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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

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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.*

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\* 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 at 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 as 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 after all, 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)

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‡ 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).

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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*).

## § 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<sup>†</sup> 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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† 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*),<sup>†</sup> 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 phenomena present to *The Problem of Sustainable Economic Development*. It may be of interest to note, however, that global warming is ranked 9<sup>th</sup> (ranked 8<sup>th</sup>

\* 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).

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)<sup>‡</sup>
- (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)<sup>§</sup>
- (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 phenomena 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).<sup>††</sup>

‡ 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<sub>1</sub>) vs. Universe (P<sub>2</sub>).*

WHAT IS THE OBJECT OF THE GAME?

*P<sub>1</sub> = Survival.*

*P<sub>2</sub> = ?*

**The Dilemma.** As we strategize, a dilemma becomes apparent before play even begins: In light of the fact that *P<sub>2</sub>*'s objective = unknown, *P<sub>1</sub>* faces the dilemma presented by universal uncertainty (*Axiom VI*): *P<sub>1</sub>* survival requires defending *relative insularity* (cf. 5), but this defense must be split between *two essentially contradictory strategies*: *S<sub>1</sub>*: defending *Ecological Insularity* (*Axioms I-III*), and *S<sub>2</sub>*: 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<sub>2</sub>*.

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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† 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).

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

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

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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).

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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‡ 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).<sup>\*</sup> 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).<sup>†</sup>

### 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,

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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).

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 phenomena eventually *will* instantly (likely without much warning) render the inhabitants of Earth *a'ohe nao 'ai i ka papa a*,<sup>‡</sup> 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<sup>§</sup>. 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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‡ 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

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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

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:ln 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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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 18<sup>th</sup> 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 1<sup>st</sup>, 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

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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).

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.

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-blindness? 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*)?

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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).

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 artisanal 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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‡ 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).

\*\* Artisanal subsistence skills are my emphasis – though I believe Jarvis, Fowler, Russell Fielding, and others may echo this point. I will also add that the 2<sup>nd</sup> 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 is 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*,<sup>†</sup> and *The Problem of Economic Power* (cf. 5).<sup>‡</sup>

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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 7<sup>th</sup> *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).

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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).

## 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. . . .

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 ( $\approx 50,000$  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  $\{i_1, i_2, i_3, \dots, i_n\} \cup$  GEMS  $\{g_1, g_2, g_3, \dots, g_n\}$  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

APPENDIX II

MY ERROR

JAN-14-2005 16:08

McINTOSH & OTIS

212 687 6894

P.01/01

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

~~Eric Raab~~  
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 through.  
Best,  
Jessica Mae

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