Everett could not recall ever having experienced this so-called *funktionlust*, this pleasure derived from doing something you do well. But that was the least of his mental troubles for the moment. For the confounded memories of the petroglyphic caves along the White Sea had returned along with strange visions of music, tears, and a tantalizing proposition of interspecies communication. Something—aside from being lost in Antarctica and freezing to death—was wrong. His gait was shrinking—the heel of one white boot barely passed the toe of the other. Breathing became progressively difficult. He struggled to pull shallow breaths into his lungs and as he did, coughed, and then coughed again. Something light was leaving him, leaving his heart, and the void left behind was quickly filled with dark, heavy matter. It was this heavy weight of the incomplete—the unsolved, unpolished, and unsung—that made Everett realize he was sick. He was neither freezing sick, nor insane sick. He was lovesick.

Yes, he was lovesick—at least this one thing was clear. Because of all that he could be grieving for—no final farewells, a father unfound, countless equations unsolved—he grieved only for the loss of Leilani Akua. Ah yes! he thought to himself in light of this revelation, *she* was my funktionlust! He spotted an object sticking out of the ice, but stumbled on a chunk of crusty snow and fell chest first on the ice. He remained still for a moment, capturing his breath, then turned his head to seek the object he had seen while standing. It was his pipe. This did not bode well for David Everett.

But he was feeling oddly warm so he decided to rest for a while. The wind-chill seemed to skirt over him from this low elevation. Yes, it was even rather balmy down on the ice. This, he decided, was a good place to duck in from the cold. And then he was back in Finland, resting in the painted caves that he had—yet had not—visited in his youth. How could he see

them so vividly? How was it that he knew every passage of their stalactite and stalagmite labyrinths? This was strange indeed. He heard the faint drone of a distant chainsaw. Oh yes! he recalled, that's right, I'm not alone, I was right, I am not alone—someone outside my cave is cutting wood to build me a fire—and they are singing as they saw, singing me a sweet song. He could feel the warmth of the fire already. The drone of the chainsaw grew nearer. And nearer, becoming discernable as many chainsaws.

Then the buzzing began to fade back to the soft hum of a single chainsaw. The soundscape procession of the advancing and receding saws was no longer in keeping with the idea of someone preparing wood for a fire so Everett turned his head and looked back towards the sound of the chainsaws and saw a dozen or so snowmobiles making their way across the ice. It was apparent they had not seen him and were no longer headed in his direction, but he smiled because the singing had not ceased and was yet comforted that he was indeed not alone afterall. He watched from the ice as the snowmobiles faded in form from the semblance of a pack of motorized dogs, to a litter of battery operated kittens, then silent fleas floating on the horizon. Then they were gone.

And although *Prometheus* was no more than several stones throws away, it might as well have been light-years—for Dr Everett had fallen into a state of deep, hypothermic sleep. Snow swirled lightly with indifference. *Prometheus* was cloaked in a requiem mask of quiet fog, moored along the ice less than a half mile beyond.

In time a distant song swirled faintly somewhere in the Ross Sea below—the song of the humpback whale. Serene modulations of seraphic and unmitigated beauty rose from the deep as a lone humpback ascended towards the ice beneath David Everett.

It is conceivable, even probable, that the whale's echo ranging abilities enabled her to detect Everett, prostrate and unmoving on the ice above—but Everett did not sense the whale's

presence, for his only sensation was the visualization of a white cloud. It was a white cloud of steam and he was one year of age, sitting in a homemade car seat set on the bathroom counter. The steam had been released from the heated water that had fallen from a showerhead. Young David Everett heard water running in the sink that he could not see—all he could see was the cloud of steam. But in time the steam diminished, condensing upon the ceiling and the mirror behind him. When it had sufficiently parted, David saw his father standing before him, dipping a razor beneath the running water and shaving by his reflection in the mirror. He saw his face and almond hair that had one day matched his own. David began to tell his father a story as he watched him shave. David said he was not a one year old boy, but rather the one pound egg of an Emperor penguin. He wanted his father to know that it was okay if he didn't know what to do with a penguin egg—most people don't—but that he himself had a general understanding of the role that fathers play in the incubation of Emperor penguin eggs and that he would be happy to share the story. David told his father that the Emperors—the only mammals to inhabit Antarctica all year—copulate in April or May. The male remains by the female's side—both fasting. One month later, eyes fixed upon the female's pouch, the father begins to sing as soon as he spots the egg. The female catches the egg with her wing and places it upon her feet before it touches the ice and joins the male in song, both staring at the egg and trumpeting for an hour or so. Then a delicate transfer takes place: the female sets the egg on the male's feet. He shifts his weight back on his heels so that the egg makes as little contact as possible with the part of his foot touching the ice, then tucks the egg in under his body for warmth. The female, having fasted for several months now, departs for the open sea to replenish herself. Then, David Everett told his father, the Emperor fathers spend the next three months—the dead of austral winter—with the eggs precariously perched on their feet, standing in a barren land of total darkness. Katabatic winds blast up to one hundred miles per hour and temperatures reach the

depths of one hundred degrees below zero. So, David said to his father, if he didn't feel like hanging around all winter, holding him on his feet—it was okay, he would understand. But if he felt like trying to stick it out, he should know that penguin fathers have an interesting strategy for surviving the winter: *They help one another.* The entire colony—now consisting exclusively of males holding eggs on their feet—gather in a giant spiral, all facing inward, huddled together. They spend the next three months slowly rotating around the spiral, each taking their turns bearing the brunt of the wind on the outside ring and enjoying the warmth of the inner circle. This is how they survive, interdependently, all in it together—one dozen ninety-pound males per square yard. Each will weigh only forty-five pounds by the time of their next meal—three months later—but most fathers will make it. The eggs hatch in August and round, downy chicks emerge. The females return from the open sea shortly thereafter, all trumpeting wildly, and miraculously each of the tens of thousands of mothers finds her chick and regurgitates food into its mouth. The fathers, after fasting and freezing all winter now, depart for the sea to fish for themselves. The object of this cyclical timing is to launch the chicks in the warmth and abundance of austral summer. But David told his father that he knew that it was a lot to ask, and that he would understand if he didn't want to stick around. Besides, three fourths of newborn chicks don't even survive to reach fledglinghood so I, David said to his father, probably won't make it anyway. But I might.

Chapter 40

Mele

Mele is a term of double entendre in the language of ancient Hawaii—traditionally it is the word for song. But it is also an elegy to the sea, testifying to the nobility of a mariner's journey over the water, and praying for a safe return to shore. There, standing on *Prometheus'* bridge in the devastating silence, Leilani silently recited such a prayer in the words her grandmother had taught her.

Koenigs reluctantly lowered his binoculars. There was nothing to see, anyway—visibility was nearly zero. Atmospheric conditions had stalled the search for Everett and Krisstenson. The moment there was a lull in the storm, pervasive fog had set in. Sean Daniels and Stearns squinted in vain into the white. Victor Ladir busied himself with nervousness and was almost convincing in his attempts to appear gravely concerned.

"I'm going back out," Leilani said. She was in shock and her unyielding eyes darted around the bridge at everything—yet focused on nothing. She whipped on her jacket and boots.

Compassion flooded Koenigs' eyes. "Leilani," he said as gently as possible, "I have no idea how to put this—but we should have allotted sixteen hours to reach safety. Minimum."

He drew the silver chain from his belt and read his pocket-watch, "We should've been underway three hours ago. Even if they're alive, by the time—"

"Do what you need to do," she shrieked, "I'm going back out."

"Leilani," the Captain said, "I know this, this must be—"

"I'm afraid," Ladir said, stepping in with reinvigorated authority, "I will not allow you to jeopardize the safety of the entire crew. We've done all we—"

"I'm staying," Leilani stated plainly, "If anyone wants out, speak up, I'll arrange for a cat to take you over to the *Liberty* before she gets underway."

"Captain," Ladir demanded, "Up anchors and get underway."

Koenigs did not move.

"I said get moving!"

Koenigs did not move and made it clear that he had no intention of doing so. Ladir took an aggressive step in his direction, but Stearns drew his standard issue Colt .45—chambering a round as he did so, taking aim, dead center on Ladir's forehead. "If the lady says she's staying," Stearns said, "we're staying."

Ladir shot furious glances around the room for support.

Daniels said, "Fuck off."

Stearns waved his .45 in the direction of the door and told Ladir, "Looks like you better make your way over to the *Liberty*."

Chapter 41

Vis Medicatrix Naturea

The most beautiful thing we can experience is the mysterious.
It is the source of all true art and science.

—Albert Einstein

Slow but steadfast, the humpback whale, a brawny and mature female, scraped her barnacle-bejeweled head against the sepulchral ice, singing her song—soft and intricate fabrics of ancient resonance. Much as a single drop of water holds the potent essence of every life form on Earth, so it was with this song.

And somewhere in that deep hypothermic state, in some other place and some other time, Everett traveled beneath the warm saltwater waves of a bygone coast, down through a dark, verdant kelp forest filled with giant, majestic bioluminescent jellyfish—gelatinous comets pulsing, gliding, and basking in the fluidity of their own radiance. Basking in the night waters like popping and streaming fireworks over knee-high fields of grain on the Fourth of July. Laughter, that of a young boy, echoed in waves through the soft, black velvet waters, and the

jellyfish were transfigured into fiery dragonflies. Spectacular dragonflies, unweaving and reweaving the colors of the rainbow with their wings and darting off to points unknown.

The child's laughter drew nearer, then slipped away. The dragonflies danced ever-varying tangos and whimsical flight paths and hung motionless with the flicker blur of their rice-paper wings. A high-pitched burst of laughter emanated from the center of a parting sea of dragonflies and the young boy emerged. He darted about, chasing the dragonflies with a long bamboo pole.

David watched the boy trail the darting flight of dragonflies. His appearance was at once familiar, yet unknown. The boy, running short of breath, came to rest by his side, and whispered in his ear.

David Everett awoke. Hey lay upon he ice and his body trembled with the deep rumbles of the song of the unseen humpback whale. Yes, he was awake. He could move. Everett rolled over and pushed himself into a seated position with his back to the wind. He looked down at the ice as the tiny crystals on the surface vibrated with the song of the whale could hear but not see. But he did see something else. There, in the distance, small as a matchbox, sat the faint gray outline of *Prometheus*, docked along the fringe ice. Everett pulled himself up and shuffled off.

Chapter 42

Searching for David Everett

Somewhere in the attic of the human subconscious lies a box which contains the idea that the owner of that particular human mind is immortal and the rules that apply to *animals* do not apply to him or her. But by accepting membership into the animal kingdom, man is forced to acknowledge that he too, like the elegant impala that falls prey to the swift puma, will one day complete his cycle. And that was the bad news.

The good news, for Leilani at least, was that a behavioral cetologist such as herself might be able to learn more about cetacean nature, maybe even more about human nature, by looking for *similarities*, analogous behavioral characteristics in the two animal species on Earth that are equipped with the most comparable cerebral equipment.

Initially, that was exactly why she was enraged when she had heard that David suggested CM-44. She had suspected, though not strongly enough to present it formally, that they were on the verge of a spectacular discovery, something cosmic. Two comparable species poised on the cusp of connectivity like never before. The bridge was being built. It was just a matter of

waiting, of riding the storm out—regardless of the consequences—and behold the vision like the Magi in the manger. She could feel it tingling in every cell of her existence.

But what could she say? It was just a hunch. Where, as David would put it, was the empirical meat and potatoes? The tangible proof? David was right—it was time to act. Her primary responsibility was to protect US soil, US soldiers, and US lives. Period. Yes, David had been right, and it was driving her crazy that she had argued with him over it, and those thoughts taunted her as she, Stearns, Daniels, and every other crewmember scoured the fringe ice surrounding the former location of the Australian dive house. They crept along on snowmobiles, snowcats, and every other snow crawler McMurdo had to offer. The ice was jagged, cracked, and heavily rutted. Leilani pressed on ahead, urging the others to cover ground more quickly.

Chapter 43

The Night Before Christmas

You wait. Everyone has an Antarctic.

—Thomas Pynchon, *V*

He pulled on the door handle until the lock mechanism popped off and distributed its aluminum entrails to random points on the infirmary floor. Dr Everett had often wondered just how it was that people went insane. Did it creep up like a stranger in the night, walking two streetlights behind, gaining a few cement squares with each additional block traveled? Or was it a slow process of disengagement, becoming more and more detached until you're floating all alone in outer space?

Everett knew he was out there all right—a bonafide rocketman on the dark side of the moon—and from this lunar darkness came the loud and erratic deluge of petroglyphs, cetacean songs, and binary riddles.

So there he found himself in front of the medical cabinet within *Prometheus*' infirmary, clutching its broken handle and desperate to locate a substance that might bring him back to

Earth. For the moment—apart from the frostbite—he actually felt fine. But he had a distinct feeling the voices, songs, roaring data streams, and misplaced memories would be back soon and he needed to be prepared. And where was everybody? The ship's decks were deserted, not a crewmember in sight. Granted, he had avoided the bridge and crept directly to the infirmary, but he had neither seen nor heard a soul.

Yes, Dr David Everett had slipped back onboard *Prometheus* and had yet to inform anyone of his arrival. Thank God, he thought, the idea of carrying on an intelligible conversation at this point was out of the question, and he didn't particularly want Leilani to see him like this. Krisstenson was gone. There was nothing to do about it now, save talk, cry, console, and toast Krisstenson's memory—and there was no doubt they would all do so in due time.

Within the medical supply cabinet, penicillin was most plentiful and there were gobs of useless gauzes, eye patches, and burn creams. The psycho pharmaceutical selection was rather limited. There was one foil-pack of anti-anxietals—he swallowed one tablet immediately—but not a good anti-psychotic in the whole lot. He was going to have to try to concoct his own remedy.

Someone—he figured Captain Koenigs—had enough Pitocin to keep blood pressure low in the highest of seas. He grabbed a few 20cc vials and a handful of syringes. Another crewmember, perhaps Hal Curtis, was tending to his tender downy hairline garden—there were a dozen 500 ml spray bottles of 5% extra strength Rogaine. He knew that minoxidil worked by increasing circulation to the scalp, and speculated that the additional circulation might assist cerebral function as well so he grabbed three bottles and a spray applicator.

He saw two other familiar faces, Soma and Vicodin. Everett's college roommate, a 260-pound Samoan All-American with access to a wide variety of painkillers and muscle relaxants, had always maintained Soma and Vicodin were his two favorites. They were known in the locker-room as 'footballs' and 'hockeypucks' due to their shapes and wide distribution

throughout the world of contact sports. When taken in unison, the consummation was a Soma Sandwich—two 500 mg Soma tablets and one 750 mg tablet of Vicodin ES. They were to be administered before, during, and after non-playoff games and fraternal drinking rituals. He grabbed a few of each in the event that sedation should become necessary. He pulled off his boots, wondering if there was anything he could do about the frostbite—his toes didn't look too hot. He started to dig through the various creams and salves when he heard footsteps in the hallway, so he dumped the loot in his boots and ducked behind the door.

The footsteps passed. Everett snuck barefoot back to his room, locked the door, pulled the shades, ate a soma-sandwich and wetted his scalp with a dozen blasts of minoxodil, thinking a few hours of sleep might help clear things up.

But it didn't.

He couldn't sleep. He was in fact feeling quite low. Death had been a relative stranger to Everett and was turning out to be an unsavory new acquaintance. He figured music would probably only make it worse, especially since the only albums he had were Krisstenson's—but he had to do something. *What's Goin' On* seemed appropriate. His fingers felt like lead, but he was able to slide the vinyl out of its jacket and as he did so, a few torn sepia pages of typewritten paper slid out from within the album jacket, sailing down to the floor in erratic loops.

He set the needle on the record and squatted down to gather the pages. They appeared to be an essay or the likes, entitled *The Declaration of Inter-Dependence*, written by Rand Krisstenson. The discovery felt like unearthing lost treasure. He sat on the edge of the bed and poured over the typewritten pages to the saxophonic jazz of *Wholy Holy*. The essay turned out to be a manifesto of sorts, lofty ideals pounded on fiery anvils of thought—lofty ideals that hinged upon connectivity, upon a global interdependence, a transcendence of the squiggly lines of ink on maps.

The last pages were a weighty collection of quotes—the words of great poets, tacticians, tantric lovers, and warriors: General Gray, Jack Kerouac, Muhammad Ali, Albert Einstein, and others. Ah, Everett thought, so here was Krisstenson's gallery of the 'all-knowers of single things'. An odd sense of déjà vu floated about the mighty words, all poignant and stirring. He could have sworn he had read them somewhere, perhaps even recently. Or that they resided somewhere in the not so distant future—but in any case, yes, they did afford vistas from the shoulders of Titans. Everett turned back to *The Declaration of Inter-Dependence* and began pouring over the text in detail. The manifesto struck him as profound and did freight a great power of the written word, but Everett's vision began rotating about the room. Slowly at first, like the smooth sounding vinyl on the turntable, then spinning like a top. He set the manifesto aside and reached for a glass of much needed water, but wavered and slumped over on his side. He was asleep.

Chapter 44

Rosa Parks

He found himself alone inside a small black tent, somewhere near the southpole. He heard a rustle outside, then something else that sounded like a horse. Dr Everett opened the tent flap and saw five men on ponies. The men were staring and swearing in utter disbelief at his tent.

Everett knew very little of Antarctic history, so he did not recognize the ghost of Robert Falcon Scott. An introduction was necessary. And it was during this introduction to Scott and his crew that Everett realized that they were staring and swearing at a Norwegian flag flying brazenly in the wind above the tent—a flag left behind by Roald Amundsen thirty-three days prior. And it was also at this point that Everett realized he was dreaming.

The men turned in circles as if spinning on the Earth's axis, staring at the ski tracks, trash, and doggie doo that rendered the otherwise whitewashed South Pole with some definition. The five men that had looked like hell upon arrival now looked ten times worse.

They silently remounted their ponies and headed back north. Everett walked alongside Scott's pony, taking small steps so as not to out-pace them.

Scott began chastising himself. "The pole must be discovered by an *Englishman*! Blah blah blah! What the bloody 'ell were we thinking!" He ranted, adding had he cooperated with

Amundsen, they would have *both* surely reached the pole and returned with ample food and all ten toes.

"You guys have serious frostbite?" Everett inquired as politely as possible.

"Frostbite?" Scott exclaimed, "I'll be dead in two months! Two long, bloody awful months."

"Oh."

"See the fella over there? Evans!"

Edgar Evans turned his head in Scott's direction like one of those odd wobbly-headed plastic car dogs, then turned back without imparting any discernable expression.

"Yes," said Everett, "I see him."

"Be dead one month from today."

"Oh," said Everett, "I see you've made this trip before."

"Every year since 1912. What year is it, anyway?"

"I'm not sure. I'm asleep."

"I see," said Scott, "I come across fellas like you every now and then." At that point Scott's pony stopped in its tracks and refused to proceed. "Sure you're not dead?" Scott asked as he dug the furry heels of his boots into the pony's gaunt ribs.

"No," said Everett, "not really."

The horse refused to budge and Scott began flapping his legs like banjo strings. The others, not more than ten or twenty yards ahead, began kicking too—their mutinous ponies having halted in concert.

"Ever think horses might've been a mistake?" Everett asked, jogging in place to stay warm.

Scott stared at him in bewilderment as if to say 'what the hell else would we use?'

"Well, I noticed the dogshit back there."

"Ha! Dogshit! Ha ha! Ol' Roald will never make it back either! Never! Not with bloody dogs! Ha! Told 'em a thousand times!"

"Well I'm not really sure," Everett said apologetically, "but I think he *did* make it back."

"Nonsense."

"No, really," Everett insisted as gently as possible, "I'm pretty sure he did."

"Really?"

Everett nodded sympathetically.

"Oh," said Scott, "I see."

In time Scott's horse moseyed along and the brave British ghost began explaining a theory he had been working on over the years. He had come to the conclusion that the failure of his expedition had followed the same downward spiraling logic that had led to the fall of the Roman Empire, the British Empire, and, if things don't change, could bring down American empire as well.

"Do you know the Rosa Parks story?" Scott asked.

"Sure."

"Don't lie! It is as unbecoming as it is American."

"How'd you know I was lying?"

"I know everything."

"You didn't know about Amundsen."

"Well, almost everything."

"Okay then," Everett said, "who was Rosa Parks?"

"She was the woman who wouldn't go to the back of the bus."

"Oh right, that's right," Everett said, "I remember."

"The point," Scott's ghost began to say, but stopped when Evans fell off his pony and would not get up. His pony made yellow snow then began to trot on ahead.

"Get up!" Scott yelled.

Evans did not move and did not respond.

"Get up you imbecile!"

"No."

"I said get up!"

Scott dismounted his pony and he and Everett stood over Evans who lay face first in the snow. His pony was out of sight.

Scott kicked him, "Evans you bloody fool, get up."

"I don't want to. I want to die."

"Don't worry," Scott said, "you will, but not today, so get the hell up!"

After some cajoling Scott managed to lift Evans' spirits and then lift his hapless frame, draping him over the bony rump of his pony. Everett now walked behind, holding Evans in place on the back of the horse.

"Anyway, as I was saying," Scott said, "the point is, most chaps assume that one day this little old lady—Parks—just decided to sit up front in a fit of spontaneous rebellion." Scott stopped speaking abruptly and Everett nodded with a smile to let him know he was paying attention. Scott continued, "But what most don't know is that Parks had spent *twelve years* leading the local NAACP chapter. The summer before she attended training sessions at Highlander Civil Rights Organizing School, and she had followed the publicity of a bus boycott in Baton Rouge two years prior. These kinds of initiatives take *time*. These initiatives take *commitment*."

"Look," Everett shouted, "let's cut to the chase here. What the hell does this have to do with me? I'm tired! No, I'm exhausted! I almost froze to death yesterday! I'm trying to get some sleep here, aren't I? Am I actually getting any *rest*? It's Christmas Eve—I think, or close

enough anyway—I'm supposed to be tucked into bed with visions of sugarplums dancing in my head. What do you want from me?"

"We want your help," Scott replied.

"Help?"

The ghost cleared his throat. "The number of species on Earth is being reduced by a rate from 100 to 1,000 times higher than in prehuman times."

Numbers. Everett perked up.

"The current removal rate of tropical rain forest," Scott rambled on, "over 1 percent of cover each year, translates to point-three percent of the species extirpated immediately or at least doomed to much earlier extinction than would otherwise have been the case."

Everett began to suspect he had heard these statistics before.

"More than half the species on earth live in the tropical rain forests," Scott continued. "If there are 10 million species in these habitats—a conservative estimate—the rate of loss may be 30,000 a year, 74 a day, 3 an hour."

"You can't prove that!" Everett countered.

"Stop bloody kidding yourself," Scott said, "you know it's true."

"All I know," Everett said, "is that there is no practical method for substantiating your data. A census of that magnitude—wait a second." Everett remembered where he had read this before, "It's not even *your* data. You stole those numbers from Ed Wilson."

"Why yes, brilliant! And I would have brought him along to narrate them himself, except that he's not *dead* yet." Scott called out, "Whoa!" to his horse. It was time to set-up camp for the evening.

Everett looked back over his shoulder and saw Amundsen's black tent with the Norwegian flag eighty or ninety yards behind them. Scott was busy unbundling the frail wooden tent stays as Evans lay motionless in the snow. Everett helped them unfold the heavy canvas and

Scott thanked him for the assistance, watching him watch the polar disaster unfold with a smile. "It can't be proven, you're right about that, but the writing is on the wall—perhaps in invisible ink to some, I suppose." Scott signaled to his comrades as his ectoplasm began to fade. "If you're unwilling to help, well, that's your choice, but the cats aren't going to like it." The ghosts dropped the tent poles and began to walk off, then vanished into the thin, Antarctic air.

Cats? Everett wondered.

Chapter 45

Dancing Kitties

In 1955, in Minamata, a tiny fishing village along the tranquil shores of the Japanese coast, cats began to dance. Calicoes, tabbies, shorthaired Siamese, and shedding Persians alike—one by one, every cat and kitten in the village began to dance wild little jigs and leaping pirouettes. Mothers and fathers traveled with their children from all corners of the island nation to witness the phenomena. Over the years the dances became progressively crazed and crescendoed into a sort of avant-garde break dancing fever.

Then the cats began to die.

Within two years all were dead. In 1957 the cat population in Minamata, Japan was zero. Then people began to die. Children were born blind, speechless, and deformed. Some said it was the curse of the dancing cats.

Of course they were wrong.

In 1968 the truth came out. Chisso, a multinational chemical company, had been dumping mercury-laced industrial waste into Minamata Bay since the early 1950s. Everett had

never heard the story, thus he did not recognize the ghosts of the cats of Minamata when they visited him in his dreams later that evening.

Since the late '50s the cats had held an annual conference at The Hotel Del Coronado to assess the progress—the *evolution*—of environmental policy. Surely, they had thought, the mercurial disaster that had blighted their childhood bird hunting and catnapping grounds would serve as the low-water mark. Surely this event had sunk inescapably deep into human memory.

But they were wrong.

And that was exactly why the cats had invited Medea agent Dr David Everett for tea, scones, and Devonshire cream in the Hotel's notorious room number thirty-three twenty-seven. The cats had charted the development of the atomic age, from its dazzling debut in Hiroshima, through its brilliant teenage years on the sizzling beaches of Bikini Island, and now, on into adulthood, the execution of fantastical feats of engineering at the power plants of Three Mile Island and Chernobyl. Despite its prowess, it was becoming increasingly clear that the atomic age, which had been so cute, bright-eyed and full of promise as a toddler, was a total loser.

The cats had read a recent account of the most catastrophic nuclear accident in Japanese history which had occurred at a uranium processing plant in Tokaimura. As ghosts of Japanese ancestry and victims of environmental blunder, this incident hit them particularly close to home. It wasn't the accident, however, that troubled the cats. Accidents are calculable risks that come with reaping the abundant fruits of atomic power. No, what was troublesome to the cats was *how* the accident occurred: an illegal operations manual had been circulated instructing workers to bypass the factory's elaborate system of stainless steel holding tanks, pipes, and metering devices—and mix uranium solutions in *buckets*. That was when the cats knew that humans were in trouble. They decided it was time to take action, and the decision was reinforced less than a month later when the United States Senate rejected a treaty to ban nuclear testing. Bad decision making was spreading like a red hot pandemic virus.

The cats had a plan. They were plotting a revolution. They had read every manifesto from *Communist* to *Cluetrain*. They had analyzed the bearded bravado of Fidel, the charismatic allure of Che, and the ultimate folly that followed. Cuba had in fact become their revolutionary model of what *not* to do. There may be more impoverished and deprived nations, but none that are the jewel of the Caribbean within thirteen miles of the most wealthy nation on Earth. No, isolation was not the name of the game. Their revolution would be achieved through networking, through the distribution of connectivity itself.

The cats had concluded that the single greatest factor in the success of the American Revolution may have been Thomas Paine. Paine rode from town to town, spreading *Common Sense,* his 1776 self-help book. Yes, *information* was the greatest source of ammunition in the American Revolution. But whereas *The Declaration of Independence* effectively severed the political bands that connected one nation to another, the cats were calling to sever the political bands which have disconnected nations and sprout a common umbilical, linking all nations to the world naval. Their plan, oddly enough, seemed to be a carbon copy of Rand Krisstenson's *Declaration of Inter-dependence*.

But the cats had a problem: they were ghosts. And as ghosts, visible only in the spirit world, they were having a hard time getting anyone to listen to their ideas, much less act upon them. They needed help, human help, and Dr David Everett was the human they were looking for. Ironically, of course *he* was the only soul present with knowledge of the single worst nuclear accident, probably the single worst manmade disaster of any kind. He considered injecting this into the discussion, but decided to sip his tea quietly and wait for a more hospitable occasion—the cats had become a bit riled up, hissing about, swatting one another, and breaking the Limoges china.

Chapter 46

Insurrection

The art of dreaming when wide awake
will be the power of every man one day.

—Henry Miller, *Sexus*

He awoke remembering nothing of his dreams. Dr Everett felt ten times better than he had the night before, he could wiggle his toes and his mind was clear, but he thought he could use a cup of coffee before he made his presence known to the others. He lifted the needle that had been wandering aimlessly in the glossy blank track at the end of the album throughout the night, switched off the phonograph, then padded lynx-like down the hallway.

The galley was a minimalist feat of stainless steel. He slid across the floor in his socks, trying to bring circulation back to his feet. He had not eaten for over twenty-four hours, but oddly enough did not feel the least bit of hunger. He began to brew coffee, but suddenly decided Jell-O water would taste better. Come to think of it, Everett thought, I can't stand coffee. He filled a teapot with hot water and ignited a blue flame gas burner, smelling the gas

that had escaped ignition. And in the sober warmth and fluorescent light of the galley, his thoughts having returned to Rand Krisstenson, Everett was reminded of the depths of his current state of despair. He hung his head and his eyes glazed over and drifted off. His sorrowful gaze deepened into a sort of netherworld trance. He found himself able to feel the building momentum of the waxing gibbous moon that he no longer needed to see to know it was there. This state deepened further yet and in time he caught glimpses of words in books he'd never read, canvases he'd never seen, and notes from music he'd never heard. Indeed, Dr Everett could not comprehend what was happening to him. He stood up, grabbed an iron skillet in one hand and a copper pan in the other, and began pacing—he imagined he was a bull, saber between his ribs, charging a Mexican matador wearing a Pepsi sombrero. He was a rat, razor blades in his eyes, held captive in a cage. He was a cat, twitching in the sand, hissing in the wind. Everett tossed a pot one way and a pan the other then began hurling everything he was strong enough to lift. He had no idea what he was doing but he was mad as hell and feeling suddenly revived all at once.

Then, in the time between the first grumble of the teapot to the time in which the water reached a rumbling boil, he was barraged by synaptic machinegun fire. He sat down on the floor. Some bonding agent, a superglue of the mind perhaps, had become unchained, releasing raging waters of emotion. It was as if enormous hard-drive hungry MPEG files had been downloaded into his brain and had suddenly found the correct decompression algorithm to allow themselves to unfurl and expand. The teapot howled, spitting steam from its spout, and Everett's conscious mind began producing conflicting analysis of the dreams it was processing from the night before. And whatever lightness had left his heart out on the ice, returned 10,000 fold and swept over him like a blast of oxygen to hypoxic organs. He stood and paced circles around the galley. This strange blast of oxygen cooled, mixed with moisture and puffed up like a snowball. The snowball then rolled down a white alpine valley—rolling into a giant snowball of

gratitude at last worthy of embodying his love for Leilani Akua. He recalled sleepless full moons, lying on the roof of the Federal building, staring into the heavens and picturing the way the Harvest Moon looked on the night of that perfect first date. He yearned to sweep Leilani off her feet, bathe her in a golden chalice of champagne kisses, and cherish her in ways reserved for saints and legendary courtesans. Full of fresh air, thirsty for Jell-O, and hungry for life, Everett became aware of a tingling pulse along his spine that radiated out to his fingers and toes. And if it were possible—as Huxley wondered from his perch high upon Blake's shoulders—to bypass the reducing valve known as the human brain, break down the doors of perception, and become aware of all that had once been known but forgotten, it happened at that very moment to Dr Everett. In a flash the continuum of space and time opened and a union, as invisible yet as real as quarks, revealed itself. A tapestry of unlikely persons, events, and circumstances joined hands and sang in concert in the amphitheater of his soul, Marvin Gaye, Rand Krisstenson, Vincent van Gogh, William of Occam, Sir Francis Beaufort, Captain Koenigs, crazed Goliards, dancing kitties, and Victor Ladir—saints, sinners, priests, and parasites alike. Like islands bridged together in an indispensable infrastructure of past, present, and future. And the voices, images, emotions, and melodious songs of the cetaceans floating through his mind broke down into a binomial beauty typically reserved for mathematics and poetics.

Tiny electrical pulses were feeding him newfound connections with life forms of every sort. Birds, bees, grass, trees, Britons, Americans, Africans, Chinese—yes, every single creature on Earth. Strange and beautiful, he felt as if he was everywhere, with everyone. Everett was sweating profusely. He withdrew a Rogaine bottle from his pocket, unscrewed the spray applicator, and dumped the bottle over his head. He sensed something behind him and turned around—it was Stearns.

Stearns looked rather startled. "You okay?" he asked.

"Yeah," Dr Everett said as a little stream of minoxodil ran down his cheek, passed over his upper lip, and found its way into his mouth. His lips were badly cracked, his skin red, raw, and wind burnt.

"We've been lookin' for you."

"I figured," he said, spitting out the unpalatable solution. "Want some Jell-O water?"

Stearns stood there for a moment, looking around at the disaster—the teapot yet howling. "You sure you're okay?"

"Yeah, I'm fine," Everett said, lifting the kettle off the flame, "Lemon okay?"

"Um, sure."

He dumped lemon Jell-O into two coffee mugs, added the boiling water, and stirred without speaking. He handed a mug to Stearns and took a gulp of Jell-O water, burning his tongue. But Everett was calm. He felt fine. In fact he felt enhanced. "You ever hear voices, Stearns?"

Stearns observed him carefully for a moment. "I think I better go find Commander Akua."

"Come on, talk to me for a second, Stearns, I need your help," Everett said, regaining his composure. "There's some strange stuff goin'on down here—and," he hesitated. "And, well—well, I think you know what I'm talking about."

"Like I said, think I better find the Commander," Stearns said, then turned for the door.

"Hold on," Everett said, grabbing Stearns by the shoulder. "Come on, listen to me. Remember when you asked about the music—the music and tears business?"

Stearns reluctantly nodded.

"Well I know what you where thinking—you were thinking there was more to it than Rand was willing to tell."

Stearns watched Everett carefully.

"And—and you were thinking of the time you saw Marvin Gaye at a Motown picnic—and about an NBA All-Star game you saw with little Bobby or little Joey or little someone."

Stearns eyed Everett apprehensively.

"Ah ha! Come on Stearns, talk to me. We don't have time to waste and I need your help."

Concern rested heavy upon Stearns' brow. "Who told you that?"

"And Daniels," Everett said, "we'll need him, too."

Chapter 47

The Straw that Broke the Camel's Back

Security along the jagged pier of ice jutting out into the Ross Sea was lax, practically non-existent, as sailors—all busy, all business—prepped countless canisters of CM-44 for deployment. The maneuver was, for all intents and purposes, a civilian mission. The decision to deploy the creatine had not been publicly announced and thus there was little reason to suppose interference. So it was not surprising, despite their lack of clearance, that Lt Stearns, Dr Everett, and Mr Sean Daniels had little problem coming aboard the *USS Liberty*. Stearns was, afterall, an active officer in the United States Navy and Everett was traveling on a makeshift stretcher, under the auspice of the need of medical care, carried by Stearns and Daniels.

What was surprising, however, was Stearns' use of force to gain entry when access to the inner sanctum of the Admiral's quarters was eventually denied. Stearns drew his Crossman .117 caliber airgun and fired a dart into the sailor's arm, flipped him up over his shoulder, and entered Admiral Cross' stateroom onboard the *Liberty*. Victor Ladir was seated with his back to the door, facing Admiral Cross; he turned his head with shadowy gray eminence. The Admiral, impeccably suited in perfectly pressed uniform, was seated behind a large desk, sorting through a stack of papers when he had heard the door and looked up—shocked, to say the least.

"Don't worry," Stearns said, laying the sailor on a couch and checking his pulse with index and forefinger drawn across his neck, "he'll be fine."

The Admiral stood and casually crossed towards an intercom, but Stearns drew his .45 and politely gestured back towards his desk. He handed Daniels his Crossman .117 and—referring to the door leading back out to the hallway—said, "Shoot anyone who walks through that door."

"Speak up, Stearns," the Admiral snapped as he sat back down, "you're right around the corner from the nearest court-martial."

"Pardon me, Admiral," Everett said as he propped his stretcher against the wall, "but we don't have much time. We need to know about the plutonium."

"I have no idea what you're talking about," Ladir ejaculated.

Everett peered out the porthole and paced the stateroom. The weather had begun to shift yet again. Herbie the extratropical cyclone had dipped to the South, slipped into retrograde and seemed to be returning for an encore. Stearns revisited the couch to check on the sailor. The Admiral appeared to grow uncomfortable in the silence.

"I can't read your mind, Admiral," Everett said, looking back from the porthole, "but we both knew someone who could—so let's hear it, we're short on time and you know what you need to do."

The Admiral turned to Ladir with raised eyebrows, then turned back to reassess Everett. He pushed the papers on his desk aside, and cleared his throat. "Twenty-two days ago, a C-5 transport was scheduled for re-fueling in Honolulu, but she never made it. Air traffic control confirmed her approach, but the descent was aborted and the aircraft passed through Honolulu airspace without further radio contact. If she maintained course we estimate they would have made it six hundred miles or so south by southwest of Hawaii before running out of fuel. She

was carrying eighty-eight steel casks, roughly two metric tons of weapons-grade plutonium." The Admiral paused, ostensibly for a reaction of some kind, but Everett was no longer paying attention. He was paying attention to Victor Ladir.

"The casks were designed to withstand impact," the Admiral added rather wearily, "given this scenario."

"Twenty-two days ago?" Everett asked.

The Admiral nodded.

"And no press release?"

"As you know, that's a complicated issue. We've had a search vessel in the area—"

"*A* search vessel? Just one?"

"Everett," he said, "You're a smart guy, I'm sure you can appreciate the fact that if the wrong folks got their hands on this payload they'd have enough juice for sixty ICBM's. We've got zero margin for intel interception. And we have every reason to believe the cans are intact and will remain so for over a thousand years—"

"Plutonium," Everett stated, "has a half-life of *twenty-four* thousand years."

The Admiral began, "If she went down where we think she did, those cans are stuck in the inert mud of—"

"If."

Everett's gaze returned to Victor Ladir. "Prepare a press release, Victor, you've got five minutes."

Ladir remained silent for several long seconds and then parried, "I fail to see what this has to do with the ungodly crisis we're dealing with at the moment, Doctor Everett. Besides, would you like to start a riot?"

"I was thinking more along the lines of an *evacuation*."

"Is that so? Where are you going to send one point three million Hawaiians? To California?"

"If you know the population of Hawaii," Everett said, "you've been considering an evacuation since day one. Protect yourself Victor."

Ladir seemed confused and began to speak but found himself cut short from whatever it was he was about to say.

Everett began swinging his arms erratically and on several occasions within a short burst of time his hands came into contact with Ladir's head. Everett realized that his thumbs were tucked inside his fists and both were jammed, if not broken, but more to his surprise, Ladir lost consciousness, fell to the ground, and remained there.

"Jesus Christ man!" Daniels howled, looking as if he had just become Dr Everett's biggest fan.

There was a knock at the stateroom door.

Daniels trained the Crossman on the door; nobody else moved a muscle. Stearns made it clear (by means of the barrel to his .45) to the Admiral that he was to say nothing. Another confident knock, then the door opened.

Daniels fired the Crossman—and Commander Leilani Akua stepped through the doorway with a dart in her left shoulder and a perplexed expression on her face. She saw David Everett and a faint smile crossed her lips as she softly spoke his name. Then she fell unconscious on the floor.

"Jesus," Daniels said, scoping out the hallway, "sorry."

Everett grimaced at Daniels as he carefully lifted Leilani into his arms and placed her on the Admiral's bed. He listened for her breath, checked her pulse, planted a light kiss on her cheek. Stearns looked down on the spectacle in disbelief.

Ladir's eyelids, meanwhile, had begun to flutter like the wings of an injured bird, then opened. He pulled himself up, wiped blood from his thin lip, and, expending much effort to make the act of walking appear effortless, crossed towards an empty seat on the couch by the unconscious sailor.

"If I were you I'd hold off on the creatine, Admiral" Everett stated, "but I think you know what you need to do."

Cross stared intently at Everett. "Need I remind you millions of lives are at stake here?"

"They're here," Everett said, referring to the mammals on the water below, "because the entire world is at stake—this is the story of the straw that broke the camel's back." It looked as if Everett was chipping through the Admiral's icy stare. "Like I said, you already know what you need to do." And with that Dr David Everett and Lt Stearns placed Commander Akua on the stretcher and departed with Daniels.

Chapter 48

Commitment at Sea

All actions in war take place in an atmosphere of uncertainty—*the fog of war*. Uncertainty pervades battle in the form of unknowns about the enemy, about the environment, and even about the friendly situation… [All] actions in war will be based on incomplete, inaccurate, or even contradictory information.

—General A.M. Gray, *Warfighting*

Some say gray whales are the friendliest whales on Earth and this may be true. Pacific coast whale-watchers from Alaska to Baja California report that grays commonly venture up to rub against the hulls of their vessels and that they are the only whale species—one of the only cetaceans—that consistently seek out human contact.

The *USS Liberty,* drawing an additional meter due to her massive payload of CM-44, labored in the heavy seas, making her way through the vast congregation of marine mammals. On deck, sailors cloaked in yellow polar immersion suits battled the elements and stormy seas.

The distant rumbles emanating from the depths of the polar ice may not have been enough to account for the fear in their eyes but there were several hands on deck who seemed a bit unnerved by the sizable pod of grays that had begun rubbing themselves against the *Liberty's* hull.

Admiral Cross stood on the bridge watching the crew deploy CM-44.

Bursts of fire from M-16's riddled the midsections of 16-gauge steel canisters as sailors braced themselves in the wind, standing by to heave the pierced barrels into the tumultuous sea. The method was crude, but a mass quantity rapid deployment mode for CM-44 had never been properly devised. The *USS Liberty* made way, beginning her eleven-hour distribution cruise along the base of the Ross Ice Shelf.

The rust-orange compound permeated the heaving sea. Gale winds took another five-knot turn for the worse and visibility dwindled to not much more than a nose. Cross lowered his binoculars, squinted intently, then lifted them back to his face. Had his eyes betrayed him? In a small window of brief visibility, had he spotted an incredulous feat? Had a whale surfaced and ingested *a half-dozen barrels* full of the seeping chemical compound? The Admiral stared intently into the eye of the storm, but saw only air-borne water and ice. He inquired whether any of the officers on the bridge had witnessed anything amiss. They had not. But even as they were responding, the skies opened for another brief interval and all hands witnessed something they would never forget. There, just off starboard, a fair-sized whale surfaced and swallowed several whole barrels of CM-44. The Admiral fell silent for several moments before turning to his aide and commanding him to initiate a communiqué to the Secretary of Defense.

***

The anemometer mounted over the bridge indicated that at 64 knots the resurrected winds officially qualified the rebuilding horror as a full-blown hurricane—a Beaufort wind force 12. The *USS Liberty* was under siege. The swelling, heaping seas dashed against the bergs, leaping up their icy cliffs, and broke over large sections of sea ice, spitting mounds of froth and foam. Cross barked out coordinates, positioning the *Liberty* in the lee of a mile long rampart berg shouldering the seas like a fortified island nation.

Crisp, calm, dexterous movements on the bridge had become stressed and erratic as incoming and outgoing communications failed repeatedly. SATHICOM, HF, VHF, and UHF all faltered alike. Helplessness was in the air—highly contagious helplessness.

"I don't give a rat's ass how many lines are down!" Cross shouted. "Get me the Secretary of Defense means get me the goddam Secretary of Defense!" But his demand remained unmet as efforts to establish satellite communications failed.

Much to every sailor's surprise, the Admiral had assumed direct control of the *Liberty,* countermanding a worthy and conflict-proven captain's command—an act contrary to every Naval custom. And then, the Admiral halted CM-44 deployment after less than a quarter of the chemical payload had been dropped. The tactical analysis behind the decision resided with the Admiral alone. His aide stood by, acutely aware of every tick of the clock on the wall behind and every beat of the heart within his chest. Their scheduled time of departure, the hour carefully calculated and determined to be the latest to allow a safe passage to northern waters, had come and gone several hours ago.

The Naval Academy, Persian Gulf, and two decades of command at sea had prepared Admiral Cross to handle most situations with equal equanimity. Except for one like this. He crossed to the window and watched ice streams flow like rivers—blocks of all shapes and sizes avalanched from the shelf into the sea. In the six hundredth year of Noah's life, as written in the seventh book of Genesis, all the fountains of the great abyss burst forth and the floodgates of the

sky were opened. The Admiral looked out over the Ross Sea at weather that had reached Genesis seven proportions. Ominous cumulus clouds shot hellfire lightning and wind whipped water off the Ross Sea like horizontal rain.

"Admiral," the ship's Executive Officer said, "it's time to get underway." He immediately looked stunned as he heard the words come out of his mouth.

The Admiral's glare made it clear to the sailor that he had crossed the line that would not be crossed again. "I'll say when it's time to get underway, Mr. Hardesly."

Another aide approached and handed the Admiral a radio handset, "I have the Secretary, sir."

The Admiral accepted the handset and spoke calmly into the mouthpiece, "Given the current circumstances I know this is an unusual request, Mister Secretary, but I need to hold a press conference immediately."

Chapter 49

Surrender

There was no more empirical evidence to collect, nothing left to observe, no measurements to take. All that remained was to theorize what catalyst or harmonic series of events were responsible for the accumulation and then sudden dispersion of the mass marine mammal congregation that had assembled in the Southern Seas. The tempest, as all tempests do, had come to an end—but more abruptly than most. Herbie the remarkable extratropical cyclone had spun off to the north and dissolved into the Pacific like powdered sugar. Moreover, the complex assemblage of marine mammals had dissipated along with the storm. Although certainly more questions than answers remained, the marine mammals' departure had done much to reconfirm that their presence had been responsible for the accelerated rate of glacial flow. By what means? Time may or may not tell. As Dr David Everett had demonstrated to his colleagues on several occasions, single processors, including the great processors known as human minds, are incapable of mapping the capabilities of larger processors.

For over the past seventy-two hours the median rate of Antarctic ablation had receded to normal levels. Of course whatever damage had already been done was done—and indeed, the damage was significant—but German satellite images confirmed that the Ross Ice Shelf was yet

entrenched between the Ross and Filchner shelves. Current data suggested the West Antarctic Ice Sheet had stabilized and the crisis in Antarctica had subsided.

Admiral Nathaniel Cross announced his resignation during a live press conference in which he admitted his awareness of an accident involving the loss of roughly two metric tons of weapons-grade plutonium. The press conference was broadcast from the bridge of the *Liberty,* just hours before the storm subsided, and the announcement ignited a chain reaction of finger pointing and scapegoating at every level of the US government, including the presidency. The Admiral, however, pledged to deploy every ship and resource at his disposal to locate the wreckage before leaving office. There are those who believed Admiral Cross simply cracked under pressure and lost his nerve, or that his exposé was purely démarche. And there are those, including Dr David Everett and his close associates, who believe otherwise.

Chapter 50

Mare Tranquillitatis

The real voyage of discovery consists not in
seeking new landscapes, but in having new eyes.

—Marcel Proust, *À la Recherche du temps perdu*

When you see the Southern Cross for the first time, so the song goes, you understand why you came this way—and indeed, the five stars that form the crux lay low on the horizon. A soft easterly breeze prevailed and the warm sea air was thick with mist and quiet revelations known only to the heart and lost civilizations.

Stars and bars flying at half-mast in honor of Commander Rand Krisstenson, *Prometheus* held port in Rio de Janeiro to refuel and take on stores for the return passage to the United States. Dr David Everett had elected, against medical advice, to embark on the twelve-day homeward cruise in lieu of the dispatched MEDIVAC flight. And presently he and Commander Leilani Akua putted off in a small Zodiac from *Prometheus*' mooring in the vesper hour of twilight on Guanabara Bay. It was good to be back in the land of the setting sun.

David steadied a white plastic bucket of ice in the bow, Leilani held the tiller in the stern, and the magnificent Cristo Redemtor stood illuminated high above upon Mount Corcovado, peering down on the city and the sea with open arms. They motored leisurely down the coast, past the white sands, murmuring sambas, and innumerable shadows of Copacabana and Ipanema—thousands, hundreds of thousands, perhaps even a million or more people filled the five mile long strand, dancing to distant music, and tossing flowered offerings to Yemanja into the sea. The waters of the bay gently rose and fell with countless bouquets and their petals brushed the Zodiac as David and Leilani passed beyond the din of the crowds and the reach of the gleaming twirl from the lighthouse on Ilha Rasa. In the halcyon waters off Ilha Paquetá, not far from the bay, Leilani silenced the outboard and dropped a modest anchor as David dug through the bucket of ice and uncovered a bottle of champagne. He popped the cork out into the sea.

They reclined in the Zodiac's bow like a pair of kingfishers, plastic cups in hand, and whispered from unspoken places in the heart—it seems there was much they had both been meaning to say. The spoke of love, they spoke of loss, they spoke of the sea, and the unfathomable mysteries therein. The spoke of dreams both simple and grand, and, yes, they spoke of Eddie, too.

In time they fell silent and rocked gently on the sea.

Nighttime blossomed in all her soothing beauty and a million distant suns sprinkled diamond light from above. David gazed up at the fleeting quarter moon as she spiraled away from the Earth at the imperceptible rate of one and a half inches per year. This fact was ordinarily a source of considerable anxiety for Doctor David Everett, but times had changed and so had he. And as he reached down to retrieve the bottle to refill their cups, a brilliant pinwheel cascade erupted from the Forte de Copacabana and the skies streamed with fantastic color and light and percussion. Yes indeed, it was New Year's Eve. And as David sipped champagne in

the bow with Leilani, watching fireworks, and moonshine dance upon the water, there was no doubt in his mind that the universe was unfolding as it should.

Coda

Now, as I understand it, convergence means
that society today is no longer pretending that there
is any real difference between things like art and nature,
science and religion, between the poetry a man makes
out of words and the poetry God makes out of time and space,
between the fight one man may fight for dignity in a ring and
the fight a whole race of people may fight for dignity on Earth.

—Muhammad Ali

In *Biophilia*—arguably one of the most important pieces of twentieth century nonfiction, E.O. Wilson suggests that every man, woman, child, dolphin, grain of wheat, humming-bird, turtle, flower, and treefrog is bound in an indispensable and inexplicable tapestry, woven from the celestial loom of a Mysterious Weaver. The ultimate design is unknowable. Which—if any—golden strands of thread can be snipped without unraveling this luxurious fabric of existence? Dependency of this sort—*interdependence*—is therefore by nature incalculable, forever unknowable, and thus of unquantifiable worth. The omission (extinction) of any *one* of these

wildly diverse and seemingly unrelated links could be enough to yield devastating results, consequences beyond prediction or comprehension. Who knows what small plant nestled in the undergrowth of a distant African savanna, or what fungi dusting the leaves of a Brazilian rainforest treetop canopy hold the antidote to a coming plague?

And who knows what creature holds the key to unlock the mysteries of your own soul, the words to your dragonfly song?

This level of protection—effectively granting rights to all living things—may sound extreme, but there was a time when the idea of granting rights to women seemed extreme to some, and there was a time when the idea of granting rights to African-Americans seemed extreme to others.

In 1900 there were 100,000 tigers living in the wild, mostly along the Siberian border with China. Today there are less than 5,000. Our children's children will never see a tiger in the wild. The great cat's fate is inevitable—the domino is falling and the angle of incident is past the point of no return—this fierce hunter will pass silently into extinction. What other dominos will fall with the tiger?

Daisaku Ikeda was convinced that a great revolution of character in just a single man or woman could help achieve a change in the destiny of a nation and further, would cause a change in the destiny of all mankind. Perhaps this is true. Perhaps this was the case with David Everett.

And perhaps this holds true for you.

MF

A Note on Notes on Type

A note on the typeface at a novel's conclusion is a corny tradition at best. One of the corniest examples reads: *This book was set in Fairfield… In its structure Fairfield displays the sober and sane qualities of the master craftsman whose talent has long been dedicated to clarity. It is this trait that accounts for the trim grace and vigor, the spirited design and sensitive balance…* Sane qualities? Spirited design? And that was just an *excerpt*.

Anyway, so what about *this* book's typeface?

Before I explain, don't get me wrong, I'm no anarchist—I seek the comforts of tradition and take shelter in ritual. But a novel's greatest qualities are often those elements which differ and set it aside from other works, making it, well, *novel*.

Thus this book was set in *Perpetua*. When I began the search for an appropriate typeface, the most critical quality was that its creator—the typographer who designed and cut the font—be a current resident of heaven. Eric Gill was the second of thirteen children, born in Brighton, England, in 1882. He was Roman Catholic. Now we all know how tough it can be for a Catholic to get to heaven. And to make things worse, Mr Gill was an insurrectionist with a penchant for femmes fatales.

But he loved expression, had a great sense of humor, and worshipped natural beauty. So I figure he's up there.

And it is my hope that Mr Gill will notice his work from high above—*Perpetua's* clean, chiseled letters, especially the letters that I have grouped into words and sentences here at the very end. Eric, I have a favor to ask. Please take a look around heaven, find Angie, and tell her that I have written a story with dolphins just for her.

A Search for a Measure of the Quality of Life on Prince Edward Island: An Inter-Provincial 'Cost of Living' Inquiry

Baldacchino, Godfrey and Funk, Matt
Provincial Government of Prince Edward Island

12. March 2008

A Search for a Measure of the Quality of Life on Prince Edward Island

by

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&

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for

Dr Michael Mayne, Deputy Minister
Department of Innovation and Advanced Learning
Provincial Government of Prince Edward Island
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31 July 2008

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A Search for a Measure of the Quality of Life on Prince Edward Island

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Department of Innovation and Advanced Learning
Provincial Government of Prince Edward Island
Charlottetown, Canada

Subject: *A Search for a Measure of the Quality of Life on Prince Edward Island:*
An Inter-Provincial 'Cost of Living' Inquiry

Dear Dr Mayne:

Thank you for this opportunity to investigate the relative cost of living and quality of life on Prince Edward Island (PEI). We appreciate the latitude which we were offered to explore this complex issue, enjoyed the challenge of conducting our research, and we are pleased to present our findings herewith in this report. We also went somewhat beyond our brief to present some interesting insights that apply specifically to Charlottetown.

As co-authors of this study, we probably offer a unique perspective on island life. This is perhaps especially true of PEI, an island with which we each hold personal, vested interests, and, moreover, an island offering relatively discernable assets, liabilities, and value propositions. There are several facets of PEI's value proposition, however, over which we often disagree: where Baldacchino may find assets and opportunities, Funk more often than not finds problems and liabilities; this source of constructive disagreement has proven to be especially fruitful in this study, however, as it has in other discourses. Our often opposing positions have helped us craft what we suggest is an even-keeled analysis. We will discuss the layout of this document after making a statement of our case.

Our investigation into the economic value proposition and the search for a meaningful measurement for the quality of life on PEI is divided into five primary sections: Following an Overview in Section I, each of the following three sections critically investigates and discusses a particular measurement methodology. Section II offers a brief consideration of the most elementary measurement, which we appreciate for its simplicity, but question its ultimate utility. Section III delivers the heart of our project, a descriptive picture of the relative costs-of-living across Canada. Section IV briefly addresses a few limitations to the analysis in Section III, especially as they relate to issues of sustainable development on/for PEI. Section V proposes a different area of inquiry in relation to the provincial capital, Charlottetown. We also consider and suggest a strategy for further investigations.

I: OVERVIEW - Competing and Contradictory Noises

We often encounter anecdotal assertions from a wide-variety of individuals who claim that the one thing they love most about PEI is the relatively low cost of living.

A UPEI economics professor commented in an Op-Ed piece in *The Guardian*, during the 2006 UPEI faculty strike, urging fellow professors to accept lower wages *because the cost of living of PEI is so low*.

When Dr Albert Adegbembo, Senior Dental Health Consultant on PEI, was interviewed about his move to PEI in 2007, he argued: "[Y]our money goes further here. Car insurance and housing are considerably cheaper." (Riley, 2008).

The entry on a local real estate agent's website, posted by islander J.P. Robison on January 6, 2008, states:

> According to the Canadian Real Estate Association (CREA), the average price of a home on Prince Edward Island in 2006 was $125,430. In 2007, the average price rose to $132,400. … CREA anticipates the average price of homes on Prince Edward Island to rise by 5.1% to 139,200 next year. When you consider the national average cost of a residential home is expected to reach $322,700 in 2008, *one has to appreciate the relatively low cost of living on this beautiful island*.[1]

When prospective employees of Charlottetown's Trapeze Animation studio review their website[2], they discover that "the cost of living [on PEI] is 30% less than in Ontario."

Yet, the assumption that the cost of living on PEI is low is not held universally. We report verbatim from a study that one of us undertook amongst recent settlers to PEI (Baldacchino, 2006a). This particular set of 320 respondents may be trusted to have made some calculations as to whether to choose to come to, and stay on, PEI. Many of these respondents claim that wages on PEI are generally lower than (most of) the rest of the country; while the cost of living and taxes (sales, corporate *and* income) are arguably higher. Provincial taxes on income in the province are almost twice as much as they are in Ontario. Mortgage arrears in Atlantic Canada, at 0.39% of total portfolio, are also the highest in the country (CIBC Household Credit Analysis, 2008). However, most respondents agree that housing, property and/or real estate are generally more affordable on PEI than elsewhere in Canada:

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1 http://www.century21.ca/jp.robison/Blog/The_average_price_for_a_home_on_PEI . Italics are ours.

2 http://animation.trapeze.com/studio/about-charlottetown/.

There is a misconception about the cost of living. While it is true that to buy a home is cheaper than in other provinces, to maintain that home is very expensive. Heating and electricity costs are outrageous, and often double a mortgage payment during the winter months. In addition, the high cost of fuel combined with the limited public transportation make it very difficult for someone new to PEI to get around, find a job they can get to and afford to begin a life here. (Respondent #049).

High Taxes, poor wages compared to other provinces. (Respondent #119).

Low salary with rather high cost of living. High tax rate. (Respondent #131).

I would say the main problem is the lack of decent paying jobs. Anyone with any education can easily go to Ontario, BC, Alberta, etc. and find jobs that pay much more for basically the same work. Also the idea that PEI has a lower cost of living is pretty much an untruth. The fact is that the only thing cheaper on PEI is real estate. Food, electricity, heating, rent, insurance are all the same or more expensive than BC for instance and real estate is not far behind these days. People will generally go where the money and jobs are and that is unfortunately not PEI. (Respondent #135).

A house may be cheap, but the cost of living is high, especially if you make only minimum wage. (Respondent #138).

There is a high tax level (after living in Alberta). (Respondent #148).

Every time I would have a job interview, I would always hear the comment that the cost of living down here is less than Ontario. I know for a fact that this is not true. The only things down here that are less expensive are car insurance and if you want to purchase a house. But the later has also changed in the last few years. The cost of real estate keeps going up. The cost of everything else is either equal or greater than the price in Ontario. (Respondent #150).

Combating the erroneous perceptions of the tax situation in Canada would be a good first step. Canada's taxes support a fair and accessible health care system for all its population, provide a social system that seeks to assure that everyone has at least a minimum level of resources with which to live, etc. The true "value" of the taxes we pay should be a drumbeat in marketing PEI (and Canada generally) to immigrants of other industrialized nations. The affordability of land and housing

on PEI, in comparison with other similar scenic retirement areas, is a sort of an open secret. Waterfront locations in the Eastern U.S., for example, are multiples more expensive. (Respondent #156).

The much-touted "lower cost of living" is dulled by much higher taxes in many cases. The slightly lower cost of living doesn't come close to making up for the dramatically lower pay rates. (Respondent #165).

Everything is more expensive here. (Respondent #181).

The taxes, such as PST tax on top of GST tax is ridiculous plus an outrageous provincial tax of 10%. Provincial income tax is higher here than the rest of Canada. (Respondent #184).

Pay scales are lower and expenses are higher. (Respondent #187).

Even when one considers the relative affordability of housing, pay rates are poor when compared to other Canadian centres. (Respondent #241).

Bien que certaines choses sont moins chères à l'Île (les loyers entre autres), d'autres sont tout aussi dispendieuses qu'à Montréal (épicerie, restaurants, essence, etc) et donc ça a fait très mal au compte de banque. (Respondent #311).

Le niveau de taxation est très élevé à l'Î.-P.-É. … un taux de taxation (impôts) 2 fois plus élevé qu'en Ontario (environ 33% du taux fédéral en Ontario et environ 65% à l'Île). Thus, if your federal income tax bill is $5,000, then your Provincial (PEI) Income Tax would be about $3,250 (65% of $5,000). In Ontario, the provincial portion would be about $1,600 (33% of $5,000). (Respondent #319).

We regularly encounter individuals who despair that the cost of living on PEI is extremely high − and often members from these divided high-cost/low-cost camps list the same factors for their conclusions! Of course they cannot both be right⋯ *Or can they?* In short, although they cannot both be right at the same time, given the same *calculation,* there are differing formulations from which each may be right and the other, wrong. Thus, the root of discrepancy can often be located in the premise that different people − especially people from significantly differentiated demographic or income groups − value (and thus calculate) 'cost of living' using different elements.

Three straight-forward findings in Section III below indicate that **the cost of living on**

PEI – in comparison to the costs of living in the other Canadian provinces – **is the highest by one measure, the second-highest by another, and the third-highest in accordance with our most detailed, long-term measurement.** We also suggest that, given PEI's relatively low-level of insularity, dependence on global markets and trade as well as fossil fuels, will continue to drive the costs of living on PEI higher[3].

II: CONSUMER PRICE INDEX

If one asks people at large about their conception of the cost-of-living, experience suggests that most will begin to describe and detail costs which more or less correlate to the Consumer Price Index (CPI): CPI figures for June 2008 and for comparable months are provided below (Table 1)[4]. **The CPI for PEI is currently higher than for every other province in Canada, with the exception of Alberta**.

	June 2008	May 2008	June 2007	May to June 2008	June 2007 to June 2008
NL	115.4	114.5	111.9	0.8	3.1
PE	**119.5**	**118.9**	**114.1**	**0.5**	**4.7**
NS	117.8	117.1	113.0	0.6	4.2
NB	114.5	113.9	112.1	0.5	2.1
QC	114.1	113.6	110.7	0.4	3.1
ON	114.2	113.6	111.1	0.5	2.8
MB	114.4	113.5	111.7	0.8	2.4
SK	117.0	116.2	113.1	0.7	3.4
AB	124.0	122.2	118.8	1.5	4.4
BC	113.6	112.8	110.3	0.7	3.0
Whitehorse	114.6	113.6	109.7	0.9	4.5
Yellowknife	116.6	115.7	111.6	0.8	4.5
Iqaluit	110.5	109.8	108.0	0.6	2.3

[3] For example, the value of exports of goods and services from PEI increased by 17% (by $335million) over 2000-2007; while the value of imports of goods and services increased by 29% (by $759million) both in annualized dollars. *Source*: Statistics Canada Table 384-0002- CANSIM Database. *Also:* PEI Annual Statistical Review, 2007, p. 62.

[4] Table 1: Consumer Price Index by Province, and for Whitehorse, Yellowknife & Iqaluit (2002=100). Source: Statistics Canada Release. http://www.statcan.ca/Daily/English/080723/d080723a.htm

Highlights of a recent (May 2008) CPI report identify some of the forces behind this situation (emphasis ours):

> Consumer prices rose 2.2% in May 2008, compared with May 2007, up from the 1.7% increase reported in April, as drivers faced significant increases in gasoline prices. ⋯. Prices for fuel oil and other fuels, which are products derived from crude oil, rose 49.3% in May compared with May 2007: the fastest increase since March 2003. ⋯ Several components put downward pressure on the rate of growth in consumer prices. For example, the price to purchase and lease vehicles declined 8.1% between May 2007 and May 2008. ⋯ **Consumers in Prince Edward Island faced the fastest increase in prices** [by province, in Canada] between May 2007 and May 2008. Prices rose 4.1% in the province during that period, a sharp increase from the 12-month change of 2.6% posted in April. Rising energy prices contributed substantially to the 1.5 percentage-point acceleration in Prince Edward Island. This growth was due mainly to upward pressure from fuel oil, gasoline and electricity prices.

And again, in the CPI report of June 2008:

> Among the provinces, **Prince Edward Island (+4.7%)** and Alberta (+4.4%) experienced the **most substantial increases** in consumer prices, driven mainly by upward pressure from energy components.

Indeed, for May 2008, the consumer price index of 118.9 on Prince Edward Island is overtaken only by Alberta with an index of 122.2. As few would be surprised to note, based upon the methodology deployed in Section III, the cost of living in Alberta is actually the second *lowest* (to British Columbia) in Canada.

Statistics Canada (1996) suggests that the CPI is rather tightly correlated with the cost-of-living, encouraging us to "think of the CPI as a measure of the percentage change over time in the average cost of a large basket of goods and services," and that "consumers can compare movements in the CPI to changes in their personal income to monitor and evaluate changes in their financial situation".

Yet, are such assertions true? The problem is that *other variables*, such as the ability to *pay* for that basket of goods, are *also* changing and *also* vary considerably from province to province. Moreover, as we begin to peel back the layers of this considerable onion, there are other, more significant, variables involved, some of which are extraordinarily difficult to quantify.

True, the CPI may prove somewhat useful for certain, limited demographics – such as retirees and others on fixed incomes (including lottery winners). But for the *Average Canadian Household* (hereafter ACH), as we will see, the CPI offers limited utility. True, the CPI offers a piece of useful data; but this is only the tip of an enigmatic iceberg.

First, one needs to review what happens when economic growth, employment growth, unemployment rates, personal income growth, retail sales, and housing starts are contemplated in light of the CPI. The *RBC Economics Provincial Outlook* analyzes all these inputs, and had this to say recently about the economic health of the province:

> Prince Edward Island's economic growth is forecast to slow to the low-to-mid one per cent range for 2008 and 1.6 per cent in 2009, as stiff economic headwinds blow on key industrial sectors, including tourism, according to the latest provincial forecast released today by RBC.
>
> The 100th anniversary celebrations of the publication of 'Anne of Green Gables' are facing some tough challenges from the strong Canadian dollar, record-high gasoline prices and a weak U.S. economy," said Craig Wright, senior vice-president and chief economist, RBC. "These factors threaten to pour cold water on the economic impact of the event and, more generally, the province's all-important tourism sector.
>
> With only Canadian travellers sustaining growth in visits to the Island recently, the sharp rise in gasoline prices since the spring might well keep even domestic visitors closer to home this year. Nevertheless, the province's economy should continue to benefit from work on infrastructure projects, as well as steady growth in employment (RBC News, 2008).

And so, although we have begun to paint a more detailed picture of the economic landscape, the *RBC Economics Provincial Outlook* is better suited to inform the business community, rather than the ACH.

III. COST OF LIVING

As noted in our proposal, we assess mean levels of Canadian household financial health by province for 2008. Comparative provincial financial health reports are being generated on the basis of 2008 estimated household average (1) disposable income; (2) expenditures; (3) liquid assets; (4) liabilities; and (5) home equity.

The most useful analysis for the ACH may be discovered, and further derived, primarily, from the extraordinarily detailed, valuable, and relevant Revenue Canada, Pitney Bowes MapInfo, Strategic Projections, Inc., and Statistics Canada data collated and published annually by the *Financial Post* (FP). Although these annual projections span several decades, a recent methodological change offers 2006, 2007, and 2008 projections as the most ideal candidates for year-to-year comparative analysis (FP, 2008, p. 5). A careful mining and sifting through FP's tremendous data-set reveals a valuable, singular measure of provincial costs-of-living: *Discretionary Income*. The 2008 discretionary income (hereafter DI) year-end projections are the following:

PE: $13,778.00	NS: $14,442.00	NB: $14,481.00	NL: $13,563.00
ON: $20,066.00	MB: $16,754.00	SK: $17,481.00	AB: $19,249.00
	BC: $17,090.00	QC: $14,306.00	

Indeed, we are beginning to paint a more comprehensive portrait of the quality of life for the ACH. Given DI alone, the ACH may infer that the costs of living on PEI are the second highest in Canada by province, with costs being higher only in the province of Newfoundland and Labrador (NL). But, referring back to the CPI figures for 2007 and 2008 in Section II, one may recall that PEI's discretionary dollars do not buy nearly as much as equivalent discretionary dollars in NL. Thus, the ACH may validly conclude that **the costs of living on PEI are higher than in any other province in Canada**.

We also note that there is one other, singular and valuable benchmark for the ACH: *Provincial arrears rates*. One could certainly argue that these rates are even more reliable and demonstrative than DI, since this measure reflects the number of ACHs unable to meet debt obligations in each province. However, since federal transfer payments often distort this number to the point of meaninglessness (so, for example, if PEI farmers are given federal aid, the arrears rate lowers) we prefer DI. It is worth noting, however, that even though PEI receives over 30% of its income through federal aid, *both* its cost of living *and*, in general, arrears rates (such as credit cards, mortgages, car payments) remained the highest in the country (CIBC, 2008).

Returning to the validity and usefulness of DI, however, we find it to be a widely representative and a pertinent tool for our analysis. Yet, in our quest to derive an even more robust figure, we expanded our search. FP also offers annual provincial household figures for total liquid assets and total liabilities, which help to smoothen and eliminate

annual aberrations (outliers) by bringing a long-term orientation to the equation (that is, atypically, annual DI values will not radically impact ACH balance sheet positions since the latter are the results of decades of economic performance, and not of any single or even several years). But there is one balance sheet entry, one other crucial piece of data, that FP has not published consistently: this is data pertaining to fluctuations in *average residential home values*. As the most significant investment the ACH makes, this data represented an essential input we brought in to conduct our third and final valuation in this section, and which may represent the most detailed, most representative portrait of provincial household financial health. Adding home appreciation to liquid net worth (LNW) gives us *total net worth* (TNW).

This, our third, and final valuation, brings PEI up two places from last to 8th (of the 10 provinces analyzed). See Table 2 (.xls spreadsheet on page 12).

Meanwhile, our optimism, for all its worth, remains tempered. As we noted from the CPI figures and analysis in Section I, rapidly rising fuel costs are taking their toll on the ACH on PEI. Relatively speaking, over the following years, and all things being equal, we anticipate that this problem will continue to affect PEI households more severely than households in other provinces, as **PEI remains one of the very few provinces without municipal natural gas pipelines**, and the only province that does not have this municipal service on the near horizon. While some laudable initiatives and investments in alternative energy (such as wind) have been made, the dependence of the province on fossil fuels remains alarmingly significant.

Table 2 - Provincial Financial Health for the Average Canadian Household (2008) [1]

	(1) Discretionary Income[2]	(2) Liquid Assets [3]	(3) Liabilities	(LNW) = (1) + (2) - (3) Liquid Net Worth	Ranking
P E I	13778	112704	57808	**68674**	**8**
NL	13563	76830	49445	**40948**	**10**
NS	14442	131646	66831	**79257**	**7**
NB	14481	100356	51025	**63812**	**9**
QC	14306	139424	58388	**95342**	**6**
AB	19249	193881	97799	**115331**	**5**
BC	17090	217711	112655	**122146**	**4**
SK	17481	177081	52677	**141885**	**2**
MB	16754	175599	56769	**135584**	**3**
ON	20066	243465	96576	**166955**	**1**

	(5) 2007 Home Value [4]	(6) Est. 2008 Value	(7) = (6) - (5) Home Appreciation	(8) = (LNW) + (7) Financial Health	(6) Home Value	(TNW) = (6) + (8) Total Net Worth	Ranking
P E I	132400	139200	6800	**75474**	139200	**214674**	**8**
NL	144444	149900	5456	**46404**	149900	**196304**	**10**
NS	184800	198600	13800	**93057**	198600	**291657**	**7**
NB	136300	142100	5800	**69612**	142100	**211712**	**9**
QC	207100	219700	12600	**107942**	219700	**327642**	**4**
AB	355600	379000	23400	**138731**	379000	**517731**	**2**
BC	429700	454200	24500	**146646**	454200	**600846**	**1**
SK	155000	163600	8600	**150485**	163600	**314085**	**6**
MB	167100	180000	12900	**148484**	180000	**328484**	**5**
ON	302300	316700	14400	**181355**	316700	**498055**	**3**

[1] *All household economic data based on FP Markets 2008 and Canadian Demographics data.*

[2] *Household Income left after federal and provincial taxes, statutory deductions and necessities as part of the Discretionary Income Product*

[3] *Interest bearing Investments per Household, plus Equity Investments per Household*

[4] *Real estate valuations based on current Canadian Real Estate Ass'n, MLS residential data & 2008 year-end forecasts*

IV. QUALITY OF LIFE?

Although we have produced a portrait of the contemporary financial health of the ACH, does it in fact reflect, or even faintly resemble, the ACH's *quality of life?*

What about the 'costs' of crime? What about the benefits derived from higher instances of "other-regarding" behaviours and quiet island life? Is it possible to place a value on the sounds of songbirds or the psychological costs associated with the noise pollution produced by rush-hour traffic? Police sirens? Gunshots? What about homicides? The psychological costs associated with a seamless visual stream of billboards, neon lights, and ubiquitous flat-screen televisions which beg for conspicuous consumption? How valuable is the water table? Water quality? Could we derive a measure for the costs associated with a probability function of contracting gastro-intestinal cancer from a tainted water source? The costs and negative externalities − especially as they pertain to an island like PEI − associated with motor vehicle fatalities? What about air quality? Are there costs associated with federal transfer payment dependence?[5] Is it possible that the negative costs associated with receiving these transfer payments could actually outweigh the benefits?[6] Are their benefits to relative sustenance independence? Are there economic and biological benefits associated with relative insularity (Funk, 2008)?

There is also an economic dimension to policy governance and democratic practice on the Island. Simpson (2007) argues that three components account for the 'costs' of running PEI:

> The first is the omnipresence of government – a condition that can't be avoided given the size of the jurisdiction and its constitutional obligations. The second is reliance on substantial financial transfers from the federal government to operate. The third is the ratio of short-term, seasonal and part-time employment to year-round employment and the overall low wage structure…

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[5] The motto of Prince Edward Island - *Parva sub ingenti,* "the small under the protection of the great" - is a bitterly paradoxical expression of the Island's status as a 'have not' province still dependent on others for survival, first as a colony under British rule and then as a somewhat reluctant new province of Canada. "The goal of greater self-sufficiency and self-reliance [for PEI] remains as elusive as ever" (Baldacchino *et al.* 1998, p 175).

[6] The perverse effects attributed to the welfare state can be interpreted from a strictly behavioural perspective. If people overestimate the magnitude of immediate benefits relative to more distant ones, they will tend to under-invest. Making their present more liveable with cash gifts amplifies this tendency. (Beaulier & Caplan, 2007, p. 487).

Various analytical tools and methodologies, such as the Human Development Index[7], Mercer's *Quality of Life Surveys*[8] *and* The Economist Magazine *World's Most Liveable Cities* List[9], address some of these complex factors to varying degrees. A problem with these rankings is that Charlottetown is too small population-wise to feature on any.

Moreover, different individuals do privilege aspects of their quality of life differently along the course of their life cycle. And what does the term 'Quality of Life' mean? A recent 2007 study of residents in Tyne Valley, PEI, found that 20-39-year olds assign top priority to "friends and family" (26.6%) followed by "community" (17.0%) and "safety" (11.7%); whereas those aged 60 years and over in the same locality placed "community" first (28.8%); followed by "friends and family" (16.6%) and then "access to services" (12.1%) (Quality of Island Life Coop, 2007). These are nevertheless some of the key indicators of what 'quality of life' may mean to different age cohorts of Islanders.

Context analysis is one technique that can be used to sift through large amounts of textual data, and systematically identify key properties such as the frequency of keywords most used. One such exercise deployed in relation to the 2006 study of 320 recent immigrants to PEI (Baldacchino, 2007, p. 7), reveals that the most commonly used words by recent immigrants in describing the positive 'selling points', or pull factors, to PEI tend to gravitate around **family, children, people and community**; with some appreciation for the **affordability of housing and property.** In this respect, and comparing these results with those from the Tyne Valley indicative study, the suggestion is that the immigrants' broad interpretation of 'quality of life' tends to somewhat match that held by Islanders.

Finally, would it be prudent or even plausible to attempt to evaluate "happiness"? Happiness is generally considered an ultimate goal of life. The United States Declaration of Independence of 1776 takes it as a self-evident truth that the "pursuit of happiness" is an "unalienable right", comparable to life and liberty. It follows that economics is - or should be - about individual happiness; in particular, how economic

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[7] The Human Development Index – is a composite index that measures a country's average achievements in health (measured by life expectancy at birth), knowledge (measured by a combination of the adult literacy rate and combined primary, secondary, and tertiary gross enrolment ratio); and standard of living (measured by GDP per capita at PPP US$) (UNDP, 2008).

[8] According to Mercer's 2008 *Quality of Living Survey*. Zurich retains its 2007 title as the highest ranked city. Vancouver is No. 4. Other highly ranked Canadian cities are: Toronto (15th) Ottawa (19th) and Montreal (22nd). The survey also identified cities with high personal safety ranking. Calgary, Montreal, Ottawa, Toronto and Vancouver are ranked jointly at No. 22 (City Mayors Environment, 2008).

[9] On this list, Vancouver is on top in 2008, with Toronto in 5th place and Calgary in 7th.

growth, unemployment and inflation, and institutional factors such as governance affect individual well-being. The complex and elusive properties of happiness and independence remain inherently difficult to quantify (Frey & Stutzer, 2000).

V. QUALITY OF LIFE IN CHARLOTTETOWN?

We were not expected, nor were we planning, to carry out any investigation into the 'quality of life' in/of the provincial capital of Charlottetown *per se*. However, this Census Agglomeration, with its 58,625 residents (Statistics Canada, 2006), has some distinct characteristics that may be worth identifying in this study. The place of residence of some 43% of the island province's population, the greater Charlottetown area has the largest proportionate concentration of residents by province. While the provincial population is essential stable (zero growth), that of Charlottetown is growing at 6.5%. It has attracted 53% of immigrants that settled in the province (2001 Census data). While the registered unemployment rate in 2005 was 10.9% in Prince Edward Island, it was 7.8% in Charlottetown.

The town has been described as a unique settlement:

> It is a combination of downtown chic baroque residences, a university town (the University of Prince Edward Island, the Island's only University, has its campus here), a provincial capital (federal and provincial departments; Lieutenant-Governor's office, apart from a city with a municipal council); and the site of the bulk of the administrative and civic infrastructure befitting a provincial jurisdiction (including an airport, cruise ship passenger terminal, arts centre, hospital, churches, court house, movie theatres, shopping malls, gyms, swimming pools, farmers' market, technical college and … a public transit system) – all within an atmosphere that is distinctly rural, intimate and laid back. No other city in Canada comes close. (Baldacchino, 2006b, p. 108).

What we do *not* have in Charlottetown are any significant banking institutions. This may turn out to be a blessing: had there been a significant finance industry on PEI, its bankers and financiers would otherwise compete for limited real estate, especially in Charlottetown. This would push up the price of residential real-estate, which, as has been noted in this and other reports, is a household's most typical significant investment. In the absence of the financial class, upper-middle class wage earners - doctors, lawyers, teachers, professors, federal and provincial government employees … may find living in Charlottetown attractive *and* affordable. The price of residential property remains a significant draw for actual and potential residents of the province, and especially of its capital.

Some very interesting insights about the city can be additionally gleaned from a 2006 study that sought to explore the relationship between the 'creative class' (Florida, 2002) and economic development in Atlantic Canada. The study (Barrieau & Savoie, 2006) looked closely at Charlottetown, and made some spectacular observations. These include:

> Charlottetown has relatively high proportions of both university-educated individuals and professional artists. "**Charlottetown**, along with Guelph, **posted somewhat surprising results by outperforming several large urban centres in both categories"**. This data is a valuable indicator for both the talent and bohemian indices.
>
> Using a combination of Florida's creative occupations list and Statistic Canada's knowledge economy occupations category, one can take stock of Atlantic Canada's creative class and determine its weight relative to the overall labour force. Nationally, 24.3% of the labour force was employed in a creative class occupation. "Within Atlantic Canada, **Charlottetown** [with St. John's and Halifax] **surpassed the Canadian average"**.
>
> Halifax had a high percentage of university graduates in Canada, ranking 5th overall at 22.6%. **Charlottetown** [along with St. John's] **also ranked above the national average**, with 18.1% of the respective '20 years and over' age group having at least a bachelor's degree.

And, especially:

> Almost 7 Canadians per 1,000 declared being an artistic professional in 2001. Interestingly, it also shows that three out of the four Atlantic urban centres figure prominently at the top of the bohemian index ranking. Halifax led the Atlantic region with 7.6 artists per 1,000 residents. "**Charlottetown, despite being the least populated urban centre in our sampling [ranked 45th in the country] was not far behind at 6.9. The Island capital is the only small city to appear near the top of the ranking"**. ... In real terms, the number of artistic professionals can be broken down as follows: 1,180 in St. John's, 405 in Charlottetown, 2,735 in Halifax, and 540 in Moncton.
>
> In sharp contrast to the rest of Canada, municipalities in Atlantic Canada dedicate very little of their total expenditures to culture. This result may be partly explained by the lower rate of urbanization in the region, as well as the small size and limited financial capacity of municipalities. Despite these

limitations, Atlantic Canada's major urban centres (Halifax, **Charlottetown** and St. John's in particular) **rank favourably in terms of creative capacity**.

The summative conclusion of these indicators – indicative though they may be - is that, while Charlottetown is *not* a multicultural city (with very few foreign-born residents) and has no significant technology intensive employment, it nevertheless has some very powerful attractions to well educated, middle class residents: affordable housing, a concentration of diverse graduate residents, and a concentration of diverse artists (with some overlap between the latter two categories). Should these be aspects of the 'quality of life' that such individuals or households are looking for, then Charlottetown may fit their bill… even though it might mean that their money travels less than in other parts of the country.

VI. CONCLUSION

We present this report with a view to open up a broader dialogue regarding the possibility of alternative and complementary explorations of the quality of life on PEI. Indeed, this topic is presently bubbling over on PEI: one merely needs to glance at the long, emotionally-charged chains of contributions which annotated *The Guardian's* coverage of the fish kills over the summer of 2008 to see how the issue of Quality-of-Life and the various "costs" associated with living on 'our Island' shape mainstream dialogues. We hope that our investigation of the cost of living and the quality of life on PEI is useful, and we look forward to discussing this and/or any other topics of interest.

ABBREVIATIONS & DEFINITIONS

ACH An **Average Canadian Household** refers to a person or group of persons (other than foreign residents), who occupy the same dwelling and do not have a usual place of residence elsewhere in Canada. It may consist of a family group (consensus family) with or without other nonfamily persons, of two or more families sharing a dwelling, of a group of unrelated persons, or of one person living alone. For census purposes, every person is a member of one and only one household. Unless otherwise specified, all household data in this publication are for private households only (FP 2008, p. 589).

CPI The **Consumer Price Index** (CPI) is a measure of the rate of price change for goods and services bought by Canadian consumers. It is the most widely used indicator of price changes in Canada. The Canadian CPI began with a study conducted by the Department of Labour in the early 1900's. The study was based on a hypothetical family budget that represented weekly expenditures of an urban working class family of five. Retail prices of 29 food items and five fuel and lighting items were collected in approximately 60 cities. In addition, information was obtained on the rent for a representative worker's dwelling. Since then, the CPI has grown in comprehensiveness and detail to keep pace with increases in its use. The CPI is defined, more precisely, as an indicator of the changes in consumer prices experienced by Canadians. It is obtained by comparing, through time, the cost of a fixed basket of commodities purchased by Canadian consumers in a particular year. Since the basket contains commodities of unchanging or equivalent quantity and quality, the index reflects only pure price movements (Canada, 1996, p 1).

DI **Discretionary Income** refers to the household income that is left after federal and provincial taxes, statutory deductions and other necessities have been met. MapInfo Canada has defined the following "necessities" as part of its Discretionary Income product: food, housing (only principal accommodation expenditures, utilities, maintenance, and property taxes), transportation (less airline fares), apparel (less jewellery) and health care expenditures (FP, 2008, p 588.)

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APPENDIX I – ORIGINAL PROJECT PROPOSAL

Measuring the Quality of Life:
An Inter-Provincial 'Cost of Living' Inquiry

By

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1. Project Rationale

Can one come up with the 'hard science' to show that part of the enviable 'quality of life' in certain provinces in Canada has to do with the differential 'purchasing power' of their residents? Although the mean level of earnings/income per annum is lower/higher in certain provinces than others, (and such mean earnings may be lower in the rural areas than in the urban ones), yet expenditures and overall costs of consumption may be lower/higher. Various persons think they are; and various others think they aren't, and neither party appears (so far) to have come up with systematic statistics to back their position or refute the alternative: usage of data is sketchy, anecdotal and fragmented, at best. Thus, by way of example, lot or property purchases and rents, gas bills, professional services, and University tuition costs on Prince Edward Island are presumably amongst the lowest, if not the lowest, in the country. But so are average wages. Moreover, the cost of food, white goods, as well as the levels of provincial taxation, is presumably higher. The fuel/gas bill has also been getting increasingly higher these past couple of years. This very focused study will come up with a measure of the cost of living, or 'household financial health', and use this to compare the state of affairs in the various provinces of Canada.

2. Method

Statistics Canada produces annual and monthly consumer price index (CPI) calculations. However, further analysis is required before consumers are able to ascertain the true costs of living – that is, relative to income, assets and liabilities. This project will assess mean levels of Canadian household financial health by province for 2008. Both national and comparative provincial financial health reports will be generated on the basis of 2008 estimated household average (1) disposable income; (2) expenditures; (3) liquid assets; (4) liabilities; and (5) home equity.

3. Outcome

The outcome of such a study would need to be prepared to withstand strong criticism, irrespective of its outcome. It should use official and the latest statistics exclusively, if possible. Comparable data must be defined in the same way to ensure validity and reliability. While time and target group specific, the outcome of such a study will help dispel, or confirm, myths or what remain as uncorroborated perceptions, that PEI is an overall more/less expensive province to live in.

Thank You

March 12, 2008

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Abstract: Expansion and development of the fisheries was the driving force behind Iceland's economic transformation during the 20th century. Yet, the overriding importance of this sector fails to show up in national accounts – such as contribution to GDP and employment statistics –because they do not take into consideration the various ways economic activity in the maritime sectors affects other branches of the economy. In addition, the national accounts do not fully reflect the significant part played by the fisheries as the county's largest currency earning industry. This ignorance of the true contribution of the fisheries can lead policy makers to underestimate the effects shocks to the fisheries will have on the economy. In this paper, econometric methods are employed to estimate the overall contribution of the fishing industry to Icelandic GDP during the period 1963-1996. Using data on GDP, marine production, capital and labour, it is shown that in the long-run a 1% change in the value of fishing industry production will lead to a 0.42% increase in GDP growth. This is considerably higher than the 11% the national accounts attribute to the fisheries.

Arnason, R., Baldursson, F., & Sturluson, J. (2006). Editorial. *Journal of Economic Behavior & Organization, 61*(2), 145-148.

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Arnason, R., Hannesson, R., & Schrank, W. (2000). Costs of fisheries management: The cases of iceland, norway and newfoundland. *Marine Policy, 24*(3), 233-243.
This paper reports on the results of an investigation of management costs in the fisheries of Iceland, Newfoundland and Norway and discusses them in a more general framework. Management costs are defined as costs necessary to overcome the problems associated with common property. The question of whether management costs should be paid by industry is discussed, as is the likely effect of user pay on the efficiency with which management is provided. Since management has public goods characteristics, it is likely that there is an unavoidable role for government in providing these services. The question of who pays for it is separate, and recovering costs from industry has both efficiency and optimal taxation aspects. A greater involvement in management by industry further raises the question of compatibility between the industry's interests and the public interest. Measured as percent of gross value of fish landings the management costs are by far highest in Newfoundland (15–25%), lowest in Iceland (about 3%), with Norway in the middle (about 10%). Management costs thus appear to be substantial and quite variable. This gives rise to three conclusions. First, when calculating optimal harvesting and investment paths one must take the management costs of implementing these paths explicitly into account. Second, what is the economic efficiency of management? Could the same level of benefits be produced at lower costs? Third, can fisheries management expenditures of the magnitude discussed be justified in the sense that the benefits exceed the costs?

Baldacchino, G. (2002). A taste of small-island success: A case from prince edward island. *Journal of Small Business Management, 40*(3), 254-259.

Baldacchino, G. *Readings: The challenge of hypothermia: A six-proposition manifesto for small island territories: Isla-601*

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Baldacchino, G. (2005). Successful small-scale manufacturing from small islands: Comparing firms benefiting from locally available raw material input. *Journal of Small Business and Entrepreneurship, 18*, 21-37.
This paper draws on an European Commission-supported Leonardo da Vinci Vocational Training pilot project-in-progress to review the prospects for SMEs in small island territories. It, focusing on manufacturing firms, and deliberately selects those which conform to a tough set of conditions of "success": strong and consistent export orientation; local ownership; locally developed or adapted technology; and a workforce of up to 50 employees. This paper is based on "best practice" data collated specifically from five such "successful" firms, each based in one of five European island regions, manufacturing a product which benefits from locally available, raw material input. Research findings suggest that idiosyncratic features associated with smallness and islandness identity facilitate business success in such locations in spite of various well-documented structural handicaps. These features include a strong branding of the product with the respective island and associated characteristics island; free riding on island tourism; limited domestic local firm rivalry; an appreciation of social capital and the "quality of island life"; and the luring of islanders back to their island in order to become local entrepreneurs.

Baldacchino, G. (2006a). Innovative development strategies from non-sovereign island jurisdictions? A global review of economic policy and governance practices. *World Development, 34*, 852-867.

The world's sub-national, island (or mainly island) jurisdictions constitute a timely, valid, and valuable category of political and economic analysis. On the basis of a global, largely inductive, and discriminant analysis, five economic and four political capacities are suggested as being characteristic of the innovative development strategies practised today by various island "autonomies." Extant "mainland-island relations" can provide insights to other smaller, non-island as well as larger players, beyond the strictures of both economic vulnerability and sovereignty.

Baldacchino, G. (2006b). Small islands versus big cities: Lessons in the political economy of regional development from the world's small islands. *Journal of Technology Transfer, 31*, 91-100.
Population, employment and economic capacity continue to concentrate in and around large urban centres. If geography (measured as proximity to large centres of population) increasingly matters in the knowledge economy, then there may be no future for periphery locations. This paper critically reviews and refutes this hypothesis by looking at the world's small islands. Handicapped by size and distance, they are unable to generate scale dynamics nor to regularly access any neighbouring, large metropolitan centres. Nevertheless, jurisdictional resourcefulness resulting from sovereignty or sub-national autonomy fosters compensatory policy capacity. Demand for niche-technology manufactures and craft-based, labour-intensive or place-specific services is likely to persist. Cyclical migration strategies allow islanders seeking work or education off island to tap the metropole and re-inject resources to reinvigorate the periphery. Remittances, aid, bureaucracy and other "rents" can provide significant fiscal resources necessary for survival.

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Baldacchino, G., & Milne, D. (2006). Exploring sub-national island jurisdictions: An editorial introduction. *Round Table, 95*(38), 487-502.
ABSTRACT FROM AUTHOR: Sub-national island jurisdictions (SNIJs) manifest diverse expressions of governance within typically asymmetrical relationships with a much larger state. Dubbed 'federacies' in the literature on federalism, these bilateral systems of self- and shared-rule arise almost exclusively on islands. The jurisdictional powers that island federacies enjoy are principally a result of bilateral negotiations between island political elites and a (usually benign) metropole. This bargain is struck against the backdrop of a particular colonial inheritance, a local 'sub-nationalist' culture, and the varying ambitions of local elites to win jurisdictional powers to advance 'sub-national' territorial interests. At other times, however, island autonomies arise as crafted, deliberate devolutions of central governments eager to exploit islands as 'managed' zones for economic or security-related activity in a globalised economy. In either case sub-national autonomies often show more success and resilience as non-sovereign island jurisdictions than their sovereign island-state counterparts.

Baldacchino, G., Milne, D. A., Bartmann, B., Salvo, A., & University of Prince Edward Island. Institute of Island Studies. (2006). *Sub-national island jurisdictions*

Baldacchino, G., Milne, D. A., Bartmann, B., Srebrnik, H. F., Paterson, R., Jolliffe, L., et al. (2000). *Lessons from the political economy of small islands : The resourcefulness of jurisdiction*. New York: St. Martin's Press.

Baldacchino, G. (2007a). *A world of islands : An island studies reader.* Charlottetown, P.E.I.; Malta: Institute of Island Studies; Miller House.

Baldacchino, G. (2007b). Fixed links and the engagement of islandness: Reviewing the impact of the confederation bridge. *The Canadian Geographer/Le Géographe canadien, 51*(3), 323-336.
(1) *If a nine-year span of postbridge operational data is long enough* [italics mine; I would also certainly add, *and if the postbridge operation data we have selected is relevant and if our causal assumptions are both correct and sufficiently comprehensive*], it appears that the Confederation Bridge has not (so far) had the significant impact that many feared, or hoped, it would have on PEI society and economy (p 322).

Baumgärtner, S., Becker, C., Faber, M., & Manstetten, R. (2006). Relative and absolute scarcity of nature. Assessing the roles of economics and ecology for biodiversity conservation. *Ecological Economics, 59*(4), 487-498.
Our aim in this essay is to identify and analyze some of the difficulties with interdisciplinary integration of economic and ecological contributions to the study of biodiversity loss. We develop our analysis from a widely accepted definition of economics which is based on the concept of scarcity. Taking a closer look at this notion, we find that economics actually limits itself to a very particular aspect of scarcity, which we denote as relative scarcity. We describe in what respect the economic approach towards biodiversity is based on this notion, and also reflect on the specific understanding of the relation of humans and nature behind the economic approach. We then turn to absolute scarcity as another notion of scarcity, and show that this is not within the scope of economics, but has been a theme of ecology and ecological economics. We describe in which way ecological and ecological–economic approaches towards biodiversity are based on the idea of absolute scarcity, and also reflect on the specific understanding of the human–nature relationship behind this notion of scarcity. Against this background, we discuss the roles of economics and ecology for nature conservation. We conclude that the interdisciplinary integration of ecology and economics requires a philosophical underpinning, and suggest a framework for further research.

Baumgärtner, S., Dyckhoff, H., Faber, M., Proops, J., & Schiller, J. (2001). The concept of joint production and ecological economics. *Ecological Economics, 36*(3), 365-372.

Abstract: Joint production is suggested as one of the conceptual foundations of ecological economics. The notion of joint production springs immediately from the application of thermodynamics, and has a long history in economic analysis. Considerations of joint production give rise to philosophical concerns relating to responsibility and knowledge. The concept of joint production is easily comprehensible, and is also constitutive and supportive of a range of concepts current in ecological economic thought.

Beaulier, S., & Caplan, B. (2007). Behavioral economics and perverse effects of the welfare state. *Kyklos, 60*(4), 485-507. SUMMARY Critics often argue that government poverty programs perversely make the poor worse off by encouraging unemployment, out-of-wedlock births, and other 'social pathologies.' However, basic microeconomic theory tells us that you cannot make an agent worse off by expanding his choice set. The current paper argues that familiar findings in behavioral economics can be used to resolve this paradox. Insofar as the standard rational actor model is wrong, additional choices can make agents worse off. More importantly, existing empirical evidence suggests that the poor deviate from the rational actor model to an unusually large degree. The paper then considers the policy implications of our alternative perspective.

(1) A variety of sources indicate that 'the poor deviate more.' If the average person violates neoclassical assumptions, the average welfare recipient violates them to a markedly greater degree (p 503).

Becker, C., Faber, M., Hertel, K., & Manstetten, R. (2005). Malthus vs. Wordsworth: Perspectives on humankind, nature and economy. A contribution to the history and the foundations of ecological economics. *Ecological Economics, 53*(3), 299-310.

Begley, L. (1993). *Crossing that bridge : A critical look at the PEI fixed link*. Charlottetown, PEI: Ragweed Press.

(1) Decisions we as Islanders make on this momentous and grave matter must be the right decisions. We owe this to ourselves, to our children and to all future citizens of this province. Mr. Speaker, there is no room for error, no opportunity for second guesses and little latitude for corrective action if our planning is inadequate and unable to meet the test of time. Simply put, Mr. Speaker, we must know what we are doing [Former Premier Joseph Ghiz, 20 March 1987] (p 1).

(2) The machinations of the federal and provincial governments and the development consortium comprise a saga of deceit, dishonesty and undemocratic action (p 4).

(3) You pay a price for progress and economic change. And I believe the best interests of the Island are served by the most effficient, modern communications with the mainland in every respect; transport, telecommunications and so on. And there's bound to be some changes as a result of this but I believe they'll be positive. *They may change the way of life to some extent but governments can compensate for this* [Elmer MacKay, Minister of Public Works 3 December 1992] [italics mine, needless to say, this is far from true] (p 6).

(4) The August 1990 [Report of the Environmental Assessment Panel], a document which resulted from over a year of study and public hearings…The… report is quite explicit and clear-cut about

Benz, M., & Frey, B. S. (Online early release). Being independent is a great thing. *Economica, 0*(0), ???-???.

Abstract

One can be independent, or one can be subject to decisions made by others. This paper argues that this difference, embodied in the institutional distinction between the decision-making procedures 'market' and 'hierarchy', affects individual wellbeing beyond outcomes. Taking self-employment as an important case of independence, it is shown that the self-employed derive higher satisfaction from work than those employed in organizations, irrespective of income gained or hours worked. This is evidence for procedural utility: people value not only outcomes, but also the processes leading to outcomes.

(1) This paper argues that there is another, so far largely neglected, aspect linking happiness and employment. Self-employment provides 'procedural utility'. Procedural utility means that people value not only outcomes, but also the conditions and processes leading to outcomes (Frey et al. 2004; Benz 2007). Individuals derive procedural utility from being self-employed because it gives them a higher measure of self-determination and freedom. In contrast, persons in dependent employment have to obey orders given by their superiors. Indeed, self-employment reflects the difference between the two most important decision-making procedures in the economy: the market and hierarchy. According to the results reported below, self-employed people enjoy their position as independent actors on the marketFand as actors not subject to a hierarchyFmainly for procedural reasons. Clearly, such procedural utility differs from outcome utility, which in the case of work relates in particular to income and working hours. Since around 10% of all individuals gainfully employed in Western countries are self-employed, a substantial share of workers is affected (p 1).

(2) Procedural utility emerges because individuals have a basic psychological need for self-determination. In psychology, three aspects of self-determination have been identified as crucial elements of human wellbeing: autonomy, competence and relatedness (for a survey, see Ryan and Deci 2000). The desire for autonomy encompasses the experience to self-organize one's own actions or to be causal. The need for competence refers to the propensity to control the environment, to experience oneself as capable and effective, and to put one's abilities to use. Finally, the need for relatedness refers to the desire to feel connected to others, and to be treated as a respected group member within social groups.

Different procedures and institutions can be expected to provide different procedural goods serving these innate needs. To the extent that procedures fulfil this role, they contribute to individual wellbeing beyond outcomes traditionally studied by economists. Psychological theory stresses, for example, that procedures providing individuals with autonomy are valued not so much because they lead to better outcomes, such as a higher income, but because having control over one's actions satisfies a basic human psychological need (e.g. Ryan and Deci 2000; Lind and Tyler 1988). In this sense, people may be satisfied with an unfavourable outcome if the procedure applied was 'good', and a favourable outcome might provide them with little overall satisfaction if the procedure that brought it about was 'bad' (p 3).

Bernholz, P., Faber, M., & Reiss, W. (1978). A Neo-Austrian two-period multisector model of capital. *Journal of Economic Theory, 17*(1), 38-50.

Berry, W., Kemmis, D., & White, C. (2005). *The way of ignorance and other essays*. Emeryville, Calif.; Berkeley, Calif.: Shoemaker & Hoard; Distributed by Publishers Group West. from http://www.loc.gov/catdir/toc/ecip0511/2005012294.html

Binswanger, H., Faber, M., & Manstetten, R. (1990). The dilemma of modern man and nature: an exploration of the Faustian imperative. *Ecological Economics, 2*(3), 197-223.

Abstract: This paper is concerned with (a) the difficulty of finding a consensus between economics and ecology, (b) new dimensions which should be taken up by economists and ecologists, and (c) a fresh view on modern economies by interpreting Goethe's Faust. This is done via a hypothetical discussion between an archetypal economist and an ecologist. A commentator summarizes their viewpoints and explains several reasons for their different attitudes. Since the dialogue comes to a dead-end, the commentator asks a writer to mediate between the two parties. The writer interprets the development of humankind during the last two centuries as "the drama of modern man and nature." He explains that the menacing state of this drama today is caused by the Faustian longing for eternity on earth.

Bowe, M., Briguglio, L., & Dean, J. W. (1998). *Banking and finance in islands and small states*. London ; Washington, DC: Pinter. from http://lcweb.loc.gov/catdir/toc/96-54223.html

Briguglio, L. (1993). The terms of trade and the direction of trade in the maltese economy. *World Development, 21*(2), 269-276.
This paper attempts to show that changes in the Maltese terms of trade are influenced by Malta's direction of trade, and not by the agricultural/manufacturing composition of exports and imports. It is shown that the deterioration (or improvement) of Malta's commodity terms of trade may be linked to the fact that Malta has to compete with developing countries in its export trade and to purchase most of its imports from industrialized countries. The paper also describes Malta's incomes terms of trade and shows that these have tended to change in a different manner from the commodity terms of trade. It will be suggested that the improvement in Maltese export competitiveness may in some years, have given rise to an increase in export demand which more than offset the negative effect of a fall in the relative prices of exports. The conclusions reached in this paper may have implications for very small and very open economies, where knowledge of what determines the terms of trade is of extreme importance, due to the fact that changes in the ratio of export to import prices have a relatively very high impact on the capacity to import of such countries.

Briguglio, L. (1995). Small island developing states and their economic vulnerabilities. *World Development, 23*(9), 1615-1632.

Briguglio, L., & Cordina, G. (2004). *Competitiveness strategies for small states*. Blata l-Bajda, Malta: University of Malta, Islands and Small States Institute ; London : Commonwealth Secretariat.

Briguglio, L., & University of Wollongong. Department of Economics. (1992). *Tourism policies, environmental preservation and sustainable development on small islands : The case of malta*. Wollongong: University of Wollongong, Department of Economics.

BRUNI, F. (2007). *Prince edward island: Beckoned by bivalves.* Retrieved 11/18/2007, 2007, from http://travel.nytimes.com/2007/11/18/travel/18Prince-Edward-Island.html

(1) Bingo is big here… and so is prayer (p 1).

(2) [A local] restaurant served lobster so carelessly prepared it might as well have been flown in from a distant continent — origin and food miles (the distance from habitat to plate) don't matter if you overcook a crustacean this feloniously — and scallops so rubbery you could have used them for racquet balls.

Across several disappointing restaurant experiences on the island, I realized that the degree to which food enthusiasts romanticize eating food at its source doesn't take into account whether the source has chefs with standards as high and skills as honed as their counterparts elsewhere. Granted, many island restaurants were closed when I went in early October, about a week after the end of peak season. But recommended restaurants I did visit didn't always impress me (p 2).

Bruni, L., & Stanca, L. (2006). Income aspirations, television and happiness: Evidence from the world values survey. *Kyklos, 59*(2), 209-225.

SUMMARY This paper investigates the role of television in producing higher material aspirations, by enhancing both adaptation and positional effects. Using a large sample of individuals from the World Values Survey, we find that the effect of income on both life and

financial satisfaction is significantly smaller for heavy television viewers than for occasional viewers. This finding is robust to a number of specification checks and alternative interpretations. The results suggest an additional explanation for the income-happiness paradox: the pervasive and increasing role of television viewing in contemporary society, by raising material aspirations, contributes to offset the effect of higher income on individual happiness.

Buffett, W. E. (2003). *Berkshire hathaway 2002 annual report*. Retrieved 10/27/2007, 2007, from http://www.berkshirehathaway.com/2002ar/impnote00.html

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Carse, S. (1998). In Baldacchino G., Greenwood R.(Eds.), *Sustaining small island development: The isle of man*. Charlottetown: Institute of Island Studies, University of Prince Edward Island.

CBC. (2007a). Help needed as another pork producer closes. http://www.cbc.ca/pei/?ref=rss

P.E.I.'s agriculture minister says he'll be looking for help for Island farmers from federal and provincial counterparts when they meet this weekend.

CBC. (2007b). Parishioners ready to fight for churches. http://www.cbc.ca/pei/?ref=rss

CBC. (2007c). Farm troubles growing on P.EI. http://www.cbc.ca/pei/?ref=rss

Farmers in P.E.I.'s three major agriculture sectors of hogs, beef and potatoes are facing serious problems, says the chair of the legislative committee looking at the state of the industry.

CBC. (2007d). Pesticides could be killing lobster larvae.(2007). http://www.cbc.ca/pei/?ref=rss

A government researcher in New Brunswick has found that agricultural pesticides can kill lobster larvae, but whether that's happening in the wild is still in question. **'We're not trying to paint anything here as the one factor.'**— *Wayne Fairchild, DFO scientist*
Wayne Fairchild, a scientist with the Department of Fisheries and Oceans in Moncton, is close to publishing results of laboratory research.
Fairchild told CBC News Wednesday his team exposed small lobsters to tiny amounts of pesticides. Three insecticides killed or damaged the larvae.
"With everything that's going on in the whole cycle, we're not trying to paint anything here as the one factor, but certainly trying to look at how much of a factor it might be," said Fairchild.
Fairchild is part of a working group of fishermen, government representatives and scientists who have been meeting to talk about the possible effects of pesticide run-off on young lobsters.
The group came together after last summer's fish kills in two Island rivers.
Some lobster fishermen from Nova Scotia asked whether pesticides from those rivers could end up in the Northumberland Strait and damage or kill young lobsters.
Linda MacLean of DFO said the group considered from early on that insecticides in particular could affect lobster larvae. *Thousands of fish were killed in the Dunk and Tryon rivers in July. Pesticides were strongly suspected as the cause, but there was not enough evidence to lay charges. (CBC)*
"A lot of the physiological processes in young developing lobster larvae, especially as they're moulting, are very similar to physiological processes in insects," said MacLean.
"If there are chemicals that are trying to target a certain life stage of an insect, they may also have that same impact on lobster larvae."
The remaining question is whether lobster larvae are, in fact, being exposed to significant levels of insecticide in the wild.
Fairchild said preliminary work has begun to see how much pesticide wild larvae may be exposed to and what that could mean to their survival.

CBC. (2007e). Polar foods committee to hit the road. http://www.cbc.ca/pei/?ref=rss
A legislative committee looking at the Polar Foods bankruptcy, described as the biggest in P.E.I. history, will be taking its work on the road.

Cepa. (2007). *JOAN ROBINSON*. Retrieved 11/21/2007, 2007, from http://cepa.newschool.edu/het/profiles/robinson.htm

Chomsky, N. (2003). *Hegemony or survival : America's quest for global dominance* (1st ed.). New York: Metropolitan Books.

Chomsky, N. (2006). *Failed states: The abuse of power and the assault on democracy* (1st ed.). New York: Metropolitan Books.

(1) The selection of issues that should rank high on the agenda of concern for human welfare and rights is, naturally, a subjective matter. But there are few choices that seem unavoidable, because they bear so directly on the prospects for decent survival. Among them are at least three: nuclear war, environmental disaster, and the fact that the government of the world's leading power is acting in ways that increase the likelihood of these catastrophes (Preface).

Clark, J. M. (1918). *Readings in the economics of war.* Chicago, IL: The University of Chicago Press.

Coase, R. H. (1937). The nature of the firm. *Economica, 4*(16), 386-405.

Copernicus, N. (1543). *On the revolutions of the heavenly spheres* [De revolutionibus orbium caelestium (literal translation: The revolutions of celstrial orbs).] (A. M. Duncan Trans.). (1976th ed.). Newton Abbot Eng.; New York: David & Charles; Barnes & Noble.

Cournot, A. A. (1838). *Researches into the mathematical principles of the theory of wealth*. New York; London: Macmillan; Macmillan.

Crowe, C. (1996). *Jerry maguire*. Culver City, Calif.: Columbia TriStar Home Video.
A sports agent suddenly discovers his scruples and promptly loses his job. But with the help of one loyal colleague and one outrageous client, he learns that loving well is the best revenge.

Damasio, A. R. (1994). *Descartes' error : Emotion, reason, and the human brain*. New York: G.P. Putnam.

Danielsson, J. *The emperor has no clothes: Limits to risk modelling.* Retrieved 11/30/2007, 2007, from http://ideas.repec.org/p/fmg/fmgsps/sp126.html
This paper considers the properties of risk measures, primarily Value-at Risk (VaR), from both internal and external (regulatory) points of view. It is argued that since market data is endogenous to market behavior, statistical analysis made in times of stability does not provide much guidance in times of crisis. In an extensive survey across data classes and risk models, the empirical properties of current risk forecasting models are found to be lacking in robustness while being excessively volatile. For regulatory use, the VaR measure is lacking in the ability to fulfill its intended task, it gives misleading information about risk, and in some cases may actually increase both idiosyncratic and systemic risk. Finally, it is hypothesized that risk modeling is not an appropriate foundation for regulatory design, and alternative mechanisms are discussed.

Darwin, C. (1859). *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life* (A facsimile of the first edition by Wildside Press, Holicong, PA, U.S.A., 2003 ed.). London: John Murray, Albermarle Street.

WHEN on board H.M.S. Beagle, as naturalist, I was much struck with certain facts in the distribution of the inhabitants of South America, and in the geological relations of the present to the past inhabitants of that continent. These facts seemed to me to throw some light on the origin of species — that mystery of mysteries, as it has been called by one of our greatest philosophers. On my return home, it occurred to me, in 1837, that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes (p 1)…

Darwin, C. (1883). *The descent of man and selection in relation to sex*. New York: D. Appleton and Company.

(1) A BRIEF summary will be sufficient to recall to the reader's mind the more salient points in this work. Many of the views which have been advanced are highly speculative, and some no doubt will prove erroneous; but I have in every case given the reasons which have led me to one view rather than to another. It seemed worth while to try how far the principle of evolution would throw light on some of the more complex problems in the natural history of man. False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for every one takes a salutary pleasure in proving their falseness: and when this is done, one path towards error is closed and the road to truth is often at the same time opened.

(2) The main conclusion here arrived at, and now held by many naturalists who are well competent to form a sound judgment is that man is descended from some less highly organised form. The grounds upon which this conclusion rests will never be shaken, for the close similarity between man and the lower animals in embryonic development, as well as in innumerable points of structure and constitution, both of high and of the most trifling importance,- the rudiments which he retains, and the abnormal reversions to which he is occasionally liable,- are facts which cannot be disputed. They have long been known, but until recently they told us nothing with respect to the origin of man. Now when viewed by the light of our knowledge of the whole organic world, their meaning is unmistakable. The great principle of evolution stands up clear and firm, when these groups or facts are considered in connection with others, such as the mutual affinities of the members of the same group, their geographical distribution in past and present times, and their geological succession. It is incredible that all these facts should speak falsely. He who is not content to look, like a savage, at the phenomena of nature as disconnected, cannot any longer believe that man is the work of a separate act of creation. He will be forced to admit that the close resemblance of the embryo of man to that, for instance, of a dog- the construction of his skull, limbs and whole frame on the same plan with that of other mammals, independently of the uses to which the parts may be put- the occasional

re-appearance of various structures, for instance of several muscles, which man does not normally possess, but which are common to the Quadrumana- and a crowd of analogous facts- all point in the plainest manner to the conclusion that man is the co-descendant with other mammals of a common progenitor.…

The main conclusion arrived at in this work, namely, that man is descended from some lowly organised form, will, I regret to think, be highly distasteful to many. But there can hardly be a doubt that we are descended from barbarians. The astonishment which I felt on first seeing a party of Fuegians on a wild and broken shore will never be forgotten by me, for the reflection at once rushed into my mind-such were our ancestors. These men were absolutely naked and bedaubed with paint, their long hair was tangled, their mouths frothed with excitement, and their expression was wild, startled, and distrustful. They possessed hardly any arts, and like wild animals lived on what they could catch; they had no government, and were merciless to every one not of their own small tribe. He who has seen a savage in his native land will not feel much shame, if forced to acknowledge that the blood of some more humble creature flows in his veins. For my own part I would as soon be descended from that heroic little monkey, who braved his dreaded enemy in order to save the life of his keeper, or from that old baboon, who descending from the mountains, carried away in triumph his young comrade from a crowd of astonished dogs- as from a savage who delights to torture his enemies, offers up bloody sacrifices, practices infanticide without remorse, treats his wives like slaves, knows no decency, and is haunted by the grossest superstitions.

Man may be excused for feeling some pride at having risen, though not through his own exertions, to the very summit of the organic scale; and the fact of his having thus risen, instead of having been aboriginally placed there, may give him hope for a still higher destiny in the distant future. But we are not here concerned with hopes or fears, only with the truth as far as our reason permits us to discover it; and I have given the evidence to the best of my ability. We must, however, acknowledge, as it seems to me, that man with all his noble qualities, with sympathy which feels for the most debased, with benevolence which extends not only to other men but to the humblest living creature, with his god-like intellect which has penetrated into the movements and constitution of the solar system -with all these exalted powers- Man still bears in his bodily frame the indelible stamp of his lowly origin.

De Botton, A. (2001). *The consolations of philosophy* (1st Vintage International ed.). New York: Vintage Books.

(1) There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility we must ready ourselves for (p 90).

(2) Reassurance can be the cruelest antidote to anxiety. Our rosy predictions both leave the anxious unprepared for the worst, and unwittingly imply that it would be disastrous if the worst came to pass. Seneca more wisely asks us to consider that bad things probably will occur, but adds they are unlikely ever to bad as bad as we fear (p 96).

(3) It is not only the hostility of others that may prevent us from questioning the status quo. Our will to doubt can be just as powerfully zapped by an internal sense that *societal conventions* [italics mine] must have a sound basis, even if we are not sure exactly what this may be, because they have been adhered to by a great many people for a long time. It seems implausible that our society could be gravely mistaken in its beliefs and at the same time that we would be alone in noticing the fact. We stifle our doubts and follow the flock because we cannot conceive of ourselves as pioneers of hitherto unknown, difficult truths (p 13).

(4) I sometimes get others to say what I cannot put so well myself because of the weakness of my language, and sometimes because of the weakness of my intellect… *[and] sometimes… to rein in the temerity of thos hasty criticisms which leap to attack writings of every kind, especially recent writings by men still alive… I have to hide my weaknesses beneath those great reputations* [italics de Botton's, p 163].

(5) We do not need years of formal education and a leisured existence. Anyone with a curious and well-ordered mind who seeks to evaluate a common-sense belief can start a conversation with a friend in a city street and, by following a Socratic method, may arrive at one or two ground-breaking ideas in under half an hour…. It…may without injustice be presented in the language of a recipe book or manual, and applied to any belief one is asked to accept… The correctness of a statement cannot, the method suggests, be determined by whether it is held by a majority or has been believed for a long time by important people. A correct statement is one incapable of being rationally contradicted (Botton 2002, pp 22-23).

(6) [The wise] will start each day with the thought… Fortune gives us nothing which we can really own. Nothing, whether public or private, is stable; the destinies of men, no less than those of cities, are in a whirl. Whatever structure has been reared by a long sequence of years, at the cost of great toil and through the great kindness of the gods, is scattered and dispersed in a single day. No, he who has said 'a day' has granted too long a postponement to swift misfortune; an hour, an instant of time, suffices for the overthrow of empires. How often have cities in Asia, how often in Achaia, been laid low by a single shock of earthquake? How many towns in Syria, how many in Macedonia, have been swallowed up? How often has this kind of devastation laid Cyprus in ruins? We live in the middle of things which have all been destined to die. Mortal have you been born, to mortals have you given birth. Reckon on everything, expect everything (p 91).

(7) Under the influence of passing moods, our critics may have fumbled towards conclusions. They may have acted from impulse and prejudice, and used their status to ennoble their hunches. They may have built up their thoughts like inebriated amateur potters. Unfortunately, unlike pottery, it is initially extremely hard to tell a good product of thought from a poor one. It isn't difficult to identify the pot made by the inebriated craftsman and the one by the sober colleague… A bad thought delivered authoritatively,

though without evidence of how it was put together, can for a time carry all the weight of a sound one. But we acquire a misplaced respect for others when we concentrate solely on their conclusions – which is why Socrates urged us to dwell on the logic they used to reach them" (pp 30-31).

De Botton, A. (2004). *Status anxiety* (1st ed.). New York: Pantheon Books.

Delaney, J. (2006). *The epoch times | potato farms a hotbed for cancer?* Retrieved 11/1/2007, 2007, from http://en.epochtimes.com/news/6-3-23/39627.html

Prince Edward Island is known nationwide for beautiful red sand beaches, a friendly people, lighthouses dotting its rugged Atlantic coastline, and for its staggeringly vast potato production. But the tiny island may soon come to be associated with another, far less benign feature: some of the highest rates of cancer and asthma in the country. *Despite repeated assertions from government officials that the statistics don't provide any proof* [italics mine: *The Problem of Induction*/Totalitarianism], many Prince Edward Island residents believe that heavy pesticide use on the island's potato farms is causing high rates of cancer and other diseases. With about 7,000 fields spanning 110,000 acres, the small island produces more than a billion kilograms of potatoes every year, making PEI one of the most intensely-farmed areas in Canada. The tiny island of PEI, which is small enough to fit into Saskatchewan 115 times, supplies nearly 30 percent of Canada's potato market. But there is a heavy price to pay for the tremendous agricultural production. According to PEI Green Party leader Sharon Labchuk, potatoes grown on that magnitude require "enormous amounts" of fungicidal chemicals to ward off blight, a disease that can devastate potato crops. Labchuk says the crops are sprayed about 20 times per year—every four days in blight season—and the three main fungicidals used on the potatoes have been classed as carcinogens by the U.S. government. Sin*ce the 1980s, potato production in PEI has doubled, but pesticide use has soared by 700 percent in the same period* [italics mine]. "Both Liberals and Conservatives have sunk a ton of taxpayers' money into subsidizing the industry, and what we have now is a virtual potato monoculture," says Labchuk. "You grow a monoculture in this industrial system and you're tied to the chemicals." Labchuk points out that because PEI is densely populated—the most densely-populated province in Canada, by far—the potato fields are interspersed among the homes, hospitals, daycares and schools, which means that people are constantly within range of the sprays. But experts disagree on whether this chemical exposure has resulted in unusually high cancer rates on the island.
…
Dr. Ron Matsusaki, emergency room physician at Western Hospital in Alberton, says that in all the years he's worked as a doctor both in Canada and the U.S., he hasn't seen cancer rates that come even remotely close to what he's seeing in the West Prince area of PEI. He says he has no doubt that these cancers are caused by "an insane amount" of chemical pesticides. Every second household in Mimnegash, a fishing village in West Prince surrounded by potato fields, has been afflicted with cancer, according to Matsusaki. "West Prince is a laboratory for rare and aggressive cancers. It's not uncommon to find people who have up to ten family members with cancer, that's how crazy it is here." West Prince resident Noralee Harper believes her five year-old-son contracted B cell lymphoma when her family lived next to a potato field. She's convinced the chemicals seeped into the well the family used, adding that *there are no government regulations in place for testing pesticide levels in the island's drinking water* [italics mine]. Though her son is in remission now, she says she's lucky because she knows families who have lost more than one child to cancer. "With each month that goes by, we hear of somebody new we that know personally who's been diagnosed with cancer. It's like the common cold, like a natural part of life. Living here, we worry non-stop, it's a daily concern." The only doctor to speak out about the link between pesticides and high cancer rates on the island, Matsusaki says that although he has received a letter of acknowledgement from the Canadian Medical Association, many of his colleagues in the medical profession as well as the Mayor of Mimnegash are "in denial" about the severity of the situation. He believes non-Hodgekins lymphoma is the most common cancer in West Prince, followed a close second by renal cell cancer, a particularly aggressive cancer that doesn't present symptoms until it's in the latter stages. PEI Health Minister Chester Gillan said in January that he's willing to look at research backing Matsusaki's claims, and *if he receives scientific proof that pesticides are poisoning PEI residents he'll act swiftly* [italics mine: *The Problem of Induction* strikes twice in one sentence— (1) Totalitarianism, once again, and (2) scientific proof is, and forever will be, impossible to establish] to ban the offending chemicals. But Labchuk with the Green party says she has provided Gillan and other government officials with ample scientific evidence on the issue over the years. She says Gillan "knows very well we're using chemicals here that are known to cause cancer." In a 1999 Environment Canada study, the fungicide chlorothalonil, also called Bravo, was present in every air sample taken on the island—even in the control area which was at the end of a wharf away from any fields. The study also found that concentrations of the fungicide were just as high or higher on days when no spraying occurred as on days when it did. The US Environmental Protection Agency classes chlorothalonil as a carcinogen that can cause a variety of ill effects including skin and eye irritation, reproductive disorders and kidney damage. Labchuk says the PEI potato industry is controlled by New Brunswick's Irving family and McCain Foods. Calling PEI's Chief Medical Officer Lamont Sweet "just a patsy for the industry and for government," Labchuk believes that there has to be an impact on the economy to get the government's attention, so she and her group Earth Action have been handing out leaflets to tourists on the premise that "tourists aren't going to come to a place that's polluted and poisoned." Tourism in PEI is equal in economic clout to the potato industry. In the early 1990s, a study conducted by a Danish pharmaceutical company found that PEI had the highest hospitalization rates for asthma anywhere in the world. Although Van Til says asthma hospitalization rates have dropped in the last five years, Matsusaki believes PEI has the highest incidence of asthma and asthma deaths in Canada. Farmer Danny Hendricken, who spends $150,000 to $170,000 per year on fungicides for his 850-acre potato farm, believes the chemicals he uses on his land not only have a detrimental effect on the people and wildlife but on the soil as well. He says he's "disappointed" that the government hasn't pressured the corporations who own the

rights to the fungicides to develop a safer way. "Some tough decisions have got to be made, but unfortunately....for them to have the political intestinal fortitude to stand up to the corporate sector who's really benefiting financially from this takes a lot of political will." And while Hendricken hopes the government will initiate improvements to the industry, he's not holding his breath. For now, pesticides are the only way for farmers to keep their heads above water. Hendricken says net farm income, which acts as a barometer indicating the health of the industry, has greatly diminished in recent years. As a result, farm debt is spiraling out of control. He says that because farmers are only making mere "cents a pound" for potatoes, they have to produce millions of pounds just to get by. "It's a lot of pressure, there's a great deal of stress. It's like a treadmill that keeps running faster and faster. The industry here is almost at its limitation where it can't run any faster, and if it makes one slip, it's gone." (p 1).

Descartes, R. (1637). *Discourse on the method of rightly conducting the reason, and seeking truth in the sciences*(J. Veitch Trans.). (1899, Authoriz reprint ed.). La Salle: Open Court Pub. Co.

Dominion. (2007). *Oil versus water.* Retrieved 11/16/2007, 2007, from http://www.dominionpaper.ca/articles/1429

University of Alberta ecologist David Schindler, winner of the 1991 Stockholm Water Prize (known as "water science's Nobel Prize"), expressed concern over industry-related chemicals found in the water and their effect on human health.
In an interview shown in a video documentary produced by OilSandsTruth.org Schindler said his biggest concern is the possibility of a breach of massive tailing ponds near Fort McMurray, which now cover an estimated 50-square kilometres. "Those ponds are acutely toxic material, so they would affect things probably well down the Athabasca and into the Slave River, and possibly beyond the Slave Delta."

Such a breach, said Schindler, could conceivably occur in the event of extreme rainfall or an earthquake. But it's not just the extreme possibility that has Schindler concerned.
"We know that those [tailing pond] dykes do seep some material. They try to catch it at the bottom and pump it back over the top. I don't know what per cent efficiency they have, but very few things are 100 per cent efficient."
In Fort Chipewyan, there have been reports of increases in diseases and cancers.

A local doctor, John O'Connor, reported disproportionately high incidents of colon, liver, blood and bile-duct cancers in the community. "There have been several different kinds of cancer, as well as what we call auto-immune diseases like rheumatoid arthritis, lupus, various skin rashes," O'Connor told the Dominion. "The malignant--the cancerous diseases have been the biggest concern."

One condition, Cholangiocarcinoma, normally occurs in one out of 100,000 people. But in Fort Chipewyan, "We've had two tissue biopsy confirmed cases...and possibly another three or four, which didn't actually get to tissue biopsy diagnosis."
"In a population of between 750 and 1200, that's very unexpected."

"There are all kinds of sicknesses going on," said Allan Adam, a councillor with ACFN. "The elders say that before, in the 70s, people weren't sick like they are now. That's when all the oil sands started developing."

Warning signs of toxicity have also turned up in animals. "Some people say that they've seen spots inside the animals, that they won't eat the moosemeat because there's a different taste in it now," said Adam. "Fish have different growths on them, that weren't there before. Pusses growing out of their skin, and the gills are deformed on some of them"

After O'Connor took his claims public and called for an inquiry into the effects of the tar sands operations on water, he became the subject of an official complaint by officials at Health Canada. He subsequently gained the support of the community, environmental groups and First Nations. The Alberta Medical Association unanimously passed a resolution defending his "professional obligation and his right to speak out when he observes something."

Chief Roxanne Marcel of the Mikisew Cree First Nation has issued an appeal: "Our message to both levels of government, to Albertans, to Canadians and to the world who may depend on oil sands for their energy solutions, that we can no longer be sacrificed any longer."

Toxins from tailing ponds aren't the only problem on the Athabasca, however.

Estimates have oil production at 3 million barrels per day by 2015. At this rate, the Athabasca tar sands are projected to last over 400 years. But along with the effects of climate change, water usage will exacerbate the drying of the Athabasca. Because the Athabasca River is iced-over for long periods, it is susceptible to low oxygen levels from decomposing organic matter. Diminished flows could exacerbate low oxygen levels further. This threatens high flows that flood shallow-side channels and perched basins in the delta, which are critical spawing grounds for fish like walleye.

"About the most positive thing I can say is that I'm glad I'm a human being and not a fish in Alberta," said Schindler.

Einstein, A., Seelig, C., Bargmann, S., & Einstein, A. (1954). *Ideas and opinions : Based on mein weltbild*. New York: Crown Publishers.

Ekelund, R. B., & Hébert, R. F. (1997). *A history of economic theory and method* (4th ed.). New York: McGraw-Hill.

Erickson, J. D., & Gowdy, J. M. (2000). Resource Use, Institutions, and Sustainability: A Tale of Two Pacific Island Cultures. *Land Economics, 76*(3), 345-354. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0023-7639%28200008%2976%3A3%3C345%3ARUIASA%3E2.0.CO%3B2-7

Abstract: This paper examines two Pacific Island cultures, Easter Island and Tikopia, and the relationship between natural resource systems, human-made capital, population growth, and institutional change. Easter Island followed a pre-industrial society pattern of

overshoot-and-collapse. However, Tikopia evolved cultural practices leading to zero-population growth and sustainable resource use. Using a modified Lotka-Volterra, predator-prey model, we find (1) investment in human-made capital does not necessarily eliminate the boom- and bust-cycles of economic activity and population observed in many past societies; and (2) institutional adaptation and resource conservation can be critical in achieving population stability.

Faber, M., Manstetten, R., & Proops, J. L. R. (1995). On the conceptual foundations of ecological economics: A teleological approach. *Ecological Economics, 12*(1), 41-54.

Abstract: Nature is characterised by the emergence and continued existence of Far From Equilibrium Self-Organizing Dissipative Structures (FFESODS), which can be described in terms of their genotypes (potentialities) and phenotypes (realizations). If a FFESODS' genotype is contained within its phenotype, we call it an organism. We can describe the behaviour of organisms as being teleological. We offer three tele for organisms: first telos - self-maintenance, development and self-realization; second telos - replication and renewal; third telos - service to other organisms, to other species or to the whole of nature. Sustainability of an ecosystem requires a balance and harmony between these mutually supporting tele. We define the related concepts of stock, store and fund. We can interpret all living activity, be it natural or economic, in terms of relationships between funds, through the three tele. We can characterise the environmental problems in the First World as stemming from too great an emphasis by humans on the first telos (through consumerism) and too little emphasis on the third telos. In the Third World we can identify environmental problems with an imbalance towards the second telos (reproduction), leading to a de-emphasis of the third telos. The long-run solution to global environmental problems must lie in the re-establishment of global harmony between the three tele of both humans and non-humans.

Faber, M., Petersen, T., & Schiller, J. (2002). Homo oeconomicus and homo politicus in Ecological Economics. *Ecological Economics, 40*(3), 323-333.

Abstract: The model of homo oeconomicus has been criticised in Ecological Economics. We discuss this critique and alternative approaches that have been developed in the literature. In contrast to these approaches, which are based on Arrow's concept of the Social Welfare Function, psychology, biology, and general considerations, we propose a concept of homo politicus that is founded in political philosophy. We show that this concept is suitable for normative purposes of Ecological Economics. At the same time, we demonstrate in a case study that the concept has empirical relevance in explaining real political processes.

Faber, M., & Proops, J. L. R. (1991). The innovation of techniques and the time-horizon: A neo-Austrian approach. *Structural Change and Economic Dynamics, 2*(1), 143-158.

Abstract: This paper uses a neo-Austrian approach to examine the effect of a finite time-horizon of a decision maker on the decision of whether or not to innovate a newly invented technique of production. An activity analysis approach is taken to production, with capital goods being themselves produced. The concept of the 'superiority' of one technique to another is introduced. A welfare function is then introduced, to examine the circumstances under which a new technique will generate greater welfare than the old technique, under a finite time-horizon. It is shown that the superiority of the new technique is a necessary, but not sufficient, condition for the innovation of the new technique. A sufficient condition for innovation is derived in terms of the technical coefficients of production, the rate of deterioration of the capital good, the rate of time preference and the time-horizon of the decision maker.

Faber, M., & Proops, J. L. R. (1993). Natural resource rents, economic dynamics and structural change: a capital theoretic approach. *Ecological Economics, 8*(1), 17-44.

Abstract: This paper concerns the effects of natural resource rents on the dynamics and structural change of an economy which is accumulating capital. The concept of rent is developed and the determinants of natural resource rents in the real world are discussed. To examine the long-run effects of rents on the price system and economic structural change, a neo-Austrian capital theoretic model is developed. This is presented in input-output form, and the corresponding prices for the model are derived so that a consistent set of national accounts for the model can be found. Natural resource use is introduced into the model with natural resource rents forming a further element of value-added. The model is then further generalised with the dynamics of capital accumulation being determined through a savings function which itself varies with the rate of return on capital. This model is used to simulate the effect on economic dynamics and structural change of two natural resource rent profiles, both of which follow the Hotelling rule. The effects of these two cases on the model are examined through the corresponding sets of national accounts.

Faber, M., Proops, J., Ruth, M., & Michaelis, P. (1990). Economy-environment interactions in the long-run: a neo-Austrian approach. *Ecological Economics, 2*(1), 27-55.

Abstract: This paper describes a neo-Austrian approach to the long-run interactions between invention, innovation and technical progress on the one hand, and resource use and pollution on the other. This approach is used to construct a formal model which simulates output, capital accumulation, pollution emission, pollution abatement, etc., for a simple model economy. We begin by reviewing the role and conceptualisation of time in economic modelling. We then move on to outline neo-Austrian capital theory as an alternative to the conventional approach. We note the implications of the neo-Austrian approach for modelling resource use and pollution, and a simulation model is constructed embodying the neo-Austrian approach to the time structure of production. The two

possible ways the model can be interpreted are then explored. Results from the simulation model are presented and assessed. Finally, plans for future work with this approach are described.

Fehr, E., & Fischbacher, U. (2004). Social norms and human cooperation. *Trends in Cognitive Sciences, 8*(4), 185-190.

Fehr, E., & Rockenbach, B. (2004). Human altruism: Economic, neural, and evolutionary perspectives. *Current Opinion in Neurobiology, 14*(6), 784-790.

Human cooperation represents a spectacular outlier in the animal world. Unlike other creatures, humans frequently cooperate with genetically unrelated strangers, often in large groups, with people they will never meet again, and when reputation gains are small or absent. Experimental evidence and evolutionary models suggest that strong reciprocity, the behavioral propensity for altruistic punishment and altruistic rewarding, is of key importance for human cooperation. Here, we review both evidence documenting altruistic punishment and altruistic cooperation and recent brain imaging studies that combine the powerful tools of behavioral game theory with neuroimaging techniques. These studies show that mutual cooperation and the punishment of defectors activate reward related neural circuits, suggesting that evolution has endowed humans with proximate mechanisms that render altruistic behavior psychologically rewarding.

Ferrer-i-Carbonell, A., & Gowdy, J. M. (2007). Environmental degradation and happiness. *Ecological Economics, 60*(3), 509-516.

Abstract: The focus of this paper is the relationship between subjective measures of well-being and individual environmental attitudes. We use an ordered probit model to examine the relationship between measures of subjective well-being and attitudes regarding ozone pollution and species extinction. Using data from the British Household Panel Survey we find a negative coefficient for concern about ozone pollution on individual's well-being and a positive one for concern about species extinction. These results hold when explanatory variables are included indicating whether or not the person lives in a polluted environment, whether or not the person engages in outdoor leisure activities, and the region where an individual lives. These results also hold when we control for individual psychological traits.

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanston, Ill.: Row, Peterson.

Fischer, G., & Encontrre, P. (1998). In Baldacchino G., Greenwood R.(Eds.), *The economic disadvantages of island developing countries: Problems of smallness, remoteness and economies of scale*. Charlottetown: Institute of Island Studies, University of Prince Edward Island.

Fitzgerald, F. S. (1934). *Tender is the night, a romance*. New York: C. Scribner's sons.

Frankfurt, H. G. (2005). *On bullshit*. Princeton, N.J.: Princeton University Press.

(1) One of the most salient features of our culture is that there is so much bullshit. Everyone knows this. Each of us contributes his share. But we tend to take the situation for granted. Most people are rather confident of their ability to recognize bullshit and to avoid being taken in by it. So the phenomenon has not aroused much deliberate concern, nor attracted much sustained inquiry. In consequence, we have no clear understanding of what bullshit is, why there is so much of it, or what functions it serves. And we lack a conscientiously developed appreciation of what it means to us. In other words, we have no theory (Frankfurt 2005, p 1).

(2) Another worthwhile source is the title essay in *The Prevalence of Humbug* by Max Black [(1985)]. Am uncertain just how close in meaning the word *humbug* is to the word *bullshit*. Of course, the words are not freely and fully interchangeable; it is clear that they are used differently. But the difference appears on the whole to have more to do with considerations of gentility, and certain other rhetorical parameters, than with the strictly literal modes of significance that concerns me most.. It is more polite, as well as less intense, to say "Humbug!" than to say "Bullshit!" For the sake of this discussion, I shall assume that there is no other important difference between the two.... Black...confronts the problem of establishing the nature of humbug more directly, and he offers the following formal definition: HUMBUG: deceptive misrepresentation, short of lying, especially by pretentious word or deed, of somebody's own thoughts, feelings, or attitudes (Ibid, pp 4-6).

Frey, B. S., & Stutzer, A. (2000). Happiness, economy and institutions. *The Economic Journal, 110*(466), 918-938.

Institutional factors in the form of direct democracy (via initiatives and referenda) and federal structure (local autonomy) systematically and sizeably raise self-reported individual well-being in a cross-regional econometric analysis. This positive effect can be attributed to political outcomes closer to voters' preferences, as well as to the procedural utility of political participation possibilities. Moreover, the results of previous microeconometric well-being functions for other countries are generally supported. Unemployment has a strongly depressing effect on happiness. A higher income level raises happiness, however, only to a small extent.

Frey, B. S., & Stutzer, A. (2002). What can economists learn from happiness research? *Journal of Economic Literature, 40*(2), 402-435. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0022-0515%28200206%2940%3A2%3C402%3AWCELFH%3E2.0.CO%3B2-A

Frey, B., Benesch, C., & Stutzer, A. (2005). Does watching TV make us happy? *Journal of Economic Psychology, 28*(3), 283-313.

Abstract: Watching TV is a major human activity. Because of its immediate benefits at negligible immediate marginal costs it is for many people tempting to view TV rather than to pursue more engaging activities. As a consequence, individuals with incomplete

control over, and foresight into, their own behavior watch more TV than they consider optimal for themselves and their well-being is lower than what could be achieved. We find that heavy TV viewers, and in particular those with significant opportunity cost of time, report lower life satisfaction. Long TV hours are also linked to higher material aspirations and anxiety.
(1) Watching TV is a very important activity, carried out by most people in the majority of countries. In many countries nowadays, watching TV occupies almost as much time as working. As it is a totally voluntary, freely chosen activity, it seems obvious that people enjoy it, because they would not do it otherwise. They are more satisfied with having the opportunity to watch TV to the extent they do rather than watching less TV or none at all.

This implication is shared by standard neoclassical economic theory. Individuals are assumed to know best what provides them with utility and are free to choose the amount of TV consumption that suits them best. By revealed preference, it follows from the fact that individuals watch so much TV as has been empirically observed that it provides them with considerable utility.

Recent developments, particularly in behavioral economics, cast doubt on this conclusion. The theory of revealed preference has been questioned (see, for instance, Sen 1982; 1995): it is, in general, not possible to infer the utility produced by observing behavior, because individuals do not always act rationally. More concretely, anomalies and biases in behavior have been identified (e.g. Thaler 1992), which undermine the direct link between observed behavior and the utility gained. Individuals may also be subject to habits which they do not have fully under control. They may consume some goods, such as drugs, alcohol or tobacco to a greater extent than they find to be good for themselves. They are subject to a self-control problem (e.g. Schelling 1984), again interfering with the direct relationship proposed by revealed preference theory. As Gruber and Mullainathan (2002) empirically show, predicted smokers, according to their own evaluation, consider themselves to be better off if smoking was restricted by a tax. Finally, individuals may systematically mispredict the utility derived from future consumption (e.g. Loewenstein and Schkade 1999; Loewenstein et al. 2003). In particular, happiness research (for a survey, see Frey and Stutzer 2002b) has empirically shown that individuals overestimate the utility of future income (e.g. Easterlin 2001), at the same time as they underestimate the utility of personal interactions (Frey and Stutzer 2004). The consumption decisions made by individuals are systematically distorted according to their own evaluations.

This paper argues that TV viewing is a case in which the theory of revealed preference does not fully apply: many people watch more TV than they consider good for themselves. The extent of TV viewing is not generally utility maximizing. Many individuals are subject to a self-control problem, mainly induced by the fact that watching TV offers immediate benefits (e.g. entertainment and relaxation) at very low immediate marginal costs. Many costs (e.g. not enough sleep, underinvestment in social contacts, education or career) are only experienced in the future. Individuals with time inconsistent preferences are therefore unable to adhere to the amount of TV viewing they planned or which, in retrospect, they would consider optimal for themselves. This tendency is aggravated when people mispredict future costs because they underestimate utility from socializing and neglect changes in preference due to TV consumption. Extensive TV viewing is thus understood to be the result of mispredicting utility and a self-control problem, lowering individuals' well-being (pp 2-3).

(2) A certain Canadian city was unable to receive any TV signals up until 1973, due to its location in a steep valley. Otherwise, it was similar to two cities in the vicinity used as control cases. A study by Williams (1986) suggests that the introduction of TV crowded out other activities, in particular those outside the home, such as sports' activities and visiting clubs. It also reduced the reading abilities and creative thinking of children and fostered more aggressive behavior and stereotyped ideas about gender roles. TV also reduced the problem solving capacities of adults (p 8).

(3) Popper was… very concerned about the mass media, especially television, which exercised 'unlimited power without responsibility'. Indeed, the last text he published before his death was a pamphlet called *Una patente per fare TV* (A Licence to Make TV), which, far from being just a sterile denunciation, proposed a solution for the safeguarding of democracy and, above all, for the protection of young children and those least able to defend themselves from the aggressiveness of images and messages appearing on the small screen. What he suggested was to establish an organization similar to a professional body, which would train its members in certain values and have the power to issue reprimands for breaches of the rules. [1]

(4) [Popper:] At present the greatest danger to the educational effort is television. Education just cannot go on if you let the television do what it likes. It is impossible for education to work against television unless television recognizes that it also has an educational task which overrules our mere entertainment. Otherwise we cannot have education. From the democratic point of view television must be controlled because of its potential political power which is almost unlimited. If you get hold of television, you can do whatever you like. And such power must be controlled. My proposal is to look at the problem of controlling television as a task similar to that of control of medical people. Medical people have to be controlled too, and they do it very largely themselves. For example, they have to have a certain education. The same applies to the system of control of lawyers, who have their own organization which controls them. Thanks to these systems of control the lawyers do not steal the money from their clients and doctors do not kill their patients. And you have to control all people who work for television in some kind of organization. They would have to be [admitted to] such an organization [only] on the basis of some [special] education, after passing appropriate examinations testing their awareness of the educational tasks, and their sense of responsibility. They would have to learn that their influence is very great and that their responsibility is equally great (Jarvie, 1999, p 36).

1Corvi, Roberta. *Introduction to the Thought of Karl Popper.*
Florence, KY, USA: Routledge, 1996. p 11.
http://site.ebrary.com.rlproxy.upei.ca/lib/upei/Doc?id=10095115&ppg=24

Fuller, S. (2003). *Kuhn vs. popper.* Cambridge, UK: Icon Books, Ltd.

(1) The Kuhn-Popper debate, strictly speaking, refers to an encounter that took place at the former Bedford College, University of London on 13 July 1965, as part of the International Colloquium in the Philosophy of Science. It was designed to pit a relatively young theorist of science (Kuhn, aged 43) whose 1962 book, *The Structure of Scientific Revolutions*, was touted as the latest word from the Unite States, against a relatively old theorist of science (Popper, aged 63) whose seminal book, *The Logic of Scientific Discovery*, had been translated into English on in 1959, a quarter-century after it first appeared in German (Fuller 2003, p10) .

(2) This brings me to the… source of the debate's continuing significance. Kuhn and Popper tapped into long-simmering, deep-rooted disagreements that went well beyond the pages of their major works on science…. Sometimes behind such scholastic fodder that frames philosophical debate lie opponents who are not so different from each other after all…. But sometimes the stereotype, for all its crudeness, *does* [italics Fuller's] capture differences in sensibility that become deeper the more one looks. This is certainly the case with Popper and Kuhn (Ibid, pp14-15).

(3) The clash between Popper and Kuhn is not about a mere technical point in epistemology. It concerns our central intellectual values, and has implications not only for theoretical physics but also for the underdeveloped social sciences and even moral and political philosophy (Lakatos 1978, vol 1, p 9).

(4) Steve Fuller argues that Kuhn actually held a profoundly conservative view of science and how one ought to study its history. Early on, Kuhn came under the influence of Harvard President James Bryant Conant (to whom *Structure* is dedicated), who had developed an educational program intended to help deflect Cold War unease over science's uncertain future by focusing on its illustrious past. Fuller argues that this rhetoric made its way into Structure…

Fuller suggests that Kuhn, deliberately or not, shared the tendency in Western culture to conceal possible negative effects of new knowledge from the general public. Because it insists on a difference between a history of science for scientists and one suited to historians, Fuller charges that Structure created the awkward divide that has led directly to the "Science Wars" and has stifled much innovative research….

"Philosophies like Kuhn's narrow the possible futures of inquiry by politically methodizing and taming them."—William R. Everdell, *Washington Times* (Fuller 2000, Dust Jacket).

(5) For Kuhn, science is simply good at solving its self-defined problems, whose purely technical nature led him to dub them 'puzzles'. But far from demoting the physical sciences, Kuhn was actually trying – as a latter-day Plato might – to insulate them from responsibility for real world effects, entanglement in which has historically prevented the social and biological science from taking full control of their inquiries (p 69).

(6) The villain… was James Bryant Conant, president of Harvard from 1933 to 1953. His "General Education in Science" program at Harvard, in which Kuhn taught, explicitly aimed to give future policy makers a broad understanding of science. In the era of the atomic bomb, Sputnik and the moon race, of penicillin, DNA, and the pill, it was clear that science had much greater social implications than had been thought only a decade or two before. Conant was one of the "action-intellectuals" who defined America's early Cold War vision, especially in the areas of science and educational policy. Central to it was the National Science Foundation, which provided large sums for basic research, of the kind that had turned out unexpectedly to be at the basis of the making of the atomic bomb (and in contrast to the kind of science directly aimed at ideologically specified technological ends, like Lysenko's biology and Nazi eugenics).

Conant's preface to Kuhn's first book, The Copernican Revolution (1957), linked the decline of Western Europe to its outdated humanities curricula. Yet, he thought, simply teaching humanists a little straight science had not proved effective either. Science tends to lack a storyline or anything that engages the emotions or encourages the taking of sides. "No one admires or condemns the metals or the behavior of their salts," as he justly said. His solution was history. Carefully chosen episodes in the history of science, in early modern times before it had become too complicated, would allow the student to engage with the excitement of discovery, the "interplay of hypothesis and experiment," and the conflict of personalities and ideas. This was the plan Kuhn implemented in his own teaching, and refined in his books (Franklin 2000, w1).

Funk, M. (2007a). On the problem of global warming: A solution for william funk, albert gore and richard branson. *Privatgelehrter* paper.

Abstract: Contrary to popular opinion, "*The Problem of Global Warming*," is *not*, I submit, ecological distress due to the superheating of the Earth--because this is clearly not the problem—it is merely a single symptom of far more significant problems, which, I further submit, stem from the *Problem of Induction* (see Hume 1739). In short, *The Problem of Induction* has generated convenient myths (see Archbar, Wintonick, Symansky, & Chomsky 1992), which encourage men to act irrationally. Irrationality spawns and maintains irrational institutions which manufacture consent (see Herman and Chomsky 1992), drive irrational conspicuous consumption (Veblen 1899), and, moreover, foster hyperirrational resource consumption— which is certainly not limited to the consumption of superheating fossil fuels. I propose a variety of counter-intuitive, viable solutions, but conclude the problem may be insoluble, as the philosophical and methodological foundations (see Popper 1945, 19556, 1959, & 1963, Russell 1928, 1938, 1941, Rowbottom & Aiston 2006) render dominant irrational agents and institutions unable to recognize the true nature of the problem (see Festinger 1957) and/or unwilling to act upon otherwise viable solutions.

Funk, M. (2007b). On the problem of hollywood economics: de vany's error—george lucas knows something. *Privatgelehrter* paper..

Abstract: Hayek (1991) lamented the difficulty in distinguishing between economics and excrement, and Hemingway (1958) noted "The most essential gift for a good writer is a built-in, shock-proof, bullshit detector." In this spirit and within the context of Frankfurt's (2004) *Theory of Bullshit*, this paper constructs a bullshit detector for economics. This apparatus is carefully calibrated to detect the Seven Deadly Sins of 'Hollywood Economics': Hubris, Intellectual Dishonesty, Greed, Mathematical Mania, Physics Fetishes, Conditions of Emptiness, and Sunspots. We trace the philosophical and methodological origin of these traits to its source, *The Problem of Induction*, then illustrate with examples from Plato to the present, including detailed analysis from the illuminating cases of Long Term Capital Management and William Stanley Jevons' sunspot theory. Furthermore, we demonstrate the contemporary effectiveness of this apparatus by detecting hereto undetected economic bullshit, namely Arthur de Vany's (2004) *Hollywood Economics: How Extreme Uncertainty Shapes the Film Industry*. In the process, we falsify de Vany's '*Nobody knows anything*' theory and advance our replacement theory: *George Lucas knows something*.

Funk, M. (2007c). *On the problem of compression: Logical errors and poor advice from the APA publication manual. The Institute of Island Studies* working paper.

Abstract: As Taleb (2004) noted:

> *I do not dispute that arguments should be simplified to their maximum potential; but people often confuse complex ideas that cannot be simplified into a media-friendly statement as symptomatic of a confused mind. MBAs learn the concept of clarity and simplicity—the five-minute manager take on things. The concept may apply to the business plan for a fertilizer plant, but not to highly probabilistic arguments—which is the reason I have anecdotal evidence in my business that MBAs tend to blow up in financial markets, as they are trained to simplify matters a couple of steps beyond their requirement* (pp 36-37).

By definiton, data and signal strength are lost through compression; thus writers commit errors through the act of compressing (paraphrasing, summarizing, etc) cited references. This paper highlights counterproductive stylistic recommendations in both Fourth and Fifth editions of the American Psychological Association's *Publicatino Manual* which (1) mandate plagairism through omission, (2) produce systemic error generation, and (3) hinder and limit the progress of science. In conclusion, this paper presents suitable amendments to the *Publication Manual*.

Funk, M. (2007d). *On the problem of the problem of non-cooperative games: a simple solution to a misunderstood problem. The Institute of Island Studies* working paper.

Abstract: Real-world deviations from the nash-cournot equilibrium have been addressed with a patchwork of ad hoc theories. Although Kahneman and Tversky (1979) shed light on these deviations, previous research has failed to discover the fountainhead of these deviations; this paper presents a bioeconomic equilibrium which provides a universal solution to this deviation.

KEY WORDS: Hume, Popper, Hayek, Austrian economics, Nash, Cournot, bioeconomics, natural selection, evolutionary economics, sustainable development, global warming, game theory, theory of natural resource value, induction

Funk, M. (2007e). *On the problems of beauty and vulnerability. The Institute of Island Studies* working paper.

Funk, M. (2007f). *On the problem of global warming: a brief history of a new & unpopular theory in an open letter to john gillis & ragnar arnason. The Institute of Island Studies* working paper.

Abstract: Funk's (2007a) theory of *The Problem of Global Warming* forwards the hypothesis that 'global warming' is *not* in fact limited to ecological distress induced through the consumption of superheating fossil fuels—but that that is merely *a single symptom* of far more significant problems, which, Funk (2007a) further submits, stem from the *Problem of Induction* (see Hume 1739). In short, *The Problem of Induction* has generated *convenient myths* (see Archbar, Wintonick, Symansky, & Chomsky 1992), which encourage men to act irrationally. Irrationality spawns and maintains irrational institutions which manufacture consent (see Herman & Chomsky 1988), drive irrational conspicuous consumption (Veblen 1899), and, moreover, foster hyperirrational resource consumption—which is certainly not limited to the consumption of superheating fossil fuels. Although Funk (2007a) forwards viable solutions, given the deep systemic entrenchment of irrationality, the paper concludes this problem may be insoluble. This paper traces the history,

evolution, and development of this new and unpopular theory.

Funk, M. (2007g). *On the problem of dependent people: natural resrouce valuation errors in atlantic canadian island jurisdictions. The Institute of Island Studies working paper.*

Georgescu-Roegen, N. (1977). What thermodynamics and biology can teach economists. Atlantic Economic Journal, *5(1), 13-21.*

Gillis, J. R. (2004). *Islands of the mind : How the human imagination created the atlantic world*. New York: Palgrave Macmillan.

Gissurarson, H. H. (2000). *Property rights in marine resources: Some new developments* . Retrieved 11/13/2007, 2007, from http://www.hku.hk.rlproxy.upei.ca/hkcer/articles/v60/hannes.htm

Gowdy, J. (1991). Bioeconomics and post keynesian economics: A search for common ground. *Ecological Economics, 3*(1), 77-87.

Gowdy, J. (1996). The future of the environment: Ecological economics and technological change : Faye Duchin and Glenn-Marie Lange, with Knut Thonstad and Annemarth Idenburg, Oxford University Press, Oxford, 1994. *Ecological Economics, 19*(2), 191-192.

Gowdy, J. (1997). Introduction: biology and economics. *Structural Change and Economic Dynamics, 8*(4), 377-383.

Gowdy, J. (2005). Sustainability and collapse: What can economics bring to the debate? *Global Environmental Change Part A, 15*(3), 181-183.

Gowdy, J. (2005). Toward a new welfare economics for sustainability. *Ecological Economics, 53*(2), 211-222.

Abstract: The debate over various definitions of sustainability has for the most part been conducted within the framework of traditional welfare economics. Discussion has centered on technical issues imbedded within the functional forms of various optimization models, especially the coefficient of the elasticity of substitution and the social discount rate. Two more basic problems are: (1) intractable theoretical difficulties within welfare economics call into question the results of traditional models of sustainability regarding intergenerational welfare and (2) equating per capita consumption with welfare contradicts empirical evidence suggesting that the link between happiness and wealth/income is relatively weak. Alternative approaches to measuring well-being are being developed and these have great potential to move the sustainability debate forward.

Gowdy, J. M. (2004). Altruism, evolution, and welfare economics. *Journal of Economic Behavior & Organization, 53*(1), 69-73.

Gowdy, J. M. (2007). Toward an experimental foundation for benefit-cost analysis. *Ecological Economics, 63*(4), 649-655.

Abstract: Empirical results from experimental economics and neuroscience have uncovered regularities in human behavior that may provide a base for new approaches to welfare theory and economic policy. These empirical findings do not challenge basic economic concepts but they do imply that our assumptions about "rational behavior", "opportunity cost", and "social welfare" should be revised using sound scientific evidence and methods. This research has the potential to make benefit-cost analysis more reflective of how people value gains and losses, and more responsive to considerations of environmental and social responsibility.

Gowdy, J. M., & Ferreri Carbonell, A. (1999). Toward consilience between biology and economics: the contribution of Ecological Economics. *Ecological Economics, 29*(3), 337-348.

Abstract: During its ten year history Ecological Economics has made a real difference in the way economists look at the natural world and in the way biologists look at the economy. In this survey article we examine the contributions to the Journal in terms of E.O. Wilson's concept of 'consilience', that is, his argument that the methods and assumptions of any field of study should be consistent with the known and accepted facts in other disciplines. In particular, we examine the contributions of ecological economics to reconciling the economic theory of the consumer and producer with biophysical reality.

Gowdy, J. M., & Howarth, R. B. (2007). Sustainability and benefit–cost analysis: Theoretical assessments and policy options. *Ecological Economics, 63*(4), 637-638.

Gowdy, J. M., & Mayumi, K. (2001). Reformulating the foundations of consumer choice theory and environmental valuation. *Ecological Economics, 39*(2), 223-237.

Abstract: The burgeoning field of environmental valuation has raised serious doubts about the fundamental axioms of consumer choice theory, the general validity of the Walrasian system and methodological individualism. This paper examines these aspects of consumer choice theory, paying particular attention to the pioneering contributions of Georgescu-Roegen. We argue that evidence from psychology, game theory, anthropology and contingent valuation surveys reveals a more complex pattern of decision-making than that described by neoclassical utility theory. We discuss the notions of the invariance of preferences, non-satiation, the principle of complementarity, lexicographic preferences and the hierarchy of wants with reference to environmental valuation. We also discuss the notion of marginal utility of money, the validity of the Walrasian system, and methodological individualism using scaling concept in hierarchy theory. We then address the conflict between theory and reality by introducing a probabilistic binary choice scheme under uncertainty about environmental attributes. We argue that these extensions are necessary to account for consumer choices revealed in environmental valuation surveys. We conclude with the hope that a reformulation of consumer choice theory based on realistic models of human behavior can be the basis for a viable alternative to neoclassical welfare economics.

Gowdy, J. M., & McDaniel, C. N. (1995). One world, one experiment: addressing the biodiversity—economics conflict. *Ecological Economics, 15*(3), 181-192.

Abstract: The self-organizing principles of markets that have emerged in human cultures over the past 10 000 years are inherently in conflict with the self-organizing principles of ecosystems that have evolved over the past 3.5 billion years. The rules governing the dynamics of ecosystems, within which all human activity takes place, are ultimately a function of biological laws, not a function of human-created economic systems. The conflict between these systems is illustrated by the fact that economic indicators have shown vigorous growth during the last century while a variety of environmental indicators have exhibited negative trends. Ultimately, however, the growth of human economies faces the constraints that limit all biological systems. In this article we outline the bases for the conflict between biological and economic activity and suggest policy approaches that will enhance the chances for creating cultures that are economically and environmentally sustainable.

Gowdy, J., & Erickson, J. (2005). Ecological economics at a crossroads. *Ecological Economics, 53*(1), 17-20.

Gowdy, J., Iorgulescu, R., & Onyeiwu, S. (2003). Fairness and retaliation in a rural Nigerian village. *Journal of Economic Behavior & Organization, 52*(4), 469-479.

Abstract: Results from ultimatum and dictator games played in western societies routinely violate the canonical economic model. Results from non-western societies are even more problematic. In this study ultimatum and dictator games were played in the small Igbo village of Umuluwe in southeastern Nigeria. Follow-up interviews to high acceptance rates suggested that fairness, not fear of retaliation, was the overwhelming reason for high offers, suggesting the limited predictive power of the neoclassical behavioral model. The economically rational prediction of a high acceptance rate of ultimatum game offers holds in traditional societies but not for the reasons the standard model assumes.

Gowdy, J., & Juliá, R. (2007). Technology and petroleum exhaustion: Evidence from two mega-oilfields. *Energy, 32*(8), 1448-1454.

Gowdy, J., & Seidl, I. (2004). Economic man and selfish genes: the implications of group selection for economic valuation and policy. *Journal of Socio-Economics, 33*(3), 343-358.

Abstract: A basic tenet of socio-economics is that economic behavior is shaped by social bonds and cultural context. A relevant controversy in evolutionary biology is group selection and the related issue of altruistic behavior, that is, behavior neutral or detrimental to the individual but positive for the survival of the group. In this paper we examine the parallel controversies surrounding "economic man" and "selfish genes" with particular emphasis on the policy implications of group selection. We argue for the replacement of standard welfare economics with models of human behavior in the spirit of "consilience" between economic theory and the best available science from other relevant disciplines.

Gowdy, J., & Seidl, I. (2004). Economic man and selfish genes: the implications of group selection for economic valuation and policy. *Journal of Socio-Economics, 33*(3), 343-358.

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Gowdy, J. (1991). Bioeconomics and post Keynesian economics: a search for common ground. *Ecological Economics, 3*(1), 77-87.

Abstract: This paper is concerned with the links between two schools of economic thought which challenge the neoclassical synthesis. Bioeconomics refers to that school of economics stressing the fact that the human species is a part of the larger biosystem of the planet and ultimately subject to the same laws and limitations as other life forms. Post Keynesian economics is a specific school of macroeconomics stressing the fundamental ideas of Keynes, Marx, and Kalecki concerning uncertainty, the nature of production, and the role of government in economic affairs. Bioeconomics and post Keynesian economics have much in common in terms of their methodological framework, their emphasis on production rather than exchange, and their interpretation of the social rate of discount. A potential area of conflict between the two schools is their attitude toward economic growth. The areas of commonality between the two schools are discussed and a research and policy program which combines the insights of both approaches is suggested.

Gowdy, J. (2004). Altruism, evolution, and welfare economics. *Journal of Economic Behavior & Organization, 53*(1), 69-73.

Gowdy, J. (2006). Evolutionary Theory and Economic Policy with Reference to Sustainability. *Journal of Bioeconomics,* Volume 8:1-19, 2006-04-23.

Synopsis: The policy recommendations of most economists are driven by a view of economic reality embodied in Walrasian general equilibrium theory. Ironically, the Walrasian system has been all but abandoned by leading economic theorists. It has been demonstrated to be theoretically untenable, its basic assumptions about human decision making have been empirically falsified, and it

consistently makes poor predictions of economic behavior. The current revolution in welfare economics offers opportunities on two related fronts for an evolutionary perspective on human behavior to reshape economic theory and policy. The first opportunity is to incorporate empirically-based information about human behavior to the study of human wants and their formation. This includes information about the evolution of the genetic component of decision making as well as the cultural dimensions of behavior. Expanding the role of economic analysis beyond stylized market behavior to focus on well-being (real utility) has far-reaching consequences for microeconomic policy. Secondly, abandoning the Walrasian model also means rethinking the microfoundations approach to the economic analysis of sustainability. This opens the door for economists to engage with the growing body of research on the evolution of whole societies. One link between the evolution of human behavior and the evolution of human societies is the psychological phenomenon of considering sunk costs. Understanding and overcoming the sunk cost fallacy may be the key to creating a sustainable society.

Keywords: behavioral economics - sunk costs - welfare economics

Gunnar, M. (1975). *Prize lecture.* Retrieved 11/3/2007, 2007, from http://nobelprize.org/nobel_prizes/economics/laureates/1974/myrdal-lecture.html

Hasler, A. D., Scholz, A. T., & Goy, R. W. (1983). *Olfactory imprinting and homing in salmon : Investigations into the mechanism of the imprinting process*. Berlin ; New York: Springer-Verlag.

Hayek, F. A. (1944). *The road to serfdom* (2001st ed.). London ; New York: Routledge Classics.

Is there a greater tragedy imaginable than that, in our endeavour consciously to shape our future in accordance with high ideals, we should in fact unwittingly produce the very opposite of what we have been striving (p4)?

Hayek, F. A. (1945). The use of knowledge in society. *The American Economic Review, 35*(4), 519-530. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0002-8282%28194509%2935%3A4%3C519%3ATUOKIS%3E2.0.CO%3B2-1

Hayek, F. A. (1982). *Law, legislation and liberty : A new statement of the liberal principles of justice and political economy*. London: Routledge and Kegan Paul.

Hayek, F. A. (1960). *The constitution of liberty* (1978th ed.). London: Routledge.

(1) Before we can try to remold society intelligently, we must understand its functioning; we must realize that, even when we believe that we understand it, we may be mistaken. What we must learn to understand is that human civilization has a life of its own, that all our efforts to improve things must operate within a working whole which we cannot entirely control, and the operation of whose forces we can hope merely to facilitate and assist so far as we can understand them (pp 69-70).

(2) As leader of the opposition from 1974 onward, [Margaret Thatcher] left no doubt that she was also one of the Conservative Party's most committed free marketers. In the mid-1970s, not long after becoming Leader, she visited the Conservative Party's research department.... She reached into her briefcase and pulled out a book. It was Hayek's *The Constitution of Liberty*. She held it up for all to see. "This," she said sternly, "is what we believe." She slammed it down on the table and then proceeded to deliver a monologue on the ills of the British economy (Yergin & Stanislaw 1998).

Hayek, F. A., Bartley, W. W., & Kresge, S. (1991). *The trend of economic thinking : Essays on political economists and economic history*. Chicago: University of Chicago Press.

(1) What made Vienna the distinctive city that it was, as much as any other the fount of Western culture, is a question to be kept in mind...What we might observe is that a milieu such as that in which Hayek spent his childhood and youth, a society in which family and associates, position and accomplishment, knowledge and history were so tightly intertwined, meant that the members of such a society were quickly and always apprised of what *mattered* [italics Bartley's]. This is no small feat, as any teacher of the present generation of youth knows too well. It is the *significance* [italics Bartley's] of knowledge and information that leads to the evolution of understanding (p 5).

(2) What is becoming a scarce resource is any sense of the significance of this *welter of information. We are losing the sense of what matters, of the habits of mind that can be traced to a loss of context; abstract ideas are not easily conveyed absent a recognizable embodiment, and the subtext, that which is not said, may be missing* [italics mine] (p 13).

Hayek, F. A. (1974). Speech at the Nobel Banquet, December 10, 1974]

Your Majesty, Your Royal Highnesses, Ladies and Gentlemen,

Now that the Nobel Memorial Prize for economic science has been created, one can only be profoundly grateful for having been selected as one of its joint recipients, and the economists certainly have every reason for being grateful to the Swedish Riksbank for regarding their subject as worthy of this high honour.

Yet I must confess that if I had been consulted whether to establish a Nobel Prize in economics, I should have decidedly advised against

it.

One reason was that I feared that such a prize, as I believe is true of the activities of some of the great scientific foundations, would tend to accentuate the swings of scientific fashion.

This apprehension the selection committee has brilliantly refuted by awarding the prize to one whose views are as unfashionable as mine are.

I do not yet feel equally reassured concerning my second cause of apprehension.

It is that the Nobel Prize confers on an individual an authority which in economics no man ought to possess.

This does not matter in the natural sciences. Here the influence exercised by an individual is chiefly an influence on his fellow experts; and they will soon cut him down to size if he exceeds his competence.

But the influence of the economist that mainly matters is an influence over laymen: politicians, journalists, civil servants and the public generally.

There is no reason why a man who has made a distinctive contribution to economic science should be omnicompetent on all problems of society - as the press tends to treat him till in the end he may himself be persuaded to believe.

One is even made to feel it a public duty to pronounce on problems to which one may not have devoted special attention.

I am not sure that it is desirable to strengthen the influence of a few individual economists by such a ceremonial and eye-catching recognition of achievements, perhaps of the distant past.

I am therefore almost inclined to suggest that you require from your laureates an oath of humility, a sort of Hippocratic oath, never to exceed in public pronouncements the limits of their competence [italics mine].

Hayek, F. A. (1974). The pretense of knowledge. *The American Economic Review, 79*(6, Nobel Lectures and 1989 Survey of Members), 3-7. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0002-8282%28198912%2979%3A6%3C3%3ATPOK%3E2.0.CO%3B2-7

(1) It seems to me that this failure of the economists to guide policy more successfully is closely connected with their propensity to imitate as closely as possible the procedures of the brilliantly successful physical sciences - an attempt which in our field may lead to outright error. It is an approach which has come to be described as the "scientistic" attitude - an attitude which, as I defined it some thirty years ago, "is decidedly unscientific in the true sense of the word, since it involves a mechanical and uncritical application of habits of thought to fields different from those in which they have been formed." ["Scientism and the Study of Society", *Economica*, vol. IX, no. 35, August 1942, reprinted in *The Counter-Revolution of Science*, Glencoe, Ill., 1952, p. 15 of this reprint.] I want today to begin by explaining how some of the gravest errors of recent economic policy are a direct consequence of this scientistic error.

(2) Unlike the position that exists in the physical sciences, in economics and other disciplines that deal with essentially complex phenomena, the aspects of the events to be accounted for about which we can get quantitative data are necessarily limited and may not include the important ones. While in the physical sciences it is generally assumed, probably with good reason, that any important factor which determines the observed events will itself be directly observable and measurable, in the study of such complex phenomena as the market, which depend on the actions of many individuals, all the circumstances which will determine the outcome of a process, for reasons which I shall explain later, will hardly ever be fully known or measurable.

(3) Why should we, however, in economics, have to plead ignorance of the sort of facts on which, in the case of a physical theory, a scientist would certainly be expected to give precise information? It is probably not surprising that those impressed by the example of the physical sciences should find this position very unsatisfactory and should insist on the standards of proof which they find there. The reason for this state of affairs is the fact, to which I have already briefly referred, that the social sciences, like much of biology but unlike most fields of the physical sciences, have to deal with structures of *essential* complexity, i.e. with structures whose characteristic properties can be exhibited only by models made up of relatively large numbers of variables.

(4) It has led to the illusion, however, that we can use this technique for the determination and prediction of the numerical values of those magnitudes; and this has led to a vain search for quantitative or numerical constants. This happened in spite of the fact that the modern founders of mathematical economics had no such illusions. It is true that their systems of equations describing the pattern of a market equilibrium are so framed that if we were able to fill in all the blanks of the abstract formulae, i.e. if we knew all the parameters of these equations, we could calculate the prices and quantities of all commodities and services sold. But, as Vilfredo Pareto, one of the founders of this theory, clearly stated, its purpose cannot be "to arrive at a numerical calculation of prices", because, as he said, it would be "absurd" to assume that we could ascertain all the data [V. Pareto, *Manuel d'économie politique*, 2nd. ed., Paris 1927, pp. 223-4].…

Hayek, F. A., Bartley, W. W., & Kresge, S. (1991). *The trend of economic thinking : Essays on political economists and economic history*. Chicago: University of Chicago Press.

(1) What made Vienna the distinctive city that it was, as much as any other the fount of Western culture, is a question to be kept in mind…What we might observe is that a milieu such as that in which Hayek spent his childhood and youth, a society in which family and associates, position and accomplishment, knowledge and history were so tightly intertwined, meant that the members of such a society were quickly and always apprised of what *mattered* [italics Bartley's]. This is no small feat, as any teacher of the present generation of youth knows too well. It is the *significance* [italics Bartley's] of knowledge and information that leads to the evolution of understanding (p 5).

(2) What is becoming a scarce resource is any sense of the significance of this *welter of information. We are losing the sense of what matters, of the habits of mind that can be traced to a loss of context; abstract ideas are not easily conveyed absent a recognizable embodiment, and the subtext, that which is not said, may be missing* [italics mine] (p 13).

(3) It is the fact that in [economics] no knowledge can be regarded as established once and for all, and that, in fact, knowledge once gained and spread is often, not disproved, but simply lost and forgotten.... The reason why in our field knowledge can be so lost is, of course, that is never established by experiment, but can be acquired only by following a rather difficult process of reasoning.... The result is that in economics you can never establish a truth once and for all but have always to convince every generation anew (p 38).

Hayek, F. A. (2007). Engineers and planners. *Mises Institute Daily Articles,* http://www.mises.org/articles.aspx
The ideal of conscious control of social phenomena has made its greatest influence felt in the economic field, writes F. A. Hayek.

The present popularity of "economic planning" is directly traceable to the prevalence of the scientistic ideas we have been discussing. As in this field the scientistic ideals manifest themselves in the particular forms which they take in the hands of the applied scientist and especially the engineer, it will be convenient to combine the discussion of this influence with some examination of the characteristic ideals of the engineers.

We shall see that the influence on current views about problems of social organization of his technological approach, or the engineering point of view, is much greater than is generally realized. Most of the schemes for a complete remodeling of society, from the earlier utopias to modern socialism, bear indeed the distinct mark of this influence.

Herman, E. S., & Chomsky, N. (1988). *Manufacturing consent : The political economy of the mass media* (2002, Edward S. Herman and Noam Chomsky ; with a new introduction by the authors.; Updated ed. of: Manufacturing consent. 1st ed. c1988.; Includes bibliographical references and index. ed.). New York: Pantheon Books.

(1) QUESTION: You write in *Manufacturing Consent* [(Pantheon, 1988)] that it's the primary function of the mass media in the United States to mobilize public support for the special interests that dominate the government and the private sector. What are those interests?
CHOMSKY: Well, if you want to understand the way any society works, ours or any other, the first place to look is who is in a position to make the decisions that determine the way the society functions. Societies differ, but in ours, the major decisions over what happens in the society -- decisions over investment and production and distribution and so on -- are in the hands of a relatively concentrated network of major corporations and conglomerates and investment firms. They are also the ones who staff the major executive positions in the government. They're the ones who own the media and they're the ones who have to be in a position to make the decisions. They have an overwhelmingly dominant role in the way life happens. You know, what's done in the society. Within the economic system, by law and in principle, they dominate. The control over resources and the need to satisfy their interests imposes very sharp constraints on the political system and on the ideological system (Chomsky 1992).

Hess, E. H. (1973). *Imprinting; early experience and the developmental psychobiology of attachment*. New York: Van Nostrand Reinhold Co.

Hector, A., & Bagchi, R. (2007). Biodiversity and ecosystem multifunctionality. Vol 448, 12 July 2007, doi:10.1038/nature05947.

Hindmarch, C., Harris, J., & Morris, S. ((2006). Growth and sustainability: intergrating ecosystem services into economics. Biologist, Volume 53, Number 3, June 2006.

Hume, D. (1739). *A treatise of human nature: Being an attempt to introduce the experimental method of reasoning into moral subjects.*

(1) Our foregoing method of reasoning will easily convince us, that *there can be no demonstrative arguments to prove, that those instances, of which we have had no experience, resemble those, of which we have had experience* (Hume 1739, Book I, Vol I, p 137).

(2) To falsify a knowledge-claim is to provide evidence that it is false. Since the time of David Hume, empiricist philosophy of science has struggled with the problem of induction: namely, how is it possible to justify inference, from a finite set of instances, to the truth of a universal law whose scope is potentially infinite? In the absence of a convincing answer to this question, our everyday and scientific belief in a regular, ordered, and predictable universe must seem to be a physiologically indispensable, but still irrational, habit of mind.

The original approach to this problem pioneered by Karl Popper involved a reasoned rejection of the question itself. Popper accepted that the problem of induction was insoluble, but it did not follow that science was irrational, or that it could not progress. Instead of seeing discovery of the truth as the aim of science, we should, rather, see scientific activity as a systematic attempt to 'falsify'—or refute—bold and imaginative conjectures about the nature of the world. Popper's formulation of this principle is widely acknowledged as one of the most original contributions to the modern philosophy of science[1].

(3) It took a remarkably long time before the novelty of the intellectual situation was grasped. Few realized what had happened. David Hume…saw that a great step forward had been taken, but he did not understand just how great and how radical this advance in human knowledge really was. *I am afraid that even today many people still do not fully understand this* [italics mine] (Popper 1994, p 36).

(4) *The classical notion of science as true, secure and sufficiently justified knowledge still flourishes even today* [italics mine]. But it was overtaken sixty years ago by the Einsteinian Revolution; by Einstein's gravitational theory.

The outcome of this revolution is that Einstein's theory, whether true or false, demonstrates that knowledge in the classical sense, secure knowledge, certainly is impossible. *Kant was right: our theories are free creations of our intellect, which we try to impose upon nature. But we are only rarely successful in guessing the truth; and we can never be certain whether we have succeeded. We must make do with conjectural knowledge* [italics mine] (Popper 1994, p 37).

(5) Hume has permanently influenced the development of the best of philosophers who came after him. *Man has an intense desire for assured knowledge. That is why Hume's clear message seemed crushing* [italics mine] (Einstein 1956 p 21-22).

(6) There is a problem in inference well-known as the problem of induction. It is a problem that has been haunting science for a long time, but hard science has not been as harmed by it as the social sciences, particularly economics, even more the branch of financial economics. (Taleb 2004, p 117)

(7) **THE PROBLEM OF INDUCTION**

According to a widely accepted view… the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called. According to this view, the logic of scientific discovery would be identical with inductive logic, i. e. with the logical analysis of these inductive methods. It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories. Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction. The problem of induction may also be formulated as the question of the validity or the truth of universal statements which are based on experience, such as the hypotheses and theoretical systems of the empirical sciences….

Scientific statements can only attain continuous degrees of probability whose unattainable upper and lower limits are truth and falsity' [Reichenbach, Erkenntnis 1, 1930, p. 186]. At this stage I can disregard the fact that the believers in inductive logic entertain an idea of probability that I shall later reject as highly unsuitable for their own purposes (see section 80, below). I can do so because the difficulties mentioned are not even touched by an appeal to probability. For if a certain degree of probability is to be assigned to statements based on inductive inference, then this will have to be justified by invoking a new principle of induction, appropriately modified. And this new principle in its turn will have to be justified, and so on.

Nothing is gained, moreover, if the principle of induction, in its turn, is taken not as 'true' but only as 'probable'. In short, like every other form of inductive logic, the logic of probable inference, or 'probability logic', leads either to an infinite regress (Popper 1959, pp 31-35).

(8) There is dangerous innocence in the expectation of a future formed on the basis of probability. Any accident to which a human has been subject, however rare, however distant in time, is a possibility we must ready ourselves for (Botton 2000, p 90).

(9) The assumption that *economists* (italics Hayek's) can find predictable solutions to economic problems is undoubtedly the most inhibiting force in… economics. It has led to the increasing isolation of theoretical economists from the day-to-day practitioners of the subject—the actual participants in an economy, the consumers and the producers (Hayek 1991, p 9).

(10) Kant, in his *Critique of Pure Reason*, asserted under the influence of Hume that pure speculation or reason, whenever it ventures into a field in which it cannot possibly be checked by experience, is liable to get involved in contradictions or 'anti-anomies' and to produce what he unambiguously described as 'mere fancies' ; 'nonsense' ; 'illusions' ; 'a sterile dogmatism' ; and 'a superficial pretension to the knowledge of everything' (Popper, 1945, vII, p38).

[1]"falsification" A Dictionary of Sociology. John Scott and Gordon Marshall. Oxford University Press 2005. Oxford Reference Online. Oxford University Press. University of Prince Edward Island. 28 July 2006 <http://www.oxfordreference.com.rlproxy.upei.ca/views/ENTRY.html?subview=Main&entry=t88.e803>

Iceland Review. (2007a). Iceland's cod catch down by 45 percent. *Iceland Review,* http://www.icelandreview.com/icelandreview/Daily_News/?ew_0_a_id=

Ten weeks into the current fishing season, long-line fishing boats have caught 2,000 tons of cod less than during the same period in 2006. The drop in the cod catch totals 45 percent, from 4,912 tons in 2006 to 2,718 this year.

The haddock catch is similar to the catch in 2006, or 5,547 tons, according to preliminary numbers from the Directorate of Fisheries, *Fréttabladid* reports.

Different types of fishing vessels have also experienced a drastic drop in cod fishing; their current catch is only half as much as in 2006, though 450 more tons of haddock have been caught this season, compared to the same period last year.

Iceland Review. (2007b). Iceland most desirable country to live in. http://www.icelandreview.com/icelandreview/Daily_News/?ew_0_a_id=

Iceland is the world's most desirable country to live in, according to an annual index on human development published by the UN Development Program yesterday, based on factors like life expectancy, education levels and real per capita income.

Iceland knocked Norway off its throne, which has been rated as the most desirable country to live in for the past six years, *transworldnews.com* reports. Norway currently ranks second, followed by Australia, Canada and Ireland. Sub-Saharan Africa is at the other end of the scale with Sierra Leone as the least desirable country to live in.

Institute of Island Studies. (1998). *Competing strategies of socio-economic development for small islands*. Charlottetown, P.E.I.: Institute of Island Studies, University of Prince Edward Island.

Jarvie, I. C., & Pralong, S. (1999). *Popper's open society after fifty years*. London ; New York: Routledge. http://rlproxy.upei.ca/login?url=http://site.ebrary.com.rlproxy.upei.ca/lib/upei/Doc?id=10017068

(1) In intellectual circles Popper was very much admired. But because The Open Society and Its Enemies was hostile to so much academic pretension it was treated less than respectfully by those in the various specialties upon whose turf it trod (p 6).

(2) In 1950, Popper went to Harvard to deliver the prestigious William James lectures. During his time in the States he appears to have given a talk at the University of Chicago, where Strauss taught. Strauss told Voegelin that the talk "was very bad," "the most washed-out, lifeless positivism" (Emberly and Cooper 1993: 67), and inquired of his opinion of Popper. Voegelin replied with a vicious letter. He reports having reluctantly read Popper because so many people insist his Open Society is a masterpiece. His judgment is that the book is "impudent, dilettantish crap. Every single sentence is a scandal . . ." (ibid.). Noting that Popper takes the concept of open society from Bergson, he comments that Bergson did not develop it "for the sole purpose that the coffeehouse scum might have some-thing to botch." Voegelin believed that Bergson would have thought that "Popper's idea of the open society is ideological rubbish" (ibid.). Voegelin is only just getting started. He accuses Popper of "impertinent disregard for the achievements in this particular problem area [the history of political thought]" (Emberly and Cooper 1993: 68) and of being unable to reproduce accurately the ideas of Plato and Hegel. Popper is "a primitive ideological brawler." Voegelin then strings more epithets together, "a failed intellectual," "rascally impertinent, loutish; in terms of technical competence as a piece in the history of thought, it is dilettantish, and as a result is worthless" (Emberley and Cooper 1993: 67). The reader astonished at this undignified diatribe needs to remember that in the book in question Popper is vehement about the duty to think for oneself and not to defer to the authority of experts. Strauss and Voegelin agree on the opposite, and on the duty of the enlightened elite to defend standards. Strauss had said he was willing to keep Voegelin's remarks to himself. Voegelin concludes: "It would not be suitable to show this letter to the unqualified. Where it concerns its factual contents, I would see it as a violation of the vocational duty you identified, to support this scandal through silence" (Emberly and Cooper 1993: 69). Following this invitation, Strauss showed the letter to Kurt Riezler, "who was thereby encouraged to throw his not inconsiderable influence into the balance against Popper's probable appointment here [in the US]. You thereby helped to prevent a scandal." With hindsight one might think that the scandal is that someone who had dared to challenge the traditional Germanic learning, the worship of the great men, the enemies of science and Enlightenment, is not met out in the open with argument, but is disposed of behind the scenes, as quietly as possible, by the self-righteous use of power.

(3) In a June 17, 1996 article by Richard Lacayo, *Time* magazine named the late University of Chicago philosopher Leo Strauss (1899-1973) as one of the most influential and powerful figures in Washington, D.C.—the man most responsible for the Newt Gingrich "Conservative Revolution" on Capitol Hill, and the intellectual godfather of [Gingrich's] "Contract on America".

If Strauss' influence on politics in the capital of the most powerful nation on Earth was awesome in 1996, it is even more so today. The leading "Straussian" in the Bush Administration is Deputy Defense Secretary Paul Wolfowitz, who was trained by Strauss' alter-ego and fellow University of Chicago professor Allan Bloom. Wolfowitz leads the "war party" within the civilian bureaucracy at the Pentagon, and his own protégé, I. Lewis "Scooter" Libby, is Vice President Dick Cheney's chief of staff and chief national security aide, directing a super-hawkish "shadow national security council" out of the Old Executive Office Building, adjacent to the White House. According to Bloom biographer Saul Bellow, the day that President George H.W. Bush rejected Wolfowitz and Cheney's demand that U.S. troops continue on to Baghdad, during Operation Desert Storm in 1991, Wolfowitz called Bloom on his private phone line to bitterly complain. It seems that "Bush 41" was not enough of a Nietzschean "superman" for Wolfowitz's taste....

On March 3, in a widely circulated radio interview on the Jack Stockwell Show in Salt Lake City (see EIR, March 14), Lyndon LaRouche had singled out Strauss as one of the leading intellectual figures... steering the United States into a disastrous replay of the Peloponnesian War, which led to the collapse of Athens. Within days of the LaRouche interview, Leo Strauss was the subject of a

series of public attacks, in the German, French and American media… for his role in producing the current generation of neo-conservatives.

Indeed, author Shadia B. Drury, in her 1997 book, *Leo Strauss and the American Right*, named the following prominent Washington players as among Strauss' protégés: Paul Wolfowitz; Supreme Court Justic Clarence Thomas; Judge Robert Bork; [neo-conservative] propagandist and former Dan Quayle chief of staff, William Kristol; former Secretary of Education William Bennett; the National Review publisher William F. Buckley; former Reagan Administration official Alan Keyes; current White House bio-ethics advisor Francis Fukuyama; Attorney General John Ashcroft; and William Galston, former Clinton Administration domestic policy advisor, and co-author, with Elaine Kamark, of the Joe Lieberman-led Democratic Leadership Council's policy blueprint.

Earlier Strauss allies and protégés in launching the post-World War II neo-conservative movement were Irving Kristol, Norman Podhoretz, Samuel Huntington, Seymour Martin Lipset, Daniel Bell, Jeane Kirkpatrick, and James Q. Wilson….

The hallmark of Strauss' approach to philosophy was his hatred of the modern world, his belief in a totalitarian system, run by "philosophers," who rejected all universal principles of natural law, but saw their mission as absolute rulers, who lied and deceived a foolish "populist" mass, and used both religion and politics as a means of disseminating myths that kept the general population in clueless servitude. For Strauss and all of his protégés (Strauss personally had 100 Ph.D. students, and the "Straussians" now dominate most university political science and philosophy departments), the greatest object of hatred was the United States itself (Steinberg 2003).

(4) In Germany and Austria Popper's vocabulary became standard in the attempt to build a philosophy for the democracies of those countries. Some German philosophers (but only some), and influential members of the intellectual and political class, took Popper's ideas for common currency, showering him with public honor and recognition. Translations into all the main European languages ensured a wide currency for the ideas. It might be only a slight exaggeration to say that Popper is a philosophical icon for the European Union's liberals. Equally important, though less obvious, was Popper's impact in totalitarian areas of Europe, From Spain and Portugal, through Eastern Europe to the USSR and to China, his works were spread in translation and samizdat publication as a fulcrum of intellectual resistance to the official ideology. After the fall of the Eastern European empire of the USSR in 1989, there was much need to build free and democratic institutions, and to reintroduce notions of freedom of thought, critical thinking, and intellectual inquiry in the former Soviet bloc countries. Popper was one of the few Western philosophers whose ideas were of sufficient scope amd depth to be applied to the task of linking free inquiry, free communication, freedom to enter and exit, with openness and freedom in politics. George Soros, the American billionaire of Hungarian origin who had encountered Popper's ideas during studies at the LSE, set up a network of philanthropic institutions in the region - aptly called "Open Society Foundations" - to put into practice Popper's ideas, by encouraging critical thinking in education, and by contributing to the development of an active, lively, civil society. In addition, Soros set up the Central European University (CEU) in Prague and then Budapest, to provide, among other things, an intellectual training ground for these ideas (p 8).

(5) Yes, despite all this I remain an optimist toward the world. It is one's duty to be an optimist. Only from this point of view can one be active and do what one can. If you are a pessimist, you have given up. We must remain optimists, we have to look at the world from the point of view of how beautiful it is, and to try to do what we can to make it better (p 48).

Jefferson, Thomas. (1776). The Declaration of Independence, http://www.archives.gov/national-archives-experience/charters/declaration_transcript.htmlU.S.C.

Kahneman, D., Slovic, P., & Tversky, A. (1982). *Judgment under uncertainty : Heuristics and biases*. Cambridge ; New York: Cambridge University Press.

Kirzner, I. M. (2006). *The austrian economists: Lifetime achievement award to professor israel M. kirzner.* Retrieved 10/31/2007, 2007, from http://austrianeconomists.typepad.com/weblog/2006/11/lifetime_achiev.html

During my fifteen years as Mises' students, I learned many lessons from him. And I learned even more lessons by painstakingly studying his published writings over the decades. As you may know, although I consider myself a disciple of Mises in economic theory, I have never subscribed to the overarching philosophical system within which Mises saw his economics as occupying the central place.

Yet, perhaps the most important lesson, which I have learned from Mises, was a lesson located outside economics itself. What Mises taught us in his writings, in his lectures, in his seminars, and in perhaps everything he said, was that economics—yes, and I mean sound economics, Austrian economics—is primordially, crucially important. Economics is not an intellectual game. Economics is deadly serious. The very future of mankind—of civilization—depends, in Mises' view, upon widespread understanding of, and respect for, the principles of economics.

This is a lesson, which is located almost entirely outside economics proper. But all Mises' work depended ultimately upon this tenet. Almost invariably, a scientist is motivated by values not strictly part of the science itself. The lust for fame, for material rewards—even the pure love of truth—these goals may possibly be fulfilled by scientific success, but are themselves not identified by science as worthwhile goals. What drove Mises, what accounted for his passionate dedication, his ability calmly to ignore the sneers of, and the isolation imposed by, academic contemporaries, was his conviction that the survival of mankind depends on the development and

dissemination of Austrian economics….

Austrian economics is not simply a matter of intellectual problem solving, like a challenging crossword puzzle, but literally a matter of the life or death of the human race…

Kuang, W., & Bloxham, J. (1997). *An earth-like numerical dynamo model.* Retrieved 11/12/2007, 2007, from http://www.nature.com.rlproxy.upei.ca/nature/journal/v389/n6649/abs/389371a0.html

The mechanism by which the Earth and other planets maintain their magnetic fields against ohmic decay is among the longest standing problems in planetary science. Although it is widely acknowledged that these fields are maintained by dynamo action, the mechanism by which the dynamo operates is in large part not understood. Numerical simulations of the dynamo process in the Earth's core have produced magnetic fields that resemble the Earth's field, but it is unclear whether these models accurately represent the extremely low values of viscosity believed to be appropriate to the core. Here we describe the results of a numerical investigation of the dynamo process that adopts an alternative approach to this problem in which, through the judicious choice of boundary conditions, the effects of viscosity are rendered unimportant. We thereby obtain a solution that at leading order operates in an Earth-like dynamical regime. The morphology and evolution of the magnetic field and the fluid flow at the core–mantle boundary are similar to those of the Earth, and the field within the core is qualitatively similar to that proposed on theoretical grounds.

Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago: University of Chicago Press.

"Philosophies like Kuhn's narrow the possible futures of inquiry by politically methodizing and taming them."—William R. Everdell, *Washington Times* (Fuller 2003, Dust Jacket).

The Structure of Scientific Revolutions by Thomas Kuhn was the most influential book on the nature of science in the second half of the 20th century – and arguably, the entire 20th century. Nevertheless, a reminder of the book's contents immediately makes this fact rather surprising. *Structure* purports to provide a general account of scientific change in 200 non-technical, lightly referenced pages, in the manner of an extended encyclopaedia entry, as the book was in fact originally conceived (Fuller 2003, pp18-19).

For Kuhn, science is simply good at solving its self-defined problems, whose purely technical nature led him to dub them 'puzzles'. But far from demoting the physical sciences, Kuhn was actually trying – as a latter-day Plato might – to insulate them from responsibility for real world effects, entanglement in which has historically prevented the social and biological science from taking full control of their inquiries (Fuller 2003, p69).

Kurlansky, M. (1997). *Cod : A biography of the fish that changed the world*. New York: Walker and Co.

(1) Only a decade after reassuring the Canadians and the world that the waters around Great Briain "show no sign of exhaustion," such a thing being scientificially impossible, the British discovered that the cod stocks in the North Sea had been depleted (Kurlansky 1997, p 144).

Lane, N. (2007). Reading the book of death. Nature, Vol 448, July 2007.

Studies of mass extinctions tend to emphasize the sheer scope of the carnage. But the subtle differences b3tween the species that died and the that survived vcan be crucial.

Lane, A. *Globalization: Stiglitz's case.* Retrieved 10/25/2007, 2007, from http://www.arlindo-correia.com/globalization_stiglitzs_case.html#Globalisation

Moore, M. (2007). *Sicko* (Widescreen ed.). New York, N.Y.: Weinstein Company : Distributred by Genius Products.
Michael Moore interviews Americans who have been denied treatment by the United States health care insurance companies -- companies who sacrifice essential health services in order to maximize profits. Sheds light on the how complicated it can become for communities and individuals, and the sacrifices they have made when they are denied health care coverage.

Larson, E. J. (2004). *Evolution : The remarkable history of a scientific theory* (Modern Library ed.). New York: Modern Library.

Laskar, J. (1990). The chaotic motion of the solar system: A numerical estimate of the size of the chaotic zones. *Icarus, 88*(2), 266-291.

Laxness, Halldór. (1946). *Independent people : An epic* [Sjálfstætt fólk.] . New York: A. A. Knopf.
"…are the small freeholders of the Icelandic countryside--operators of the one-man, one-family farm got by inheritance or puchase and held with grim tenacity against all connivances of nature and man by folk whose ruling passion is to be their own masters on their own acres." [Dust jacket]

Laxness, Halldór. (1955). *Nobel banquet speech, stockholm, december 10, 1955*. Retrieved 10/15/2007, 2007, from http://nobelprize.org/nobel_prizes/literature/laureates/1955/laxness-speech-e.html

I was travelling in the south of Sweden a few weeks ago, when I heard the rumour that the choice of the Swedish Academy might possibly fall on me. Alone in my hotel room that night, I naturally began to ask myself what it would mean to a poor wanderer, a writer from one of the most remote islands in the world, to be suddenly singled out by an institution famous for its promotion of

culture, and brought here to the platform by its command.

It is not so strange perhaps that my thoughts turned then - as they still do, not least at this solemn moment - to all my friends and relations, to those who had been the companions of my youth and are dead now and buried in oblivion. Even in their lifetime, they were known to few, and today they are remembered by fewer still. All the same they have formed and influenced me and, to this day, their effect on me is greater than that of any of the world's great masters or pioneers could possibly have been. I am thinking of all those wonderful men and women, the people among whom I grew up. My father and mother, but above all, my grandmother, who taught me hundreds of lines of old Icelandic poetry before I ever learned the alphabet.

In my hotel room that night, I thought - as I still do - of the moral principles she instilled in me: never to harm a living creature; throughout my life, to place the poor, the humble, the meek of this world above all others; never to forget those who were slighted or neglected or who had suffered injustice, because it was they who, above all others, deserved our love and respect, in Iceland or anywhere in the world. I spent my entire childhood in an environment in which the mighty of the earth had no place outside story books and dreams. Love of, and respect for, the humble routine of everyday life and its creatures was the only moral commandment which carried conviction when I was a child.

I recall my friends whose names the world never knew but who, in my youth, and long into my adult life, guided my literary work. Though no writers themselves, they nevertheless possessed infallible literary judgment and were able, better than most of the masters, to open my eyes to what was essential in literature. Many of those gifted men are no longer with us, but they are so vivid in my mind and in my thoughts that, many a time, I would have been hard put to distinguish between which was the expression of my own self and which the voice of my friends within me.

I am thinking, too, of that community of one hundred and fifty thousand men and women who form the book-loving nation that we Icelanders are. From the very first, my countrymen have followed my literary career, now criticizing, now praising my work, but hardly ever letting a single word be buried in indifference. Like a sensitive instrument that records every sound, they have reacted with pleasure or displeasure to every word I have written. It is a great good fortune for an author to be born into a nation so steeped in centuries of poetry and literary tradition.

My thoughts fly to the old Icelandic storytellers who created our classics, whose personalities were so bound up with the masses that their names, unlike their lives' work, have not been preserved for posterity. They live in their immortal creations and are as much a part of Iceland as her landscape. For century upon dark century those nameless men and women sat in their mud huts writing books without so much as asking themselves what their wages would be, what prize or recognition would be theirs. There was no fire in their miserable dwellings at which to warm their stiff fingers as they sat up late at night over their stories. Yet they succeeded in creating not only a literary language which is among the most beautiful and subtlest there is, but a separate literary genre. While their hearts remained warm, they held on to their pens.

As I was sitting in my hotel room in Skåne, I asked myself: what can fame and success give to an author? A measure of material well-being brought about by money? Certainly. But if an Icelandic poet should forget his origin as a man of the people, if he should ever lose his sense of belonging with the humble of the earth, whom my old grandmother taught me to revere, and his duty toward them, then what is the good of fame and prosperity to him?

Your Majesties, ladies and gentlemen - It is a great event in my life that the Swedish Academy should have chosen to link my name with the nameless masters of sagas. The reasons the Academy has given for singling me out in so spectacular a manner will serve as an encouragement to me for the rest of my days, but they will also bring joy to those whose support has been responsible for all that my work may have of value. The distinction you have conferred on me fills me with pride and joy. I thank the Swedish Academy for all this with gratitude and respect. Though it was I who today received the Prize from Your Majesty's hands, nevertheless I feel that it has also been bestowed on my many mentors, the fathers of Iceland's literary tradition.

Lippmann, W. (1922). *Public opinion* (1965th ed.). New York: Free Press.

Lorius, C., Jouzel, J., Raynaud, D., Hansen, J. & Le Treut, H. (1990). *The ice-core record: Climate sensitivity and future greenhouse warming.* Retrieved 11/12/2007, 2007, from http://www.nature.com.rlproxy.upei.ca/nature/journal/v347/n6289/abs/347139a0.html The prediction of future greenhouse-gas-induced warming depends critically on the sensitivity of Earth's climate to increasing atmospheric concentrations of these gases. Data from cores drilled in polar ice sheets show a remarkable correlation between past glacial–interglacial temperature changes and the inferred atmospheric concentration of gases such as carbon dioxide and methane. These and other palaeoclimate data are used to assess the role of greenhouse gases in explaining past global climate change, and the validity of models predicting the effect of increasing concentrations of such gases in the atmosphere.

Lovelock, J., & Whitfield, M. (1982). *Life span of the biosphere.* Retrieved 11/12/2007, 2007, from http://www.nature.com.rlproxy.upei.ca/nature/journal/v296/n5857/abs/296561a0.html

There has been life on Earth for at least 3,500 Myr but the assumption that a comparable future lies ahead may not be justified. Main sequence stars appear to increase their burning rate as they age. Thus the Sun, if a typical star, can be predicted to have increased its output by 30% since the Earth's origin 4,500 Myr ago[1]. The maintainance of an equable climate since life began probably required some means of planetary thermo-stasis. The Gaia hypothesis proposed by Lovelock and Margulis[2] included an unspecified biological means for climate control. Walker *et al*.[3] suggests an abiological automatic thermostasis in which the atmospheric abundance of CO_2, a greenhouse gas, adjusts to resist the warming tendency of the increased solar flux. Here we discuss possible links between the

biological and geological control mechanisms. It is clear that whatever the mechanism, atmospheric CO^2 is now close to its lower limit of partial pressure, so the biosphere may soon, in geological terms, be exposed without protection to the predicted progressive increase of solar luminosity**.**

Mackay, C. (1967). *Extraordinary popular delusions and the madness of crowds. with facsim. title pages and reproductions of original illus. from the editions of 1841 and 1852*. Wells, N.J.: Fraser Publ. Co.

Magnússon, M. (2003). The vinland sagas: The norse discovery of america. *Penguin classics* [Graenlendinga Saga] (M. Magnússon, H Pálsson Trans.). (November 2003 POSTSCRIPT to The Vinland Sagas : the Norse discovery of America, 1965 ed., pp. 125). London: Penguin Books.

This edition allows me to pay tribute to my friend, collaborator and mentor Hermann Pálsson (1921-2002), Professor Emeritus of Icelandic Studies at the University of Edinburgh, who died after an accident in Bulgaria. He was one of the most eminent and erudite Icelandic scholars of his generation, and did an enormous amount to illuminate the Icelandic Sagas for the English-speaking world.

Herman was born on a farm in the north of Iceland, the sixth child in a family of twelve. He earned a degree in Icelandic studies at the University of Iceland (1943-7), and an honours degree in Celtic studies at teh University College, Dublin in 1950, which gave him a significant insight into Irish influences on Norse literature which few specialists in Icelandic could boast at the time. As a young lecturer at Edinburgh University in the 1950's he created a centre of excellence for Norse studies which became a magnet for students and the envy of many other institutions….

On one of the last occasions we were together, we found that our thoughts on the Vinland Sagas had been coalescing: we had come to believe that 'Vinland' had never existed as a precise geographical location in North America. The name itself--'Vinland the Good'--carries too many overtones of romance and fable: fables of the Hesperides, of the Fortunate Isles… 'Vinland the Good' smacks much more of a wistful and wishful concept that of a geographical reality. To the Norse explorers, *Vinland was always somewhere beyond the next horizon--tantalizingly near, but always just out of reach* [italics mine, pp 125-126].

Magnússon, M., & Pálsson, H. (*c.* 1000 A.D.a). Eirik's saga. *Penguin classics*(M. Magnússon, H Pálsson Trans.). (The Vinland sagas : the Norse discovery of America, 1965 ed., pp. 75). London: Penguin Books.

Then Bjarni said that *the people who were to go should be chosen by lot, and not by rank* [italics mine].

But everyone tried to get into the boat. The boat, however, would not hold them all and so they agreed to this suggestion… When the lots were drawn it so happened that Bjarni himself, along with nearly half the crew, drew a place, and these all left the ship for the boat.

When they were in the boat one young Icelander who had been Bjarni's companion said, 'Are you going to leave me here, Bjarni?'

'This is how it has to be,' replied Bjarni.

The Icelander said, 'But that is not what you promised when I left my father's farm in Iceland to go with you.'

'I see no other way,' said Bjarni. 'What do you suggest?'

'I suggest we change places; you come up here and I shall go down there.'

'So be it,' said Bjarni. 'I can see that you would spare no effort to live, and are afraid to die.'

So they changed places. The Icelander stepped into the boat and Bjarni went back on board the ship; and it is said that Bjarni and all those who were on the ship with him perished (pp 103-104).

Magnússon, M., & Pálsson, H. (*c.* 1000 A.D.b). The greenland saga. *Penguin classics* [Graenlendinga Saga] (M. Magnússon, H Pálsson Trans.). (The Vinland sagas : the Norse discovery of America, 1965 ed., pp. 123). London: Penguin Books.

(1) A great swarm of skin-boats was then heading towards them down the fjord.

Thorvald said, 'We shall set up breastworks on the gunwales and defend ourselves as best we can, but fight back as little as possible.'

They did this. The Skraelings[1] shot at them for a while, and then turned and fled as fast as they could.

Thorvald asked his men if any of them were wounded; they all replied that they were unhurt.

'I have a wound in the armpit,' said Thorvald. "An arrow flew up between the gunwale and my shield, under my arm--here it is. This will lead to my death.'

'I advise you now to go back as soon as you can. But first I want you to take me to the headland I thought so suitable for a home. I seem to have hit on the truth when I said that I would settle there for a while. Bury me there and put crosses at my head and feet, and let the place be called Krossaness for ever afterwards' (pp 60-61).

(2) *He made an agreement with his crew that everyone should share equally in whatever profits the expedition might yield* [italics mine]….

They put to sea and arrived safe and sound at Leif's Houses [Vinland, possibly present day Newfoundland] and carried their hammocks ashore. Soon they had plenty of good supplies, for a fine big rorqual was driven ashore; they went down and cut it up, and so there was no shortage of food….

The livestock were put out to grass…. *They made use of all the natural resources of the country that were available, grapes and game of all kinds and other produce* [italics mine] (p 65).

[1]The term Skrailing was used in early Icelandic sources to designate the inhabitants of Greenland and North America. The Skrailings of Vinland have been tentatively identified with the Micmac or extinct Beothuk Native American tribes. The derivation of the word is uncertain, but is has contemptuous associations--something like 'wretches'.

Malhotra, R. (1994). Nonlinear resonances in the solar system. *Physica D: Nonlinear Phenomena, 77*(1-3), 289-304.

Orbital resonances are ubiquitous in the Solar system. They play a decisive role in the long term dynamics, and in some cases the physical evolution, of the planets and of their natural satellites, as well as the evolution of small bodies (including dust) in the planetary system. The few-body gravitational problem of hierarchical planetary-type systems allows for a complex range of dynamical timescales, from the fast orbital periods to the very slow orbit precession rates. The interaction of fast and slow degrees of freedom produces a rich diversity of resonance phenomena. Weak dissipative effects - such as tides or radiation drag forces - also produce unexpectedly rich dynamical behaviors. This paper provides a mostly qualitative discussion of simple dynamical models for the commonly encountered orbital resonance phenomena in the Solar system.

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7. *Logic*. a. The process of inferring a general law or principle from the observation of particular instances (opposed to DEDUCTION, q.v.).
[Directly representing L. *inductio* (Cicero), rendering Gr. (Aristotle), in same sense.] 1553 T. WILSON *Rhet. 111 We mighte heape many men together, and prove by large rehersall, any thyng that we would, the whiche of the logicians is called induction. 1613 PURCHAS Pilgrimage (1614) Ep. Ded. iii, Others may hence learne by that most laborious, though not most learned Argument of Induction, two lessons fitting these times. 1656 STANLEY Hist. Philos. v. (1701) 182/1 Induction is every method of reason which proceedeth either from like to like or from singulars to generals. 1734 BERKELEY Analyst §19 You must take up with Induction, and bid adieu to Demonstration. 1812-16 PLAYFAIR Nat. Phil. I. 2 It is from induction that all certain and accurate knowledge of the laws of nature is derived. a*1862 BUCKLE *Misc.Wks. I. 41 Logic, considered as a science, is solely concerned with induction; and the business of induction is to arrive at causes. 1876 FOWLER Induct. Logic (ed. 3) Pref., Induction..may or may not employ hypothesis, but what is essential to it is the inference from the particular to the general, from the known to the unknown.*

*b. An act or instance of induction; the result of this; a conclusion derived from induction; formerly used in the wider sense of 'inference'. c*1440 J. CAPGRAVE *Life St. Kath. v. 1923 The hill in whiche god af the wrytyn lawe On-to the Iewes, ledeth to that perfeccyon Of crystis gospell..Paule in*

*his bookis maketh swyche induccyon; He seyth it longeth to Ierusalem as in seruageWith alle his children heere in pylgremage. c*1530 L. COX *Rhet. (1899) 49 He treateth of the fourme of Sillogismes, Enthimemes and Inductions. 1587 GOLDING De Mornay xxvi. 396We would haue [God] to vse Inductions as Plato doth, or Syllogismes as Aristotle doth. 1697 tr. Burgersdicius his Logic II. xi. 46 In an induction..it's proved that animals void of bile are long-liv'd, because a man, a horse, an ass, &c., are long-liv'd. 1727-41 CHAMBERS Cycl. s.v., The conclusion of a syllogism, is an induction made from the premises. 1833 H. MARTINEAU Briery Creek iv. 86 They look..into the evidence of circumstance, and learn to make an induction for themselves. 1868 W. R. GREG Lit. & Social Judgm. 313 The contrast between his wide inductions and the apparently flimsy foundation on which they are made to rest. 1869 FOWLER Induct. Logic i. 1 [This] is an inference of that particular character which is called an Inductive Inference or an Induction***.***

Online etymology dictionary. Retrieved 11/21/2007, 2007, from http://www.etymonline.com/index.php?term=economy

Plato. (circa 360 B.C.). *The republic*(J. Adam Trans.). (2d , ed.). Cambridge, UK: At the University Press.

(1) The wise shall lead and rule, and the ignorant shall follow. [Plato, Laws, 690 b, Popper 1945, Vol. I, p 120].

(2) "Lies are necessary, Plato asserts, 'if your herd is to reach highest perfection' ; for this needs 'arrangements that must be kept secret from all butt the rulers, if we wish to keep the herd of guardians really free from disunion'. Furthermore, Plato "decrees that the rulers should fabricate, for the purpose of mating the young auxiliaries, 'an ingenious system of balloting, so that the persons who have been disappointed .. may blame their bad luck, and not the rulers', who are, secretly, to engineer the ballot" (Ibid, p 150).

(3) "Plato had used the term 'banausic' to describe a plebeian, abject, or depraved state of mind. Aristotle extends the disparaging use of the term so as to cover all interests which are not pure hobbies. In fact, his use of the term is very near to our use of the term 'professional', more especially in the sense in which it disqualifies in an amateur competition, but also in the sense in which it applies to any specialized expert, such as a physician. For Aristotle, every form of professionalism means a loss of caste. A feudal gentleman, he insists, must never take too much interest in 'any occupation, art or science… There are also some *liberal arts*, that is to say, arts which a gentleman may acquire, but always only to a certain degree. For if he takes too much interest in them, then these evil effects will follow', namely, he will become proficient, like a professional, and lose caste" (Popper 1945, Vol. II, pp 3-4).

(4) "Aristotle's thought is entirely dominated by Plato's. Somewhat grudgingly, he followed his great teacher as closely as his temperament permitted, not only in his general political outlook but practically everywhere. So he endorsed, and systematized, Plato's naturalistic theory of slavery : 'Some men are by nature free, and others slaves and for the later, slavery is fitting as well as just… A man who is by nature not his own, but another's, is by nature a slave… Hellenes do not like to call themselves slaves, but confine this term to barbarians… The slave is totally devoid of any faculty of reasoning', while free women have just a very little of it. (We owe to Aristotle's criticisms and denunciations most of our knowledge of the Athenian movement against slavery. By arguing against the fighters for freedom, he preserved some of their utterances.)" (Ibid p 3).

Popper, K. R. (1945). *The open society and its enemies*. London: G. Routledge & Sons, Ltd.

(1) The development of thought since Aristotle could, I think, be summed up by saying that every discipline, as long as it used the Aristotelian method of definition, has remained arrested in a state of empty verbiage and barren scholasticism, and that the degree to which the various sciences have been able to make any progress depended on the degree to which they have been able to get rid of this essentialist method. (this is why so much of our 'social science' still belongs to the Middle Ages.) This discussion of this method will have to be a little abstract, owing to the fact that the problem has been so thoroughly muddled by Plato and Aristotle, whose influence has given rise to such deep-rooted prejudices that the prospect of dispelling them does not seem very bright. (Popper 1945, Vol. II, p 9).

Popper, K. R. (1956). ON THE NON-EXISTENCE OF SCIENTIFIC METHOD. (preface from 1956 edition, Vol. I of the Postscript to 1983 edition of The Logic of Scientific Discovery edited by W.W. Bartley III ed.,). London: Routledge.

(1) But in fact, we know nothing from having seen it; for the truth is hidden in the deep.
-DEMOCRITUS

(2) Scientific Method holds a somewhat peculiar position in being even less existent than some other non-existent subjects.
What I mean is this. The founders of the subject, Plato, Aristotle, Bacon and Descartes, as well as most of their successors, for example John Stuart Mill, believed that there existed a method of finding scientific truth. In a later and slightly more sceptical perioud there were methodologists who believed that there existed a method, if not of finding a true theory, then at least of ascertaining whether or not some given hypothesis was true; or (even more sceptical) whether some given hypothesis was at least 'probable' to some ascertainable degree.
I assert that no scientific method exists in any of these three senses. To put it in a more direct way:

(i) There is no method of discovering a scientific theory.
(ii) There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.
(iii) There is no method of ascertaining whether a hypothesis is 'probable', or probably true.

(pp 5-6).

Popper, K. R. (1959). *The logic of scientific discovery* [Logik der Forschung, 1935, Vienna, Austria] . London ; New York: Routledge.

(1) This is the book where Popper first introduced his famous "solution" to the problem of induction. Originally publish in German in 1934, this version is Popper's own English translation undertaken in the 1950s. It should go without saying that the book is a classic in philosophic epistemology--perhaps the most important such work to appear since Hume's "*An Enquiry Concerning Human Understanding*." Popper argues that scientific theories can never be proven, merely tested and corroborated. Scientific inquiry is distinguished from all other types of investigation by its testability, or, as Popper put, by the falsifiability of its theories. Unfalsifiable theories are unscientific precisely because they cannot be tested (Nyquist, 2001).

(2) There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these . . . laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience' (Popper 1959, p 37).

(3) Scientific discovery must ever depend upon some happy thought, of which we cannot trace the origin; — some fortunate cast of intellect rising above all rules. No precepts will elevate a man of ordinary endowments to the level of a man of genius: nor will an inquirer of truly inventive mind need to come to the teacher of inductive philosophy to learn how to exercise the faculties which nature has given him. [Whewell 1849, reprinted under the title 'Mr Mill's Logic' in Butts 1968], p. 117).

(4) The initial stage, the act of conceiving or inventing a theory, seems to me neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man—whether it is a musical theme, a dramatic conflict, or a scientific theory—may be of great interest to empirical psychology; but it is irrelevant to the logical analysis of scientific knowledge. This latter is concerned not with questions of fact (Kant's quid facti?), but only with questions of justification or validity (Kant's quid juris?). Its questions are of the following kind. Can a statement be justified? And if so, how? Is it testable? Is it logically dependent on certain other statements? Or does it perhaps contradict them? In order that a statement may be logically examined in this way, it must already have been presented to us. Someone must have formulated it, and submitted it to logical examination.
Accordingly I shall distinguish sharply between the process of conceiving a new idea, and the methods and results of examining it logically. As to the task of the logic of knowledge—in contradistinction to the psychology of knowledge—I shall proceed on the assumption that it consists solely in investigating the methods employed in those systematic tests to which every new idea must be subjected if it is to be seriously entertained.

Some might object that it would be more to the purpose to regard it as the business of epistemology to produce what has been called a 'rational reconstruction' of the steps that have led the scientist to a discovery—to the finding of some new truth. But the question is: what, precisely, do we want to reconstruct? If it is the processes involved in the stimulation and release of an inspiration which are to be reconstructed, then I should refuse to take it as the task of the logic of knowledge. Such processes are the concern of empirical psychology but hardly of logic. It is another matter if we want to reconstruct rationally the subsequent tests whereby the inspiration may be discovered to be a discovery, or become known to be knowledge. In so far as the scientist critically judges, alters, or rejects his own inspiration we may, if we like, regard the methodological analysis undertaken here as a kind of 'rational reconstruction' of the corresponding thoughtprocesses. But this reconstruction would not describe these processes as they actually happen: it can give only a logical skeleton of the procedure of testing. Still, this is perhaps all that is meant by those who speak of a 'rational reconstruction' of the ways in which we gain knowledge.

It so happens that my arguments in this book are quite independent of this problem. However, my view of the matter, for what it is worth, is that there is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition', in Bergson's sense. In a similar way Einstein speaks of the 'search for those highly universal laws . . . from which a picture of the world can be obtained by pure deduction. There is no logical path', he says, 'leading to these . . . laws. They can only be reached by intuition, based upon something like an intellectual love ('Einfühlung') of the objects of experience.' (Popper 1959, pp 7-9)

(5) (a) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start. Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.
(b) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.
(c) If a proposed solution is refuted through our criticism we propose another solution.
(d) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.
(e) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.
(f) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism – the logical contradiction – is objective

(Popper 1992, pp. 66-67).

(6) It is often difficult enough for the expert, and certainly in many instances impossible for the layman, to distinguish between legitimate and illegitimate claims advanced in the name of science.... If we are to safeguard the reputation of science, and to prevent the arrogation of knowledge based on a superficial similarity of procedure with that of the physical sciences, much effort will have to be directed toward debunking such arrogations, some of which have by now become the vested interests of established university departments. We cannot be grateful enough to such modern philosophers of science as Sir Karl Popper for giving us a test by which we can distinguish between what we may accept as scientific and what not - a test which I am sure some doctrines now widely accepted as scientific would not pass (F.A. Von Hayek, *Nobel Lecture*, 1974).

(7) Emile Zola described a work of art as a corner of nature seen through a temperament. The philosopher Karl Popper, the economist F.A. Hayek, and the art historian K. H. Gombrich have shown that the creative process in science and art consists of two main activities: an imaginative jumping forward to a new abstraction or simplified representation, followed by a critical looking back to see how nature appears in the light of the new vision (Peter Mitchell, *Nobel Banquet Speech*, 1978).

(8) My characteristics as a scientist stem from a non-conformist upbringing, a sense of being something of an outsider, and looking for different perceptions in everything from novels, to art to experimental results. I like complexity, and am delighted by the unexpected. Ideas interest me. I was influened early on by reading Arthur Koestler and Edward de Bono, and more recently by the writings of Karl Popper... (Peter C. Doherty, *Nobel Lecture*, 1996).

(9) Popper believed the "discovery was not a matter of logic" but rather the application of methodology, which fits the discovery of cointegration. This insight intrigues me... (Clive Granger, *Nobel Lecture*, 2003).

Popper, K. R. (1962). *Conjectures and refutations : The growth of scientific knowledge* (First Edition Preface from the 1963 Routledge edition ed.)

The essays and lectures of which this book is composed are variations upon one very simple theme--the thesis that we can learn from our mistakes. They develop a theory of knowledge and of its growth. It is a theory of reason that assigns to rational arguments the modest and yet important role of criticizing our often mistaken attempts to solve our problems... Though it stresses our fallibility it does not resign itself to skepticism, for it also stresses the fact that knowledge can grow, and that science can progress - just because we can learn from our mistakes (xi)

Popper, K. R. (1963). *Conjectures and refutations : The growth of scientific knowledge* (Originally published: 5th ed., rev. London ; New York : 2002. ed.). London ; New York: Routledge Classics.

This problem had been seen and solved long before; first, it appears, by Xenophanes, and then by Democritus, and by Socrates... The solution lies in the realization that all of us may and often do err, singly and collectively, but that this very idea of error and human fallibility involves another one-the idea of objective truth: the standard which we may fall short of. Thus the doctrine of fallibility should not be regarded as part of a pessimistic epistemology. This doctrine implies that we may seek for truth, for objective truth, though more often than not we may miss it by a wide margin. And it implies that if we respect truth, we must search for it by persistently searching for our errors: by indefatigable rational criticism, and self-criticism (p 21).

Popper, K. R. (1992). *In search of a better world* [Auf der Suche nach einer besseren Welt.] (Laura J. Bennett, with additional material by Melitta Mew Trans.). London ; New York: Routledge.

(1) There is, for instance, the misguided and erroneous methodological approach... which urges that it is high time that the social sciences learn from the natural sciences what scientific method is. This misguided naturalism establishes such demands as: begin with observations and measurements; this means, for instance, begin by collecting statistical data; proceed, next, by induction to generalizations and to the formation of theories (p 68).

(2) (i) The method of the social sciences, like that of the natural sciences, consists in trying out tentative solutions to those problems from which our investigations start.

Solutions are proposed and criticized. If a proposed solution is not open to objective criticism, then it is excluded as unscientific, although perhaps only temporarily.

(ii) If the proposed solution is open to objective criticism, then we attempt to refute it; for all criticism consists in attempts at refutation.

(iii) If a proposed solution is refuted through our criticism we propose another solution.

(iv) If it withstands criticism, we accept it temporarily; and we accept it, above all, as worthy of further discussion and criticism.

(v) Thus the method of science is one of the tentative attempts (or brain-waves) to solve our problems which are controlled by the most severe criticism. It is a critical development of the method of 'trial and error'.

(vi) The so-called objectivity of science lies in the objectivity of the critical method; that is, above all, in the fact that no theory is exempt from criticism, and further, in the fact that the logical instrument of criticism – the logical contradiction – is objective (pp

66-67).

(3) What, then, are we to trust? What are we to accept? The answer is: whatever we accept we should trust only tentatively, always remembering what we are in possession, at best, of partial truth (or rightness), and that we are bound to make at least some mistake or misjudgement somewhere (p 391).

(4) We can leave it to the competition between theories to eliminate the unusable ones (p 28).

(5) We can never excel others in our reasonableness in a way that would establish a claim to authority (p 227).

(6) No theory is final (p 261).

(7) All the great… scientists were intellectually modest; and Newton speaks for them all when he says: 'I do not know what I may appear to the world, but to myself I seem to have been only a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.'"
Moreover, all the great scientists realized that every solution to a scientific problem raises many new and unsolved problems. Our knowledge of our ignorance, becomes increasingly conscious, detailed and precise, the more we learn about the world. Scientific research is the best method we have for obtaining information about ourselves and about our ignorance. It leads us to the important insight that there may be great differences between us with regard to minor details of what wed may perhaps know, yet we are all equal in our infinite ignorance (p 40).

Popper, K. R. (1999). *All life is problem solving* [Alles Leben ist Problemlösen.] . London ; New York: Routledge.

(1) A follower of the Enlightenment speaks as simply as possible: we want to be understood. In this respect Bertrand Russell is our great master (p 206).

Popper, K. R., & Bartley, W. W. (1956). *Realism and the aim of science* (1983, including Popper's introduction from the 1982 edition and Popper's preface from 1956 edition ed.). London: Routledge.

Proops, J. L. R., Faber, M., Manstetten, R., & Jöst, F. (1996). Achieving a sustainable world. *Ecological Economics, 17*(3), 133-135.

Robinson, J. (1962). What are the rules of the game? *Economic philosophy* (1983rd ed., pp. 117). Singapore: Penguin Books.

Rand, A. (1969). Art and cognition. *The romantic manifesto; a philosophy of literature* (pp. 201). New York: World Pub. Co.

Rees, W.E. (2003). Economic development and environmental protection: an ecological economics perspective. Environmental Monitoring and Assessment, 86, 29-45, Kluwer Academic Publishers, Netherlands.

RICHARDSON, M., & KEUCK, G. (2002). *Haeckel's ABC of evolution and development*. Retrieved 11/20/2007, 2007, from http://journals.cambridge.org.rlproxy.upei.ca/action/displayAbstract;jsessionid=84F5151FF2470EC3D55D0CD66002FC32.tomcat1?fromPage=online&aid=135297#

Russell, B. (1928). *Sceptical essays*. London: G. Allen & Unwin.

(1) The search for happiness based upon untrue beliefs is neither very noble nor very glorious. There is a stark joy in the unflinching perception of our true place in the world, and a more vivid drama than any that is possible to those who hide behind the enclosing walls of myth (p 21).

(2) The results of failure in politeness, however bad from the point of view of social occasion, are admirable from the point of view of dispelling myths. There are two ways in which our natural beliefs are corrected: one the contact with fact, as when we mistake a poisonous fungus for a mushroom and suffer pain in consequence; the other, when our beliefs conflict, not directly with objective fact, but with the opposite beliefs of other men (pp 17-18).

(3) There are 'perilous seas' in the world of thought, which can only be sailed by those who are willing to face their own physical powerlessness. And above all, there is liberation from the tyranny of Fear, which blots out the light of day and keeps men grovelling and cruel. No man is liberated from fear who dare not see his place in the world as it is; no man can achieve the greatness of which he is capable until he has allowed himself to see his own littleness (pp 22).

Ryder, R. (2007). Farm industry on downward spiral: Beef producers among those getting out as prospect for future looks grimmer each year. *The Guardian: News,* http://www.theguardian.pe.ca/index.cfm?sc=98

If Islanders are losing touch with the ordinary farmer, it should be no surprise. After all, farmers just aren't as plentiful on the landscape as they once were.
Numbers from Statistics Canada show that farming just isn't the dominant social force that it used to be on Prince Edward Island. In fact, the on-farm population in the 2001 census was just a little better than one-tenth what it was when the first available provincial

farm census was taken back in 1931.
The change becomes more stark when you realize that the overall Island population has increased more than 50 per cent since the 1931 count.
The scary thing for Island farmers, though, may be the fact that many people in this generation of farmers aren't expecting their children to follow them into the family business.
Darlene Sanford is seeing those farm bloodlines end in her industry. The president of the P.E.I. Cattle Producers Association said she is seeing a steady stream of people getting out of the beef business.
"We're losing in some cases generations of beef producers," says Sanford.
She said it's difficult to sell the prospect of long hours of physical labour in a business that rarely sees a profit.
"With kids growing up in the environment now they probably love the animals like I did but they see friends who have weekends off and who have extra money to go on vacations once a year," she said.
"Kids are saying maybe I'll do something else and a lot of parents are encouraging them to do that. They've seen how things have gone downhill in the last 10 or 15 years."
Last Thursday, a lot of farmers were talking about that downhill trend and asking whether government or consumers could be doing more to alleviate it.
Some 200 growers and supporters packed a meeting in Charlottetown to hear almost every sector of the agriculture industry talk about hard times and slim prospects.
Kevin MacIsaac, chair of the P.E.I. Potato Board, told the room that he is at a loss to explain why farmers seem to be getting less and less of a share of the dollars Canadians spend on food.
He said growing expenses and shifting exchange rates are hurting profitability for the farmer.
MacIsaac said he knows that non-farmers aren't unsympathetic to the growers' dilemma.
"I believe the consumer wants us to be part of society and would contribute to our well being. Under the current system they are not able to do so," he said.
"We have already made efforts to reduce our supply in order to strengthen prices, we now need government to step up."
The trouble is that the amount government seems prepared to step up doesn't add up to the kind of help farmers feel is needed.
The federal government has promised $600 million in farm aid nationally, while the province is weighing the advisability of extending further aid to the Albany beef plant and to Charlottetown's NOFG pork plant.
Island Agriculture Minister Neil LeClair told Thursday's meeting the malaise in farming is not just an Island issue. He said it is something that the country as a whole must wrestle with.
"I don't think you can fix this at a provincial level and it doesn't matter what province you're talking about. This is a national level issue," he said.
Darlene Sanford sees the problem, and the solution, at a much closer level.
This year she's looking at the prospect of selling a 1,600-pound beef cow, one she's fed and tended for 12 months, for about the same price she paid for the same animal as a 700-pound calf.
She said the best hope for Island beef farmers is a change in buying patterns that would see Islanders buy Island meat — and stores making an effort to ensure consumers can tell the difference.
"If we could sell for the same price as Alberta, we'd make up for the fact that they have these economies of scale by the fact that our farms are just 20 minutes from market," Sanford said.
"There's literally no predictability in the system now. But it can isolate ourselves to a point from that — to where we follow the ups and downs of the market but don't go as far down or as far up — if we can take some of the hurt out of that, that would be very beneficial to our producers."
The beef producer said the danger is that her industry is getting near a tipping point.
She noted a feedlot like hers operates on a year-to-year cycle and could be restocked in a good enough economic climate. The Island would be in a different predicament if it loses its cattle genetics — the prize bulls and cows with high quality produced through decades of careful breeding, according to Sandford.
"The guys who were so-so managers, those guys are already gone. The guys we're losing now are the cream of the crop.
"These are people who want to do this, people who have made their lives and fed their families doing this. We're losing in some cases generations of beef producers."

Randy Campbell from Stratford, PEI writes: PEI Farming

There is no doubt that farming on PEI is in crisis. Farmers are having trouble selling their products for what they paid to produce them, and that is AFTER the farmers have already passed on the cost of poisoning the land, and water to the rest of the public. The only winner I can see with this arrangement is the person who cares not for their fellow man, nor this beautiful Island, but cannot live without $1.80 pounds of pork, and 50 lbs of potatoes for a fiver.

Though blame can easily be placed on the farmers, the government and the consumers, there are actions that all three can take to improve this situation.

First off, the consumer. Charlottetown's farmer's market is open. Buying local and organic food provides incentives for farmers to produce food locally. It also provides incentives for farmers to convert to organic agriculture. If you shop at larger supermarkets, buy seasonal vegetables produced locally, and ask the store manager to carry more locally produced organic produce and meats. There are even some progressive young Islanders offering to deliver local organic food straight to your door. Buying local/organic is very simple, and shows that you are person that cares about the Island, and cares about the future of Islanders.

Secondly, farmers. I feel that farmers are in a particularly difficult situation and deserve our respect and admiration. I am not a farmer, however I could not imagine the frustration that would ensue if I had spent my life and life savings creating something that turned out to be, not only unprofitable, but also the punching bag of many of the environmentally aware Islanders. If Prince Edward Island farmers can find ways to convert to better farming practices, everyone will benefit. Many changes would help the situation, such as, increasing the size of hedge rows, to better crop rotation, to planting winter crops, to converting to organic agriculture. Consumers and government can provide incentives, but ultimately farmers must make the switch; one cannot underestimate the amount of work this would take. Finally, there are many farmers doing everything they can to address social and environmental issues, and they should be applauded loudly.

Lastly, Government. Though we have given our decision making powers to our elected officials, they must still respond to our demands, or risk being ousted. Though, I believe that this problem could be solved by everyone buying strictly local organic produce and meat, this is unlikely, and thus incentives must come from the government as well. Free trade is not working for agriculture. Within the free trade agreement, farmers NEED subsidies to farm and these are explicitly counter to free trade. It is a trade barrier, and is supposed to be removed. Unfortunately farmers could not survive if the subsidies were removed. What needs to be removed is agriculture from Free Trade agreements. We need a food commission to set fair prices for food produced in Canada and Prince Edward Island. Some would say that they are against government interference with "the market." Well "the market" is killing our farmers and our land, so it is time for a change. Yes, food prices will increase. Acutely, the government should continue to aid farmers until they can guarantee fair prices. How can we expect farmers to invest in environmental practices when "the market" is so unprofitable and especially uncertain?

There is no doubt that we are all in this mess together, and we need leadership within all sectors of our society. Undoubtedly though, by seeing every purchase as a vote towards a possible future, we will be able to overcome this tragedy. It is not someone else's responsibility. It is our responsibility. It is our responsibility to make this a priority; to create a just and sustainable Island.

Posted 03/12/2007 at 9:31 AM
Tracey from PEI/Ottawa writes: Randy…you are wasting your time posting such great comments hidden in the comments section. Send this in to the Editor….it is worth hearing and you make GREAT points.

Posted 03/12/2007 at 10:01 AM

Jainta Deveaux from cornawall, pei writes: What a nice front page, now that is more like it. An yes keep the debate going. Now I feel we are starting to make some real progress. Thanks guys

> **Sherry from PEI writes:** WELL SAID, RANDY!
> I agree with Tracy. Cut/Paste and send that off to the editor. This is no place for intelligent comments. Posted 03/12/2007 at 11:45 AM

> **C.A. From PEI from pei writes:** I was coming home on an Air Canada flight on Friday evening and was chatting with the person beside me, upon hearing that I was from PEI, the first thing this person said to me was What is going on in PEI, with all the fish kills and the sprays ….needless to say how do you answer this question other than saying Nothing ….this person was a awyer with the Federal Gov't, highly educated and well read, she said that she was in New York at the time of the fish kills , and it was on the news down there, I wouldn't say that this would be good for tourism, you know, The Gentle Island ….can't have it both ways folks, we are going to have to decide what we are an agricultural or tourism…both don't go together, especially with the chemicals that are being sprayed…Posted 03/12/2007 at 1:24 PM

> **deputy dawg from pe writes:** C.A. IF THAT PERSON YOU WERE SITTING BESIDE WAS A FEDERAL LAWYER. YOU MUST BE PRETTY IMPORTANT CAUSE FEDERAL LAWERS DONT FLY THIRD CLASS! AND WHEN SOMEONE ASKS YOU A QUESTION LIKE THAT, YOU TELL THEM THAT IT IS YOUR PROVINCAL GOVT. THAT IS TO BLAME, WHERE EVER THE HECK THEY ARE!
> AND AS FAR AS WE CANT HAVE IT BOTH WAYS, I SAY KEEP THE FARMERS!!! SEND THE TOURIST ELSEWHERE! WOOO! MERRY CHRISTMAS! STAND UP FOR YOUR FARMERS, THEY GREW YOUR DINNER, NOT THAT LAYWER OR THAT TOURIST!
> THANK YOU FOR HEARING MY OPINION Posted 03/12/2007 at 1:39 PM

> **C.A. From PEI from pei writes:** Flown lately deputy dawg….there are only 2 classes that come to Charlottetown…and

nowhere did I say I didn't support the farmers, but when you have a farmer spraying a harvested field of potatoes in 60km winds beside a school (Crapaud) then , unfortunately, it paints the whole works of them with the same brush, because this is what makes news, not the farmer that is land and environment friendly…And I agree, the Tourism is a 3 month deal, the farmers are here for the long haul, 12 months of the year, but something has to be done about the chemical sprays, and unfortunately the culprits are not the little guys, its the big guys, the 2000 acre boys who are be backed by the McCains and the Irvings….that's my take , whether I'm right or wrong, who knows…. Posted 03/12/2007 at 1:49 PM

Lester Morrison from Charlottetown, PE writes: Deputy Dawg,
You can shout Stand up for farmers all you want, it is clear the most people on PEI do NOT support farmers. And you can shout that farmers grow your dinner, but the sad reality is that they do not. The vast majority of our food is produced off island, and out of country.

Scharfe, S., & Briére, E. (1996). *Complicity : Human rights and canadian foreign policy : The case of east timor*. Montreal ; New York: Black Rose Books.

Sharratt, S. (2007). Pork farmers facing crisis: Major hog operators calling it quits across the province. *The Guardian,* http://www.theguardian.pe.ca/index.cfm?sc=98

The P.E.I. hog industry is on the verge of collapse as high feed prices, lacklustre federal policies and the high Canadian dollar has forced major interests to sell off herds and call it quits — all within the last month.

And the tide could continue to swamp the rest of the conventional pork industry here as producers see nothing in the financial columns but the same red as on the killing room floors.

"This is the perfect storm of agriculture destruction," said Anthony Nabuurs, chair of the P.E.I. Hog Board. "I'm not blaming anyone but farmers are taking a pounding."

Almost 30 per cent of producers — removing more than 50,000 animals from Island production — have closed their doors in the past few weeks because of the high dollar, the continued decline in market price and feed prices that have almost doubled.

Barley alone, a hog staple that normally sells for $130 a tonne this time of year, is well over $200 a tonne.

Beef producers are in trouble as well with the high Canadian dollar, but could find some solace if a government plan now in negotiation can be worked out to maintain the Atlantic Beef Products plant in Albany.

"My whole life has been with hogs and we did make good money on it," says veteran and respected Montague area producer Clayton Bulpitt, who has been in the business for the past 40 years.

"But I don't see any future . . . the hog industry here in the Maritimes is toast."

In the last six weeks, Island hog producers have been bailing out of the business like sailors in a sinking ship after taking a reality check on the future.

Major long-time producers like Gordon Lank in Hampshire with 900 sows, Frank Meerburg in Flat River with 700, and numerous others, including former hog board chairman Willem De Boer of Brudenell, are packing it in.

"Those who haven't got out will soon realize they won't have a choice," said one dispirited producer who didn't want to elaborate on his situation.

Some say the only remaining hog producers on P.E.I. will be a few who convert to organic or natural pork which, so far, is a niche market at best.

"The reality is that we're producing a pig right now for 95 cents a kilogram and it costs the farmer twice that," said Nabuurs. "The scary part is that the outlook isn't any better down the road and that's why people are leaving."

Prices have sunk to an all-time low in the conventional industry and with the high Canadian dollar (hog producers are paid according to American currency), the majority are losing as much as $60 to $80 per animal. With one third of producers leaving the industry, officials estimate less than 100 farms are still in the hog business — a once $30-million industry to the province.

"I guess the question is can we afford to totally lose this industry altogether," said Nabuurs. "We're hoping to find some solution, but it's not a great time to be chair of the hog board."

Wayne MacKinnon at the Department of Agriculture says beef and hog producers are being devastated by serious market declines.

"At the beginning of June of this year, the price for steers at the Atlantic Beef Products plant was $1.67 per hundredweight and hogs were $144.18 per hundred kilograms. At those prices, producers were making a modest profit," he explained.

"But five months later, the price for steers has plummeted to $1.14 and hogs are in the low $90 range. In the meantime, feed and

other costs have risen, and the livestock industry is in crisis."

A recent report prepared by Kevin Grier of the George Morris Centre at the University of Guelph says P.E.I. is based on the Chicago Mercantile Exchange's live hogs futures contracts. P.E.I. conventional livestock prices are determined by markets elsewhere.

"In all Canadian farm product markets, from cattle to vegetables, the first determinant of pricing is the overall North American market conditions, particularly reflected in U.S. commodity pricing," he said.

Grier says if U.S. cattle were priced at $90 a hundredweight in 2003 when the Canadian dollar was trading at 65 cents against the U.S. dollar, cattle in Ontario would be priced at $139 per hundredweight ($90 divided by 0.65.).

In October of 2007, that same U.S. $90 steer would be worth just $87 in Canada with the exchange rate at 1.03.

The Canadian dollar appreciation of the past three years has resulted in 37 per cent lower cattle pricing and the same principal applies to hogs.

"The province has been trying to help, but federal policies are killing us," said Bulpitt.

"The American farmer has the U.S. farm bill which subsidizes money into food production. They're coming off the best five years ever in agriculture and we're coming off the worst."

GO ORGANIC from ONT writes: It's time to take a look at the feasibility of this province competing in an international agri-business like pork and beef. It is totally not acceptable to drain resources needed for health, education and the wellbeing of marginalized Islanders, in order to prop up industries that can't make it in the international market place. The movement for farming is for smaller farms, producing food for local markets and trading in Organically grown food stuffs. We simply can't compete with Pork and Beef produced in much more favourable markets. But we can excel as a non GMO, organic farming community. It means change, and this doesn't seem to be on the political agenda. Particularly when you look at envirnoment being run by Mr. Potato Industry, Agriculture by Mr. Pork industry etc etc…So more tax payers money poured down this lost cause is the order of the day!!! Posted 17/11/2007 at 10:19 AM

Shaw, G. B. (1903). *Man and superman: Maxims for revolutionists.* Retrieved 10/30/2007, 2007, from http://www.bartleby.com/157/6.html

IDOLATRY
The art of government is the organization of idolatry. *5* The bureaucracy consists of functionaries; the aristocracy, of idols; the democracy, of idolaters. *6* The populace cannot understand the bureaucracy: it can only worship the national idols. *7* The savage bows down to idols of wood and stone: the civilized man to idols of flesh and blood. *8* A limited monarchy is a device for combining the inertia of a wooden idol with the credibility of a flesh and blood one. *9* When the wooden idol does not answer the peasant's prayer, he beats it: when the flesh and blood idol does not satisfy the civilized man, he cuts its head off. *10* He who slays a king and he who dies for him are alike idolaters. *11*

ROYALTY
Kings are not born: they are made by artificial hallucination. When the process is interrupted by adversity at a critical age, as in the case of Charles II, the subject becomes sane and never completely recovers his kingliness. *12* The Court is the servant's hall of the sovereign. *13* Vulgarity in a king flatters the majority of the nation. *14* The flunkeyism propagated by the throne is the price we pay for its political convenience. *15*

DEMOCRACY
If the lesser mind could measure the greater as a foot-rule can measure a pyramid, there would be finality in universal suffrage. As it is, the political problem remains unsolved. *16* Democracy substitutes election by the incompetent many for appointment by the corrupt few. *17* Democratic republics can no more dispense with national idols than monarchies with public functionaries. *18* Government presents only one problem: the discovery of a trustworthy anthropometric method. *19*

LIBERTY AND EQUALITY
He who confuses political liberty with freedom and political equality with similarity has never thought for five minutes about either. *23* Nothing can be unconditional: consequently nothing can be free. *24* Liberty means responsibility. That is why most men dread it. *25* The duke inquires contemptuously whether his gamekeeper is the equal of the Astronomer Royal; but he insists that they shall both be hanged equally if they murder him. *26* The notion that the colonel need be a better man than the private is as confused as the notion that the keystone need be stronger than the coping stone. *27* Where equality is undisputed, so also is subordination. *28* Equality is fundamental in every department of social organization. *29* The relation of superior to inferior excludes good manners. *30*

EDUCATION
When a man teaches something he does not know to somebody else who has no aptitude for it, and gives him a certificate of proficiency, the latter has completed the education of a gentleman. *31* A fool's brain digests philosophy into folly, science into superstition, and art into pedantry. Hence University education. *32* A learned man is an idler who kills time with study. Beware of his false knowledge: it is more dangerous than ignorance. *37* Activity is the only road to knowledge. *38* Every fool believes what his

teachers tell him, and calls his credulity science or morality as confidently as his father called it divine revelation. *39* No man fully capable of his own language ever masters another. *40* No man can be a pure specialist without being in the strict sense an idiot. *41* Do not give your children moral and religious instruction unless you are quite sure they will not take it too seriously. *42*

RELIGION
Beware of the man whose god is in the skies. *83* What a man believes may be ascertained, not from his creed, but from the assumptions on which he habitually acts. *84*

THE PERFECT GENTLEMAN
The fatal reservation of the gentleman is that he sacrifices everything to his honor except his gentility. *113* A gentleman of our days is one who has money enough to do what every fool would do if he could afford it: that is, consume without producing. *114* The true diagnostic of modern gentility is parasitism. *115* No elaboration of physical or moral accomplishment can atone for the sin of parasitism. *116* A modern gentleman is necessarily the enemy of his country. Even in war he does not fight to defend it, but to prevent his power of preying on it from passing to a foreigner. Such combatants are patriots in the same sense as two dogs fighting for a bone are lovers of animals. *117* The North American Indian was a type of the sportsman warrior gentleman. The Periclean Athenian was a type of the intellectually and artistically cultivated gentleman. Both were political failures. The modern gentleman, without the hardihood of the one or the culture of the other, has the appetite of both put together. He will not succeed where they failed. *118* He who believes in education, criminal law, and sport, needs only property to make him a perfect modern gentleman. *119*

REASON
The reasonable man adapts himself to the world: the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man. *124* The man who listens to Reason is lost: Reason enslaves all whose minds are not strong enough to master her. *125*

TIME'S REVENGES
Those whom we called brutes had their revenge when Darwin shewed us that they are our cousins. *129*

GOOD INTENTIONS
Hell is paved with good intentions, not with bad ones. *131*

CIVILIZATION
Civilization is a disease produced by the practice of building societies with rotten material. *144* Those who admire modern civilization usually identify it with the steam engine and the electric telegraph. *145* Those who understand the steam engine and the electric telegraph spend their lives in trying to replace them with something better. *146* The imagination cannot conceive a viler criminal than he who should build another London like the present one, nor a greater benefactor than he who should destroy it. *147*

GAMBLING
The most popular method of distributing wealth is the method of the roulette table. *148* The roulette table pays nobody except him that keeps it. Nevertheless a passion for gaming is common, though a passion for keeping roulette tables is unknown. *149* Gambling promises the poor what Property performs for the rich: that is why the bishops dare not denounce it fundamentally. *150*

STRAY SAYINGS
We are told that when Jehovah created the world he saw that it was good. What would he say now? *152* The conversion of a savage to Christianity is the conversion of Christianity to savagery. *153* No man dares say so much of what he thinks as to appear to himself an extremist. *154* Decadence can find agents only when it wears the mask of progress. *156* In moments of progress the noble succeed, because things are going their way: in moments of decadence the base succeed for the same reason: hence the world is never without the exhilaration of contemporary success. *157* Do not mistake your objection to defeat for an objection to fighting, your objection to being a slave for an objection to slavery, your objection to not being as rich as your neighbor for an objection to poverty. The cowardly, the insubordinate, and the envious share your objections. *162* Take care to get what you like or you will be forced to like what you get. Where there is no ventilation fresh air is declared unwholesome. Where there is no religion hypocrisy becomes good taste. Where there is no knowledge ignorance calls itself science. *163* If history repeats itself, and the unexpected always happens, how incapable must Man be of learning from experience! *165* Those who understand evil pardon it: those who resent it destroy it. *167* Acquired notions of propriety are stronger than natural instincts. It is easier to recruit for monasteries and convents than to induce an Arab woman to uncover her mouth in public, or a British officer to walk through Bond Street in a golfing cap on an afternoon in May. *168*

Sluckin, W. (1965). *Imprinting and early learning*. Chicago: Aldine Pub. Co.

Smith, V. L. (2002). *Constructivist and ecological rationality in economics* (http://nobelprize.org/nobel_prizes/economics/laureates/2002/smith-lecture.html ed.). Retrieved 10/27/2007.

Sokal, A. D. (1996). *A physicist experiments with cultural studies.* Retrieved 10/27/2007, 2007, from http://physics.nyu.edu/~as2/#papers "The displacement of the idea that facts and evidence matter by the idea that everything boils down to subjective interests and perspectives is -- second only to American political campaigns -- the most prominent and pernicious manifestation of anti-

intellectualism in our time."
-- Larry Laudan, *Science and Relativism* (1990)

For some years I've been troubled by an apparent decline in the standards of intellectual rigor in certain precincts of the American academic humanities. But I'm a mere physicist: if I find myself unable to make head or tail of *jouissance* and *différance*, perhaps that just reflects my own inadequacy.
So, to test the prevailing intellectual standards, I decided to try a modest (though admittedly uncontrolled) experiment: Would a leading North American journal of cultural studies -- whose editorial collective includes such luminaries as Fredric Jameson and Andrew Ross -- publish an article liberally salted with nonsense if (a) it sounded good and (b) it flattered the editors' ideological preconceptions?
The answer, unfortunately, is yes. Interested readers can find my article, ``Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," in the Spring/Summer 1996 issue of *Social Text*. It appears in a special number of the magazine devoted to the ``Science Wars."
What's going on here? Could the editors *really*not have realized that my article was written as a parody?

In the first paragraph I deride ``the dogma imposed by the long post-Enlightenment hegemony over the Western intellectual outlook": that there exists an external world, whose properties are independent of any individual human being and indeed of humanity as a whole; that these properties are encoded in ``eternal" physical laws; and that human beings can obtain reliable, albeit imperfect and tentative, knowledge of these laws by hewing to the ``objective" procedures and epistemological strictures prescribed by the (so-called) scientific method. Is it now dogma in Cultural Studies that there exists no external world? Or that there exists an external world but science obtains no knowledge of it?

In the second paragraph I declare, without the slightest evidence or argument, that ``physical `reality' [note the scare quotes] ... is at bottom a social and linguistic construct." Not our *theories*of physical reality, mind you, but the reality itself. Fair enough: anyone who believes that the laws of physics are mere social conventions is invited to try transgressing those conventions from the windows of my apartment. (I live on the twenty-first floor.)

Throughout the article, I employ scientific and mathematical concepts in ways that few scientists or mathematicians could possibly take seriously. For example, I suggest that the ``morphogenetic field" -- a bizarre New Age idea due to Rupert Sheldrake -- constitutes a cutting-edge theory of quantum gravity. This connection is pure invention; even Sheldrake makes no such claim. I assert that Lacan's psychoanalytic speculations have been confirmed by recent work in quantum field theory. Even nonscientist readers might well wonder what in heavens' name quantum field theory has to do with psychoanalysis; certainly my article gives no reasoned argument to support such a link.
Later in the article I propose that the axiom of equality in mathematical set theory is somehow analogous to the homonymous concept in feminist politics. In reality, all the axiom of equality states is that two sets are identical if and only if they have the same elements. Even readers without mathematical training might well be suspicious of the claim that the axiom of equality reflects set theory's ``nineteenth-century liberal origins."

In sum, I intentionally wrote the article so that any competent physicist or mathematician (or undergraduate physics or math major) would realize that it is a spoof. Evidently the editors of *Social Text* felt comfortable publishing an article on quantum physics without bothering to consult anyone knowledgeable in the subject. The fundamental silliness of my article lies, however, not in its numerous solecisms but in the dubiousness of its central thesis and of the ``reasoning" adduced to support it. Basically, I claim that quantum gravity -- the still-speculative theory of space and time on scales of a millionth of a billionth of a billionth of a billionth of a centimeter -- has profound *political*implications (which, of course, are ``progressive") (pp2-3).

Sokal, A. D. (1996). *A plea for reason, evidence and logic.* Retrieved 10/27/2007, 2007, from http://physics.nyu.edu/~as2/#papers
1.
My goal is to defend what one might call a scientific *worldview* -- defined broadly as a respect for evidence and logic, and for the incessant confrontation of theories with the real world; in short, for reasoned argument over wishful thinking, superstition and demagoguery. And my motives for trying to defend these old-fashioned ideas are basically *political*. I'm worried about trends in the American Left -- particularly here in academia -- that at a minimum *divert* us from the task of formulating a progressive social critique, by leading smart and committed people into trendy but ultimately empty intellectual fashions, and that can in fact *undermine* the prospects for such a critique, by promoting subjectivist and relativist philosophies that in my view are inconsistent with producing a realistic analysis of society that we and our fellow citizens will find compelling.

David Whiteis, in a recent article, said it well:

"Too many academics, secure in their ivory towers and insulated from the real-world consequences of the ideas they espouse, seem blind to the fact that non-rationality has historically been among the most powerful weapons in the ideological arsenals of oppressors.

The hypersubjectivity that characterizes postmodernism is a perfect case in point: far from being a legacy of leftist iconoclasm, as some of its advocates so disingenuously claim, it in fact … plays perfectly into the anti-rationalist -- really, anti-*thinking* -- bias that currently infects "mainstream" U.S. culture."

2.
Now of course, no one will admit to being against reason, evidence and logic -- that's like being against Motherhood and Apple Pie. Rather, our postmodernist and poststructuralist friends will claim to be in favor of some new and *deeper* kind of reason, such as the celebration of "local knowledges" and "alternative ways of knowing" as an antidote to the so-called "Eurocentric scientific methodology" (you know, things like systematic experiment, controls, replication, and so forth). You find this magic phrase "local knowledges" in, for example, the articles of Andrew Ross and Sandra Harding in the "Science Wars" issue of *Social Text* (pp 126-129).

Sokal, A. D. (1996). *Transgressing the boundaries: An afterword.* Retrieved 10/27/2007, 2007, from http://physics.nyu.edu/~as2/#papers

(1) Alas, the editors of *Social Text* have discovered that my article, ``Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity", which appeared in *Social Text* #46/47, is a parody. In view of the important intellectual and political issues raised by this episode, they have generously agreed to publish this (non-parodic) Afterword, in which I explain my motives and my true views.1 One of my goals is to make a small contribution toward a dialogue on the Left between humanists and natural scientists -- ``two cultures" which, contrary to some optimistic pronouncements (mostly by the former group), are probably farther apart in mentality than at any time in the past 50 years.

Like the genre it is meant to satirize -- myriad exemplars of which can be found in my reference list -- my article is a mélange of truths, half-truths, quarter-truths, falsehoods, non sequiturs, and syntactically correct sentences that have no meaning whatsoever. (Sadly, there are only a handful of the latter: I tried hard to produce them, but I found that, save for rare bursts of inspiration, I just didn't have the knack.) I also employed some other strategies that are well-established (albeit sometimes inadvertently) in the genre: appeals to authority in lieu of logic; speculative theories passed off as established science; strained and even absurd analogies; rhetoric that sounds good but whose meaning is ambiguous; and confusion between the technical and everyday senses of English words.2 (N.B. All works cited in my article are real, and all quotations are rigorously accurate; none are invented.)

…. I'm a stodgy old scientist who believes, naively, that there exists an external world, *that there exist objective truths* [italics mine] about that world, and that my job is to discover some of them. (If science were merely a negotiation of social conventions about what is agreed to be ``true", why would I bother devoting a large fraction of my all-too-short life to it?…)

But my main concern isn't to defend science from the barbarian hordes of lit crit (we'll survive just fine, thank you). Rather, my concern is explicitly *political*: to combat a currently fashionable postmodernist/poststructuralist/social-constructivist discourse -- and more generally a penchant for subjectivism -- which is, I believe, inimical to the values and future of the Left.[1] (pp 2-3).

(2) Stanislav Andreski: So long as authority inspires awe, confusion and absurdity enhance conservative tendencies in society. Firstly, because clear and logical thinking leads to a cumulation of knowledge (of which the progress of the natural sciences provides the best example) and the advance of knowledge sooner or later undermines the traditional order. Confused thinking, on the other hand, leads nowhere in particular and can be indulged indefinitely without producing any impact upon the world.

As an example of ``confused thinking", I would like to consider a chapter from Harding (1991) entitled ``Why `Physics' Is a Bad Model for Physics". I select this example both because of Harding's prestige in certain (but by no means all) feminist circles, and because her essay is (unlike much of this genre) very clearly written. Harding wishes to answer the question, ``Are feminist criticisms of Western thought relevant to the natural sciences?" She does so by raising, and then rebutting, six ``false beliefs" about the nature of science. Some of her rebuttals are perfectly well-taken; but they don't prove anything like what she claims they do. That is because she conflates five quite distinct issues: 1) *Ontology.* What objects *exist* in the world? What statements about these objects are *true*? 2) *Epistemology.* How can human beings obtain *knowledge* of truths about the world? How can they assess the *reliability* of that knowledge? 3) *Sociology of knowledge.* To what extent are the truths *known* (or *knowable*) by humans in any given society influenced (or determined) by social, economic, political, cultural and ideological factors? Same question for the false statements erroneously believed to be true. 4) *Individual ethics.* What types of research *ought* a scientist (or technologist) to undertake (or refuse to undertake)? 5) *Social ethics.* What types of research *ought* society to encourage, subsidize or publicly fund (or alternatively to discourage, tax or forbid)?

These questions are obviously related -- e.g. if there are no objective truths about the world, then there isn't much point in asking how one can know those (nonexistent) truths -- but they are conceptually distinct (pp 4-5).

(3) A lot of the blame for this state of affairs rests, I think, with the scientists. The teaching of mathematics and science *is* often authoritarian; and this is antithetical not only to the principles of radical/democratic pedagogy but to the principles of science itself. No wonder most Americans can't distinguish between science and pseudoscience: their science teachers have never given them any rational grounds for doing so. (Ask an average undergraduate: Is matter composed of atoms? Yes. Why do you think so? The reader can

fill in the response.) Is it then any surprise that 36% of Americans believe in telepathy, and that 47% believe in the creation account of Genesis?$_2$ (pp 8-9).

(4) Ross (1992, 549) expressed further (and quite justified) misgivings: "I'm quite skeptical of the ``anything goes'' spirit that is often the prevailing climate of relativism around postmodernism.... Much of the postmodernist debate has been devoted to grappling with the philosophical or cultural limits to the grand narratives of the Enlightenment. If you think about ecological questions in this light, however, then you are talking about ``real'' physical, or material, limits to our resources for encouraging social growth. And postmodernism, as we know, has been loath to address the ``real,'' except to announce its banishment."

1 The natural sciences have little to fear, at least in the short run, from postmodernist silliness; it is, above all, history and the social sciences -- and leftist politics -- that suffer when verbal game-playing displaces the rigorous analysis of social realities.

2 Telepathy: Hastings and Hastings (1992, 518), American Institute of Public Opinion poll from June 1990. Concerning ``telepathy, or communication between minds without using the traditional five senses'', 36% ``believe in'', 25% are ``not sure'', and 39% ``do not believe in''. For ``people on this earth are sometimes possessed by the devil'', it is 49-16-35 (!). For ``astrology, or that the position of the stars and planets can affect people's lives'', it is 25-22-53. Mercifully, only 11% believe in channeling (22% are not sure), and 7% in the healing power of pyramids (26% not sure).

Creationism: Gallup (1993, 157-159), Gallup poll from June 1993. The exact question was: ``Which of the following statements comes closest to your views on the origin and development of human beings: 1) human beings have developed over millions of years from less advanced forms of life, but God guided this process; 2) human beings have developed over millions of years from less advanced forms of life, but God had no part in this process; 3) God created human beings pretty much in their present form at one time within the last 10,000 years or so?'' The results were 35% developed with God, 11% developed without God, 47% God created in present form, 7% no opinion (pp 13-14).

Sokal, A. D. (1996). Transgressing the boundaries: Toward a transformative hermeneutics of quantum gravity. *Social Text,* (46/47, Science Wars), 217-252. http://links.jstor.org.rlproxy.upei.ca/sici?sici=0164-2472%28199621%2F22%290%3A46%2F47%3C217%3ATTBTAT%3E2.0.CO%3B2-S

There are many natural scientists, and especially physicists, who continue to reject the notion that the disciplines concerned with social and cultural criticism can have anything to contribute, except perhaps peripherally, to their research. Still less are they receptive to the idea that the very foundations of their worldview must be revised or rebuilt in the light of such criticism. Rather, they cling to the dogma imposed by the long post-Enlightenment hegemony over the Western intellectual outlook, which can be summarized briefly as follows: that there exists an external world, whose properties are independent of any individual human being and indeed of humanity as a whole; that these properties are encoded in "eternal" physical laws; and that human beings can obtain reliable, albeit imperfect and tentative, knowledge of these laws by hewing to the "objective" procedures and epistemological strictures prescribed by the (socalled) scientific method.

But deep conceptual shifts within twentieth-century science have undermined this Cartesian-Newtonian metaphysics (Heisenberg 1958; Bohr 1963); revisionist studies in the history and philosophy of science have cast further doubt on its credibility (Kuhn 1970; Feyerabend 1975; Latour 1987; Aronowitz 198%; Bloor 199 1); and, most recently, feminist and poststructuralist critiques have demystified the substantive content of mainstream Western scientific practice, revealing the ideology of domination concealed behind the facade of "objectivity" (Merchant 1980; Keller 1985; Harding 1986, 1991; Haraway 1989, 1991; Best 1991). It has thus become increasingly apparent that physical "reality," no less than social "reality," is at bottom a social and linguistic construct; that scientific "knowledge," far from being objective, reflects and encodes the dominant ideologies and power relations o f the culture that produced it; that the truth claims of science are inherently theory-laden and self-referential; and consequently, that the discourse of the scientific community, for all its undeniable value, cannot assert a privileged epistemological status with respect to counterhegemonic narratives emanating from dissident or marginalized communities. These themes can be traced, despite some differences of emphasis, in Aronowitz's analysis of the cultural fabric that produced quantum mechanics (1988b, esp. chaps. 9 and 12); in Ross's discussion of oppositional discourses in post-quantum science (1 99 1 intro. and chap. 1); in Irigaray's and Hayles's exegeses of gender encoding in fluid mechanics (Irigaray 1985; Hayles 1992); and in Harding's comprehensive critique of the gender ideology underlying the natural sciences in general and physics in particular (1986, esp. chaps. 2 and 10; 1991, esp. chap. 4) (pp 217 - 218).

Soros, G. (2006). Europe as a prototype for a global open society. Paper presented at the http://www.soros.org/resources/articles_publications/articles/europe_20061120. , *2007*(10/22/2007) Retrieved 10/22/2007

Spedding, C. (2005). How sustainable is sustainability? Biologist, Volume 52, Number 6, December 2005.

Steinberg, P. E. (2001). *The social construction of the ocean*. Cambridge ; New York: Cambridge University Press.

Stewart, D. (2007). Barlow warns water crisis not just third world issue: Council of canadians chair speaking out against 'alarming trend' of water commodification, one result of which is rising rates of water-related deaths. *The Guardian: News,*

http://www.theguardian.pe.ca/index.cfm?sc=98
ABSTRACT: Just as wars in the 20th century were fought over oil, world-renowned social justice advocate Maude Barlow believes wars of the 21st century will be fought over water.

(1) Barlow said the big problem on P.E.I. will be an agricultural one with pesticides and nitrates leaching into groundwater. "For you, it will be an issue of preserving your way of life."
Barlow is calling for provincial and federal strategies in the form of legislation.

Stigler, G. J. (1982). *The process and progress of economics.* Retrieved 11/5/2007, 2007, from http://nobelprize.org/nobel_prizes/economics/laureates/1982/stigler-lecture.html

Abstract: The lecture focuses on the reasons that new ideas are accepted or rejected by a science. A distinction is drawn between pre-scientific and scientific stages of a discipline. The diverse fates of new ideas are illustrated by a variety of episodes in the history of economics, including the economics of information and the theory of economic regulation.

(1) Most economists enter this market in new ideas, let me emphasize, in order to obtain ideas and methods for the applications they are making of economics to the thousand problems with which they are occupied: these economists are not the suppliers of new ideas but only demanders. Their problem is comparable to that of the automobile buyer: to find a reliable vehicle. Indeed, they usually end up by buying a used, and therefore tested, idea. *Those economists who seek to engage in research on the new ideas of the science - to refute or confirm or develop or displace them - are in a sense both buyers and sellers of new ideas. They seek to develop new ideas and persuade the science to accept them, but they also are following clues and promises and explorations in the current or preceding ideas of the science* [italics mine]. It is very costly to enter this market: it takes a good deal of time and thought to explore a new idea far enough to discover its promise or its lack of promise. The history of economics, and I assume of every science, is strewn with costly errors: of ideas, so to speak, that wouldn't run far or carry many passengers (57).

Stiglitz, J. E. (2001). *Nobel autobiography.* Retrieved 10/25/2007, 2007, from http://nobelprize.org/nobel_prizes/economics/laureates/2001/stiglitz-autobio.html

Stiglitz, J. E. (2001). *INFORMATION AND THE CHANGE IN THE PARADIGM IN ECONOMICS.* Retrieved 10/25/2007, 2007, from http://nobelprize.org/nobel_prizes/economics/laureates/2001/stiglitz-lecture.html

(1) My first visits to the developing world in 1967, and a more extensive stay in Kenya in 1969, made an indelible impression on me. Models of perfect markets, as badly flawed as they might seem for Europe or America, seemed truly inappropriate for these countries (p 473).

(2) More recently, I have turned my attention to some aspects of what might be called the political economy of information: the role of information in political processes, in collective decision making. For two hundred years, well before the economics of information became a subdiscipline within economics, Sweden had enacted legislation to increase transparency. There are asymmetries of information between those governing and those governed, and just as markets strives to overcome asymmetries of information, we need to look for ways by which the scope for asymmetries of information in political processes can be limited and their consequences mitigated (p 474).

(3) The reining paradigm of the twentieth century, the neoclassical model, ignored the warnings of the nineteenth century and earlier masters on how information concerns might alter the analyses, perhaps because they could not see how to embrace them in their seemingly precise models, perhaps because doing so would have led to uncomfortable conclusions about the efficiency of markets (p 475).

(4) The fact that information was imperfect was, of course, well recognized by all economists. While they may have hoped that economies with imperfect information behaved much like economies with perfect information, they real reason that models with imperfect information were not developed was that it was not obvious how do to so. There were several problems that had to be overcome: while there was a single way in which information is perfect, there are an infinite number of ways in which information can be imperfect (p 486).

(5) Perhaps the most important single idea in economics is that competitive economies lead, as if by an invisible hand, to a (Pareto) efficient allocation of resources, and that every Pareto efficient resource allocation can be achieved through a competitive mechanism, provided only that the appropriate lump sum redistributions are undertaken. It is these (fundamental theorems) of welfare economics which provide both the rationale for the reliance on free markets, and the belief that issues of distribution can be separated from issues of efficiency, allowing the economist the freedom to push for reforms which increase efficiency, regardless of their seeming impact on distribution; if society does not like the distributional consequences, it should simply redistribute income. The economics of information showed that neither of these results was, in general, true (p. 503).

(6) As in Darwinian ecological models, the major determinant of one's environment is the behavior of others, and their behavior may in turn depend on their beliefs about others' behavior. (Hoff and Stiglitz [2000]). As Darwin noted after his visit to the Galapagos (p

521-522):

How has it happened in the several islands situated within sight of each other, having the same geological nature, the same height, climate, &c… This long appeared to me a great difficulty: but it arises in chief part from the deeply-seated error of considering the physical conditions of a country as the most important for its inhabitants; whereas it cannot, I think he disputed that the nature of the other inhabitants, with which each has to compete, is at least as important, and generally a far more important element of success (Darwin 1859, p 400).

(7) Political processes inevitably entail asymmetries of information: our political leaders are supposed to know more about threats to defense, about our economic situation, etc., than ordinary citizens. There has been a delegation of responsibility for day-to-day decision making, just as there is within a firm.

The problem is to provide incentives for those so entrusted to act on behalf of those who they are supposed to be serving – the standard principle agent problem. Democracy – contestability in political processes – provides a check on abuses of the powers that come from delegation just as it does in economic processes; but just as we recognize that the take-over mechanism provides an imperfect check, so too we should recognize that the electoral process provides an imperfect check. Just as we recognize that current management has an incentive to increase asymmetries of information in order to enhance its market power, increase its discretion, so to in public life. And just as we recognize that disclosure requirements – greater transparency – and specific rules of the game (e.g. related to corporate governance) can affect the effectiveness of the take-over mechanism and the overall quality of corporate governance, so too the same factors can affect political contestabilty and the quality of public governance (p 522 - 523).

(8) We have the good fortune to live in democracies, in which individuals can fight for their perception of what a better world might be like. We as academics have the good fortune to be further protected by our academic freedom. With freedom comes responsibility: the responsibility to use that freedom to do what we can to ensure that the world of the future be one in which there is not only greater economic prosperity, but also more social justice (p 527).

Taleb, N. (2001). *Fooled by randomness : The hidden role of chance in the markets and in life* (2005, 2nd Edition ed.). New York:

(1) I am now convinced that, perhaps, most of econometrics could be useless—much of what financial statisticians know would not be worth knowing. For a sum of zeros, even repeated a billion times, remains zero; likewise an accumulation of research and gains in complexity will lead to naught if there is no firm ground beneath it (p 114).

(2) We are still very close to our ancestors who roamed the savannah. The formation of our beliefs is fraught with superstitions—even today (I might say, especially today). Just as one day some primitive tribesman scratched his nose, saw rain falling, and developed an elaborate method of scratching his nose to bring on the much-needed rain, we link economic prosperity to some rate cut by the Federal Reserve Board, or the success of a company with the appointment of the new president "at the helm". Bookstores are full of biographies of successful men and women presenting their specific explanation on how they made it big in life (we have an expression, 'the right time and the right place,' to weaken whatever conclusion can be inferred from them). This confusion strickes people of different persuasions; the literature professor invests a deep meaning into a mere coincidental occurance of word patterns, while the economist proudly detects 'regularities' and 'anomalies' in data that are plain random (p x).

(3) As I am witing these lines I see the following headlines on my Bloomberg:

The Dow is up 1.03 on lower interests rates
The Dollar down 0.12 yen onn higher Japanese surplus

and so on for an entire page. If I translate it well, the journalist claims to provide an explanation for something tht amounts to *perfect noise*. A move of 1.03 with the Dow at 11,000 constitutes less than a 0.01% move. Such a move does not warrant an explanation. There is nothing there an honest person can try to explain; there are no reasons to adduce" (pp 213-214).

(4) All of my colleagues who I have known to denigrate history blew up spectacularly—and I have yet to encounter some such person who has not blown up. But the truly interesting point lies in the remarkable similarities in their approaches. The blowup, I will repeat, is different from merely incurring a monetary loss; it is losing money when one does not believe that such fact is possible at all (pp 51-54).

TED. (1997). *Celand cod war.* Retrieved 11/13/2007, 2007, from http://www.american.edu/TED/icefish.htm

Thaman, R. (1988). Health and nutrition in the pacific islands: development or underdevelopment? GeoJournal, 16.2, 211-227.

Tourtellot, J. B. Destinations rated: Islands @ national geographic traveler. *2007*(November/December, 2007)

UNIPCC. (2007). *Intergovernmental panel on climate change.* Retrieved 11/1/2007, 2007, from http://www.ipcc.ch/

Global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years (see Figure SPM-1). The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land-use change, while those of methane and nitrous oxide are primarily due to agriculture.
• Carbon dioxide is the most important anthropogenic greenhouse gas.... The global atmospheric concentration of carbon dioxide has increased from a pre-industrial value of about 280 ppm to 379 ppm 3 in 2005. The atmospheric concentration of carbon dioxide in 2005 exceeds by far the natural range over the last 650,000 years (180 to 300 ppm) as determined from ice cores. The annual carbon dioxide concentration growth-rate was larger during the last 10 years (1995 – 2005 average: 1.9 ppm per year), than it has been since the beginning of continuous direct atmospheric measurements (1960 – 2005 average: 1.4 ppm per year) although there is year-to-year variability in growth rates.
• The primary source of the increased atmospheric concentration of carbon dioxide since the pre-industrial period results from fossil fuel use, with land use change providing another significant but smaller contribution. Annual fossil carbon dioxide emissions 4 increased from an average of 6.4 [6.0 to 6.8] 5 GtC (p 2).

Van der Post, L. (1958). *The lost world of the kalahari*. New York: Morrow.

Veblen, T. (1899). *The theory of the leisure class*. New York; London: The Macmillan Company; Macmillan.

The quasi-peaceable gentleman of leisure, then, not only consumes of the staff of life beyond the minimum required for subsistence and physical efficiency, but his consumption also undergoes a specialisation as regards the quality of the goods consumed. He consumes freely and of the best, in food, drink, narcotics, shelter, services, ornaments, apparel, weapons and accoutrements, amusements, amulets, and idols or divinities. In the process of gradual amelioration which takes place in the articles of his consumption, the motive principle and proximate aim of innovation is no doubt the higher efficiency of the improved and more elaborate products for personal comfort and well-being. But that does not remain the sole purpose of their consumption. The canon of reputability is at hand and seizes upon such innovations as are, according to its standard, fit to survive. Since the consumption of these more excellent goods is an evidence of wealth, it becomes honorific; and conversely, the failure to consume in due quantity and quality becomes a mark of inferiority and demerit.

This growth of punctilious discrimination as to qualitative excellence in eating, drinking, etc. presently affects not only the manner of life, but also the training and intellectual activity of the gentleman of leisure. He is no longer simply the successful, aggressive male, -- the man of strength, resource, and intrepidity. In order to avoid stultification he must also cultivate his tastes, for it now becomes incumbent on him to discriminate with some nicety between the noble and the ignoble in consumable goods. He becomes a connoisseur in creditable viands of various degrees of merit, in manly beverages and trinkets, in seemly apparel and architecture, in weapons, games, dancers, and the narcotics. This cultivation of aesthetic faculty requires time and application, and the demands made upon the gentleman in this direction therefore tend to change his life of leisure into a more or less arduous application to the business of learning how to live a life of ostensible leisure in a becoming way. Closely related to the requirement that the gentleman must consume freely and of the right kind of goods,
there is the requirement that he must know how to consume them in a seemly manner. His life of leisure must be conducted in due form. Hence arise good manners in the way pointed out in an earlier chapter. High-bred manners and ways of living are items of conformity to the norm of conspicuous leisure and conspicuous consumption.

Conspicuous consumption of valuable goods is a means of reputability to the gentleman of leisure. As wealth accumulates on his hands, his own unaided effort will not avail to sufficiently put his opulence in evidence by this method. The aid of friends and competitors is therefore brought in by resorting to the giving of valuable presents and expensive feasts and entertainments. Presents and feasts had probably another origin than that of naive ostentation, but they required their utility for this purpose very early, and they have retained that character to the present; so that their utility in this respect has now long been the substantial ground on which these usages rest. Costly entertainments, such as the potlatch or the ball, are peculiarly adapted to serve this end. The competitor with whom the entertainer wishes to institute a comparison is, by this method, made to serve as a means to the end. He consumes vicariously for his host at the same time that he is witness to the consumption of that excess of good things which his host is unable to dispose of single-handed, and he is also made to witness his host's facility in etiquette.

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It is widely believed that meteorites originate in the asteroid belt, but the precise dynamical mechanism whereby material is transported to Earth has eluded discovery. The observational data for the ordinary chondrites, the most common meteorites, impose severe constraints on any proposed mechanism. The ordinary chondrites are not strongly shocked, their cosmic ray exposure ages are typically <20 Myr, their radiants are concentrated near the antapex of Earth's motion and they show a pronounced 'afternoon excess' (for every meteorite which falls in the morning two fall in the afternoon). Wetherill[1] concluded that these data could only be explained by an "unobserved source" of material with perihelia near 1.0 AU and aphelia near Jupiter. His subsequent, more sophisticated investigations have not changed this basic conclusion. Recently I have shown[2,3] that there is a large chaotic zone in the phase space near the 3/1 mean motion commensurability with Jupiter and that the chaotic trajectories within this zone have particularly large variations in orbital eccentricity. Since asteroidal debris is quite easily injected into this chaotic zone, it could provide Wetherill's 'unobserved source' if chaotic trajectories which begin at asteroidal eccentricities (e<0.2) reach such large eccentricities that Earth's orbit is crossed (e>0.57)[4]. In this report I present a numerical integration which demonstrates that at least some of these chaotic trajectories do have the properties required to transport meteoritic material from the asteroid belt to Earth. Combined with the Monte Carlo calculations which show that the resulting meteorites are consistent with all the observational constraints, the case for this chaotic route to Earth is fairly strong.

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There are several physical situations in the solar system where chaotic behavior plays an important role. Saturn's satellite Hyperion is currently tumbling chaotically. Many of the other irregularly shaped satellites in the solar system had chaotic rotations in the past. There are also examples of chaotic orbital evolution. Meteorites are most probably transported to Earth from the asteroid belt by way of a chaotic zone. Chaotic behavior also seems to be an essential ingredient in the explanation of certain non-uniformities in the distribution of asteroids. The long-term motion of Pluto is suspiciously complicated, but objective criteria have not yet indicated that the motion is chaotic.

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Karl Popper is generally regarded as one of the greatest philosophers of science of the 20th century. He was also a social and political philosopher of considerable stature, a self-professed 'critical-rationalist', a dedicated opponent of all forms of scepticism, conventionalism, and relativism in science and in human affairs generally, a committed advocate and staunch defender of the 'Open Society', and an implacable critic of totalitarianism in all of its forms. One of the many remarkable features of Popper's thought is the scope of his intellectual influence. In the modern technological and highly-specialised world scientists are rarely aware of the work of philosophers; it is virtually unprecedented to find them queuing up, as they have done in Popper's case, to testify to the enormously practical beneficial impact which that philosophical work has had upon their own.

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