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

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* 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

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EPIGRAPH

In framing an ideal we may assume what we wish, but should avoid impossibilities.

ARISTOTLE.

—Aldus Huxley, *Island*, 1962

I suppose the process of acceptance will pass through the usual four stages:

(*i*) This is worthless nonsense,

(*ii*) This is an interesting, but perverse, point of view,

(*iii*) This is true, but quite unimportant,

(*iv*) I always said so.

—J.B.S. Haldane, *Journal of Genetics,* 1963

PRÉCIS

The theory presented here was developed to address the problem of the long-term survival of the human species. This paper tables axioms which fruitfully model *The Problem of Sustainable Economic Development*, 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 an evolutionary stable, sustainable economic development strategy, and, thus, fosters national security, international cooperation, global threat mitigation, and, ultimately, survival of the human species.*

Key Terms:

Human survival, sustainable economic development, noncooperative games, problem of induction, natural selection, astrophysical and planetary phœnomena, global threat mitigation, 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*).

§ 1. THESIS

THE THEORY presented here was developed to address the problem of human survival on Earth,* a planet lacking central authority:

> 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. Central questions include the following. 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? (3:*1737*).

We will explore these questions and several others.

Thus, in light of the scope of our ambitious endeavor, wasting no time with introductions (*cf.* 4), we'll 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 (5:*129*).

§ 2. AXIOMS

Axiom I - Ground Zero 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. 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 (6:*vii-viii*).

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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. The present inquiry… 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 (2:*190*).

† 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 (7:*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.

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 contribute uncertain and unquantifiable *positive externalities* toward the mitigation of *Axioms IV-VI*.

Axiom IV - Political Uncertainty Premise[*] (8-18)

> Survival…is the basic, continuing, inescapable problem for all living organisms… It follows that survival is the… 'problem' for human societies as well; it is a prerequisite for any other… objectives…. Our economic and social life…, [and] the actions of… governments… [is] either directly or indirectly related to the meeting of our basic survival needs (17:*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 immigration *must* occur within an unknown and unknowable time-frame, < ≈50,000 years from present (*cf.* 18 ; 19).

Although details pertaining to the risk factors outlined below represent a considerable discourse in of itself, (18) surveys, 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 risk factors, but rather highlight the hereto unrecognized nature of the dilemma catastrophic astrophysical and planetary phænomena present to *The Problem of Sustainable Economic Development*. It may be of interest to note, however, that *The Problem of Global Warming* is ranked 8th (also ranked 8th in 18); only two are of anthropogenic nature. Risks are presented in an order of approximate relevance, but, again these risk factors ultimately lie well-beyond the reach of probability theory:

(*i*) *The Problem of Meteorites* (*cf.* 18 ; 20)[‡]
(*ii*) *The Problem of Super-Eruptions* (*cf.* 18 ; 22)
(*iii*) *The Problem of Supermassive Star Collapse* (*cf.* 18)
(*iv*) *The Problem of Chaotic Behaviour* (*cf.* 23-24)[§]
(*v*) *The Problem of Solar Flux* (*cf.* 18)
(*vi*) *The Problem of Ohmic Decay* (*cf.* 25)
(*vii*) *The Problem of Industrial Agricultural* (*cf.* 26-29)
(*viii*) *The Problem of Global Warming* (*cf.* 18 ; 30)
(*ix*) *The Problem of Ice Ages* (*cf.* 18)

Axiom VI - Universal Uncertainty Premise
This may represent the least understood, simple truth on Earth (*cf.* 31-37). *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" (38:*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 (8:*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.' It is a big mistake to say that war is irrational (10:*351*).

‡ 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 (21:*abstract*).

§ 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 suspicious (24:*abstract*).

** 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 (6:*36*).

§ 3. HYPOTHESIS

Yes, we do indeed discover 'that the axioms actually determine a solution uniquely,' as the true nature of several widely-held – *though false* – theories immediately come to light. We will begin to explore these truths with a highly simplified model, *THE TRULY NONCOOPERATIVE GAME OF LIFE ON EARTH*:

WHAT ARE THE RULES OF THE GAME?
Axiom I, Axiom II, Axiom III, Axiom V, Axiom VI

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

WHAT IS THE OBJECT OF THE GAME?
Homo Sapiens = Survival.
Universe = ?

The Dilemma

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

In other words, resources must be split between two invariably contradictory 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 relatively 'ecologically degrading' economic activities have been and always will be required in our race to offer solutions relating to S_2.

Indeed, this highlights the disquieting nature of *The Prisoner's Dilemma* (39).*

But all hope is not lost; this tactical dilemma does not negate the existence of an ESS: "The laws of nature are approximate…: we first find the 'wrong' ones, and then we find the 'right' ones" (41:*2*); indeed, our *Axioms* enable us to hone in on the 'Unity of Nature' by a sweeping process of elimination.

The logical implications which follow from our axioms falsify an extraordinarily wide-range of theories—including the central thesis of 'ecological economics' and the canons of a number of influential contemporary ideologies – including ideological environmentalism and socialism; our theoretical framework enables us to *exclude* many false theories, thereby moving us closer to the truth (and thus ESS) (*cf.* 32 ; 42).†

Brundtland's Error

Sustainable Development in Small Island Development States: Issues and Challenges notes the 'seminal' *Brundtland Report* defined sustainable development as:

> Development that meets the needs of the present without compromising the ability of future generations to meet their own needs (43:*1*).

A review of the vast body of literature on this topic soon reveals that this definition is almost universally accepted.

We trust, however, that we have demonstrated that this definition is theoretically impossible. Countless theorists have fallen 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 (44:*abstract*).

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

We may also pause to briefly consider how remarkable it is that, long ago, this conclusion was derived without the aid of our indirect proof:‡

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* Life's toughest choices are not between GOOD AND BAD, but between BAD AND WORSE (40:*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 (42:*26*).

‡ *Reductio ad absurdum*, which Euclid loved so much, is one of a mathematician's finest weapons (45:*19*).

> 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 (8:*485*).

Countless and inevitable 'altered circumstances,' which countless ecologists 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

The first chapter 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" (46:*1-1*), but in the truly noncooperative game of life on Earth, 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 may wish to briefly explore the most important section of a well-known thesis.* Although we may be getting a bit ahead of ourselves, the implications which readily follow from our theory as they relate to dominant strategy in the international arena may already be fairly clear:

> 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 (48:*23*).

Indeed, *there have always been inescapable situations and there always will be inescapable situations which make the situation truly non-cooperative*.

And thus, in reality, all the games that people, nations, planets, and the universe play *are all noncooperative games*† *with incomplete information* (50).

However, perhaps ironically, the ultimate solution to this problem hinges upon unprecedented levels of international cooperation:

> Science has greatly extended the range of questions in which man has a choice; it has extended man's freedom to make significant decisions. Is there anything in the methods of science itself, or in the spirit of science, which can help in the making of these decisions? To what extent is there a play on the word *science* which can mislead us and take us up false roads when we speak of this science of human relationships? Is there anything we can learn from the relevance of science to politics?
>
> If we are to answer these questions and answer them honestly, we must recognize important and basic differences between problems of science and problems of action as they arise in personal or in political life. If we fail to recognize these differences, we shall be seeking magic solutions and not real ones (51:*108-109*).

On the Law of Superabundance

> "How much is enough?" Put more concretely, it is: 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 (52:*1-2*).

If our answer to this question is not implicitly clear, we shall render it explicitly: *this problem is also theoretically insoluble*. A half-century prior to (2, 53-54), an influential exploration of this challenging problem 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 (55:*4*).

These 'postulata,' the essence of which provided Darwin's 'Malthusian Insight' of 1838 (56:*122*), demonstrated an intuitive grasp of *The Law of Superabundance*, and, in light of our *Axioms*, we discover that the solution to this problem is neither 'population control' (57-58), nor "to increase global food and timber supply to accommodate a world growing to 10 billion or more people" (59:*19679*), because, once again, (*i*) we're unable to pursue either strategy with any conviction.

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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 (47:*164*).

† The Nash equilibrium has helped to clarify a distinction sometimes still made between 'cooperative' and 'noncooperative' games… One trend in modern game theory, … the 'Nash program,' is to erase this distinction… so that all games can be modeled as noncooperative (49:*4000*).

As *The Law of Superabundance* stipulates, "the effort towards population…[is] always greater than the means to support it" (55:12).* And of course nature knows best—because populations may plummet at any unknowable point in time: we have outlined many scenarios whereby, "even if death doesn't get you right away, you're unlikely to have much spare energy for sex" (60:*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 (62:*3-4*).

As our *Axioms* illustrate, innumerable geopolitical, planetary, or astrophysical phænomena eventually *will* instantly 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 peasants to Presidents to Philosopher Kings – may find themselves "hunters, the lowest and rudest state of society" (8).

But of course the problem is that it takes *years – even several generations* – to become *Jägermeistern*. *Millions*, even *billions* of people – *especially* the highly interdependent inhabitants of the 'first-world' – may, some day, discover just how much Darwinian fitness they do or do not possess.§

On Sustainable Economic Development

And now that we've constructed a solid theoretical foundation with our *Axioms*, we're now able to develop a tenable solution to *The Problem of Sustainable Economic Development* by developing a

> unified theory of value informs *ESS* by resolving fundamental, open-problems in economics, evolutionary theory, and conservation biology. This solution illuminates dimly seen politico-economic principles, illustrates the central role relative insularity plays in natural selection, informs *ESS* at the individual, and national level, and thus, as a whole, informs strategy for human survival. First we derive a global solution via axioms, then develop *The Principle of Relative Insularity*, a postulate which informs *ESS* for our negotiation model, *The Earth Island Survival Game.* This game informs ESS at the national level, tactics which resolve *The Tragedy of the Commons*, promote human survival, national security, international cooperation, global threat mitigation, and thus illuminate the illusive path toward sustainable development (65:*precis*).

However, there is one key solution we may wish to equip ourselves with prior to setting off on this quest; although it may be tempting to dive into this excitement, in acknowledgement of the fact that

> 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 (66:*12* ; *cf.* 67).

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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 (55:*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 (61:*450*).

‡ Literally, 'nothing but burnt food to eat,' used to refer to a 'terrible situation' (63:*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 (64:*135*).

Thus, to help make this necessarily long journey as easy as possible, we may wish to take the time for a proper introduction after all (*cf.* 4), as the solution to *The Problem of Sustainable Economic Development* on islands helps us derive the solution to *The Problem of Sustainable Development* on the island of Earth. Thus, please consider this warm invitation to explore a discourse which

> 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 their 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* (*i.e. The Tragedy of the Commons*); the other model informs an ESS which promotes survival, resource holding power, cooperative behaviours, self-sufficiency, and independence by illuminating the illusive path toward *Sustainable Economic Development* on islands (4:*precis*).

"This sketch is most imperfect;* but in so short a space I cannot make it better. Your imagination must fill up very wide blanks" (53:*6, cf.* 68).†

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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 (2:*191*).

† 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 (69:*35-36*).

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