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7 December 2011

RATIONAL SUSTAINABILITY

"I have striven not to laugh at human actions, not to weep at them, nor to hate them, but to understand them." -Spinoza

The purpose of this paper is to provide a new basis of sustainability that is based on methodological individualism. If sustainability is to itself be sustainable, it can have no other foundation. Our past experience and logic show that basing any economic endeavor on a collectivist approach will result in failure.(Mises 1922) Unfortunately for the purpose of sustainability, it became a cover for the advancement of a collectivist agenda. The agenda states that the principles based upon methodological individualism, particularly capitalism are inherently bad and must be swept aside as that is what is the source of defilement and exploitation of our planet. (Rand 1971)

The marginalization of traditional economic theory as being inadequate and the rejection of capitalism acted to delay an effective action in the process of reaching a sustainable economy. There are early actors that under traditional economic theory and a capitalist framework able to transform their operations to be sustainable.(Anderson 2009) If change is possible under the existing framework, then sustainability must also be compatible with methodological individualism. The difficulty is in showing how this can be done.

This paper will cover four key areas. First it will lay an epistemological foundation for rational sustainability. Second it will show how methodological individualism was abandoned by Keynes in the development of macroeconomics, and how subsequently it can be readily integrated in macroeconomic theory. The paper will then explore the consequences of the reintegration of methodological individualism and suggest how this can readily explain resilience theory and incorporate economic interaction with the physical world. In the final portion, the paper will explore the method and implications of social choice under this new framework by rebutting Sen (1970).

Foundations

In our discourse about what it is the basis of rational sustainability, it is important to understand the limitations of the theory and the implications of the assumptions. The theory of rational sustainability is based on the requirement of being concerned with reproducible events that can be understood through reason. Second is the that the principle of maximum entropy represents a ontology that is canonical, or natural. Finally, the development of the theorem of, for lack of a more descriptive adjective, love of life, which will be covered first.

Love of life

The existence of life on this planet is dependent upon two things for survival: other life forms and some sort of energy input. These requirements for life are self evident, especially for higher life forms such as ourselves. Plants take nutrients from the decayed and broken down remains of

other life. Using energy, mostly sunlight, the decayed remains, loam – detritus, as building blocks to grow. The plants are then consumed by animals which are consumed by other animals. In this sense the death of a life form is merely a change of state into another life form. It is only the intensity of life that varies from state to state. The love of life is merely an acknowledgement of this phenomenological view.

What serves as the basis for life and what happens to consciousness upon death, are to this point unanswered questions and are to be taken on a matter of faith. It is when reason becomes inadequate to describe the unknown that some belief structure is useful to provide an explanation. Reason is a continuously evolving entity as is our belief structure. It is when reason evolves as during the Renaissance and theology fails to change, that conflict ensues and progress becomes difficult. This paper does not advocate the abandonment of religion. For some a belief of order in the the unknown is necessary, for others that is not. However, to not acknowledge the benefit that religion has given human kind over the millennia is to ignore our past, which we will be doomed to repeat if we forget. The acknowledgement of the importance of religion in human development was what Peirce so aptly pointed out as lacking in the fundamental structure of positivism.

However, it is important to note that theology must evolve as our understanding of the world around us changes. To ignore what reason provided in understanding of reproducible events, binds and delays human development and only prolongs suffering. The reaction of the church to Galileo is an example of this, as are Newton's fears of upsetting the church with the development of classical motion.

Religion seems to provide two main attributes for a society. First is that it explains what the extent of our collective knowledge cannot. It also provides a social context that provides a set of guidelines that define a society. Many of these religious tenets and customs evolved over the span of millennia to what we see today. New religions come and go, and some stay around for a very long time. As there are several religions in the world that have existed over a millennia , there must be some reproducible characteristic of them. This framework for a successful religion seems to be one that respects and values individuals and provides a sense of comfort and value to the member individuals by defining moral behavior as that which did not take away from other individuals without warrant. Whereas religions based on subjugation of a particular sect or group, including some forms of paganism and those based on sadism/human sacrifice did not create societies that were strong enough to survive. Many religions never entirely go away, e.g. Zoroastrianism, but are relegated to the margins of the established society as the societies that once supported them waned for various reasons, even though the particular religion provided a valuation of self and others.

Where the failure in many classical religions is that humans are treated as being separate from the world they inhabit. This separation and lack of connection allows value to be defined outside of any context to the world we inhabit. When we did not have the empirical evidence that we do today, religion served as the mores of a society as already discussed. It is from this point that the religions that valued life (to varying degrees) provided us with a stable framework that allowed us to be able to explore our world. As we explored, the more we understood and our religions evolved too with our growing knowledge.

Reproducibility and action

Some may argue about the need to discuss reproducibility. It is however fundamental to this discussion. Reproducibility means that under a given set of constraints some event in space time can be duplicated. The duplication is not an exact replication of each degree of freedom of the entire system. To do this would be impossible. Here is an example, there is an adage that, "One cannot cross the same river twice." This point is true as the exact point of how the river was precisely shaped with the exact same location of the fish, pebbles, and water. These conditions of the microstate are irrelevant to our understanding of how to safely ford a river or to build a bridge and then drive across it repeatedly. Thus, the crossing of a river is a reproducible event, understood by a few key macroscopic variables that can be observed or induced from past experience.

Others will argue that to know what is the desire of any human mind or even a society is an impossible endeavor. To disprove this we will have to look at the construction of a society a simple one where the constituents of the society have no desire to maintain reproducibility and seek complete anarchy. Thus the society cannot observe such reproducible individual acts as drinking liquids or eating food, or even fundamental societal acts such as reproduction, which by definition is a reproducible event. There will be some drastic consequences as a result of this. Without procreation, the society would cease to exist in short order. The lack of consistent eating and drinking would only serve to accelerate that outcome. Sex, and its fundamental outcome child bearing is the fundamental social activity that serves to allow the creation of future generations. For any society, human or animal, to have longevity beyond a few days, it must consist of at least two reproducible events: subsistence and procreation.

Rationality

We do not claim to know that each actor in the economy is "rational". However, we will restrict our exposition of utility to those of demonstrated preference. Thus action is required to demonstrate utility,

"Human action is purposeful behavior. Or we may say: Action is will put into operation and transformed into an agency, is aiming at ends and goals, is the ego's meaningful response to stimuli and to the conditions of its environment, is a person's conscious adjustment to the state of the universe that determines his life." (Mises 1998)

We shall take this definition for the time being as it allows measurement of human behavior through observation of physical activities such as the purchase of goods or how and where time is spent. Action in this sense describes how the individual interacts with their surroundings. Unfortunately, von Mises' version of action and that of others, Pierce, are philosophically insufficient for our purpose. To quote Pierce:

"This employment five times over of derivatives of concipere must then have had a purpose. In point of fact it had two. One was to show that I was speaking of meaning in no other sense than that of intellectual purport. The other was to avoid all danger of being understood as attempting to explain a concept by percepts, images, schemata, or by anything but concepts. I did not, therefore, mean to say that

acts, which are more strictly singular than anything, could constitute the purport, or adequate proper interpretation, of any symbol. I compared action to the finale of the symphony of thought, belief being a demicadence. Nobody conceives that the few bars at the end of a musical movement are the purpose of the movement. They may be called its upshot. But the figure obviously would not bear detailed application. I only mention it to show that the suspicion I myself expressed after a too hasty rereading of the forgotten magazine paper; that it expressed a stoic, that is, a nominalistic, materialistic, and utterly philistine state of thought, was quite mistaken."(Peirce 1934) (CP 5.402)

The culmination of a series or symphony of thought as Peirce describes is the lowly and humble physical action. He suggests in his writing that it is thought that is the culmination or symphony. He misses the point of what a symphony is. A symphony is series of actions of multiple individuals coordinated by the actions of a conductor; that they in themselves represent a series of actions over the span of every individuals lifetime. They the performers have taken the time and conducted the actions necessary to be able to perform the symphony and are an ultimate expression of human will over a long period of time. It is not important to know what they are thinking when they are playing the symphony, but that they are playing. I contend that there is not lay person off of the street who having never laid hands on a violin, be able to take up the violin and play Beethoven's Pastoral as one who has dedicated their life to the study of the violin and the great symphonies.

From an epistemological sense, the sum of a person's life is the path that they have walked and the actions that they have taken along the path. Their thoughts, not without relevance, are not necessary to judge an individuals character. Who they are is defined by what they have done and by what they do. We have no other metric to judge an individual or ourselves for that matter. It will not become clear until after we discuss the principle of maximum entropy that the clear mathematical definition of action in a classical sense is consistent with our intuitive understanding.

Morality and entropy

We cannot begin the further undertaking of developing rational sustainability without first understanding the concept of entropy and the principle of maximum entropy. Compounding the confusion, entropy is oft misunderstood, since its discovery by Clausius.

Entropy is often thought of as measure of disorder, and that for a spontaneous process the system will move toward an equilibrium and entropy will increase as described in a popular undergraduate thermodynamics text.(Moran and Shapiro 2008) In this college text book some almost 200 years later was not able to explain entropy more clearly. Later work by Shannon showed it to be a measure of information.(Shannon 1948) It wasn't until Jaynes made the connection to statistical mechanics (Jaynes 1957) that entropy developed a deeper physical meaning. Jaynes referred to Gibbs' work (Gibbs 1902) as, "[He] asked a more modest question, which can be answered: "What is the best guess we can make, from the partial information that we have?" But Gibbs was only recognizing something that is true universally. In all of science, in or out of thermodynamics, what happens in the real world depends on physical law and is on the level of ontology."(Jaynes 1991) Recent work by this author shows that what Jaynes suggested about Gibbs formalism being something universally true is correct.(Abel 2011)

“The development of Information Theory made it possible to see the method of Gibbs as a general procedure for inductive reasoning, independent of ergodic theory or any other physical hypotheses, and whose range of validity is therefore not restricted to equilibrium problems; or indeed to physics. In the following we show that the Principle of Maximum Entropy is sufficient to construct ensembles representing a wide variety of non equilibrium conditions, and that these new ensembles yield transport coefficients by direct quadrature [numerical solution].”(Jaynes 1978)

Entropy is still undefined to this point to the lay reader. Entropy is simply the expected uncertainty of a probability distribution. It is defined as:

$$s = - \int p(X) \cdot \log[p(X)] dX \quad (1)$$

Entropy represents a quantification, or rather a measure of our knowledge about that which the probability distribution describes. Jaynes describes it as a measure of the numbers of ways the microstate can be realized and still yield the same macroscopic results.(Jaynes 1985) The more relevant information that is presented to the problem formulation the lower the overall entropy will be, representing the extent of our knowledge about the problem. In the quantification of “wicked problems” the maximum entropy principle provides an elegant and meaningful solution that assumes nothing beyond that which is already known.

But who’s knowledge is it anyway? In the case of determining policy, entropy is the measure of the policy maker’s ignorance over the entire range of all the possibilities that the outcome of the policy will have. For an engineer designing a steam plant, it is the measure of the engineer’s ignorance of the configuration of states of the steam and water based on the constraints that she specified. There is no difference in the entropy between the two, other than in the engineer’s case where the entropy contains Boltzmann’s k because the uncertainty is so large. In light of the uncertainty in describing physical systems, it is amazing to consider the accuracy and reliability the engineer can exert over those systems with only consideration of a few variables, e.g. temperature and pressure.

The occurrence of when this theory fails is not in itself a failure of the theory, but instead a failure in our description of the problem, that there is some unaccounted degree of freedom that we did not know about. Thus failure represents a most valuable opportunity to expand our knowledge.(Jaynes 1978) Such an phenomenological approach is in keeping with the methodology of pragmatism.

They either consist in physical -- that is, ultimately, dynamical -- explanations of phenomena, or else in explaining things on the basis of our common sense knowledge of human nature. Now dynamics is nothing but an elaboration of common sense; its experiments are mere imaginary experiments. So it all comes down to common sense in these two branches, of which the one is founded on those instincts about physical forces that are required for the feeding impulsion and the other upon those instincts about our fellows that are required for the

satisfaction of the reproductive impulse. Thus, then all science is nothing but an outgrowth from these two instincts. (Peirce 1934) (CP 6.500)

We can see that the ontology of the principle of maximum entropy is based on observation and prediction in the physical world based off of empirical evidence that we have used to shape our individual and therefore collective understanding of the physical world. The approach that Peirce so strongly advocates in the scientific method is what Jaynes described so humbly, "How shall we best think about Nature and most efficiently predict her behavior, given only our incomplete knowledge?" (Jaynes 1986) The scientific method is an honest expression of admitting what we do not know and humbly seeking to explain our experience by not claiming that which we cannot know. The scientific method represents a profound morality of reason.

Asheim states two axioms that are needed to be able to justify sustainability. (Asheim, Buchholz et al. 2001). The first which we shall critique in this section is the *Efficiency (of R) Axiom*. This axiom relies on the condition of Pareto optimality. This author shows that Pareto Optimality is nothing more than the Principle of Maximum Entropy. (Abel 2011) Asheim describes the Efficiency Axiom as "the least controversial ethical axiom on R is that any social preferences must deem one utility path superior to another if at least one generation is better off and no generation is worse off." (Asheim, Buchholz et al. 2001) From the ontology of the principle of maximum entropy, the "normative" axiom of Pareto optimality is only a statement of phenomenological observation and prediction.

Using normative words to describe a positive statement, we can describe something as being Pareto optimal as good (where no one may be made better off without making someone else worse off) and how far the system is away from Pareto optimality is its measure of "bad", where someone benefits at the expense of another. Spinoza offers a warning about applying normative values to a purely rational activity, freedom, "If men were born free, they would, so long as they remain free, form no conception of good and evil."

We justified the use of the principle of maximum entropy based on phenomenology. It is a universal principle used extensively in the physical and social sciences. Most of the uses of maximum entropy are done unwittingly, and often times provide the only way to be able to reasonably predict behavior. Some would critique this as reductionism. It is. The use of maximum entropy identifies a particular stationary point in the system. The analysis of this stationary point results in a set of differential equations. Some prominent individuals take great exception to the use of physics to describe human behavior like von Mises. (Mises 1998) First, this is not physics. This author showed that when we adopt the principle of maximum entropy that the fundamental differential equations of thermodynamics are an intrinsic property of the mathematical space that defines the world we inhabit. (Abel 2011) Second, when we adopt the position of maximum entropy we have simply admitted that we are going to assume that what it is that we are analyzing will assume the configuration that we know the least about based on the information that we have at hand.

It is from the above perspective of maximum entropy that we have what is perhaps the definition of rationality. By assuming the least and using all pertinent information at hand that we attempt to predict the world around us. A rational decision is now formally defined as a decision which assumes nothing beyond the information at hand, including prior information and does not

exclude pertinent information for ideological purpose. Ideology is now defined as the exclusion of any information acting to reduce the entropy of a decision. Pertinent information is that information which acts to reduce the entropy of a decision. In the previous definitions decision may be replaced with analysis.

Kant suggests that morality and rationality are the same thing. The definition of rationality used here is different from Kant's.¹ Rationality here is defined as the full use of the degrees of freedom of our mind and the sum of our knowledge to base our choices. As we showed, morality and rationality are equivalent, it means that only by fully embracing our rationality, our minds, our reason, our humanity that we can act morally. Stated another way, the only moral action is to use the full faculty of our minds and the entire sum of the information that is available to us. Only by embracing reason can we act morally. Then ideology becomes amoral. Abandoning the individual is amoral because it ignores the consequence of our past experience with experiments of this nature, Nazi Germany, the Soviet Union, Cambodia under the Khmer Rouge, the Reign of Terror in France, the current regime in North Korea.(Mises 1922) Unfortunately, the list continues *ad nauseam*. It is because of this that von Mises proved that any collectivist society cannot sustain its existence.(Mises 1922) If a form of governance is not sustainable then it itself cannot enact policies that are.

Positive action does not require normative values

As action is usually preceded by a decision, referring to action being rational is assuming too much. It assumes too much by presuming that the individual who is evaluating the other person acted based on a rational decision. No action can ever completely be determined to be rational by an outside observer. An observer of human behavior can describe an action being rational only in terms of degrees of plausibility based off of observation of that individual and that of the society to which the actor belongs. Thought of another cannot be known by the observer, only the character of thought as observed by the actor's action.

What has previously been a normative value, seeking efficiency or rather more eloquently "To do no harm", is now a product of pure and rational thought. Through his application of reason, Spinoza had a great insight into this. If an individual acts rationally, assuming nothing beyond that which he knows and with out ignoring pertinent information, that they are acting under the simple principle of doing no harm. Their action can be defined as being moral and, in the sense of Gibbs, canonical. Only an individual actor can know if their action is moral, for the observer of action it can only be induced.

We have shown that rationality is a sufficient moral code. With it a rational actor can only to love life and to acknowledge their part in life. If a rational individual is threatened, their love of life

¹ There is much similarity in here with Kant's reasoning. The fundamental difference is that of a world view. Kant's view of reality, at least as how this author understands it, is a construct of the mind's representation of empirical observation. That the world comes from a thought. Reality here is reality. It has no other definition. The universe is as it is. What our minds do is to create an understanding of the world around us, physical modeling without necessarily the benefit of physics. What Peirce would describe as semiotic, is here described as a space of 'understanding'. This space is a construct of our mind and is contained within us. Our knowledge is a topological space, a manifold, that is embedded into the topology of our body. As we learn it is not the world around us that changes. It is our space of 'understanding' that changes.

does not prevent them from taking a life without sufficient basis. Stated another way rationality demands that if attacked, a lack of proportional response will only beget further attacks. The constrained prisoners dilemma of game theory shows that this "tit for tat" is the only effective strategy to end the aggression.(Axelrod and Hamilton 1981) The act of aggression on behalf of an individual represents taking both the aggressor and the victim hostage.

Value as defined by expected utility holds for any positive affine transformation.(Neumann and Morgenstern 1944) Thus any specific value is relative to any individual or common reference. What rationality provides is an anchor for moral relativism that acts to constrain the possible actions to those which do not take away from others.

Abandonment of Individualism

The dangers of not maintaining methodological individualism are a shift to unconstrained moral relativism where values are specified by a small group that does not necessarily represent the entire society. Their specification of preference over canonical preference, ultimately leads to the harm of the entire society. (Mises 1922) Contrary to egalitarian beliefs, such a shift only takes from those who have less and gives to those who did not earn but instead took through force.

Defining a democracy as a equal say among individuals of a group in the discourse of the society is perhaps the cleanest form. It does however, demand a high price, respect of the rule of the society and acting in accordance with the discourse of the society. It demands a further responsibility and that is the respect of the voice of each participant as being intrinsic in the foundation of the democracy. It is the fundamental respect and valuation of life that serves as the cornerstone of any democratic process. We showed previously that respect can only come from a rational individual. Thus rationality, as defined in this paper, is the cornerstone of democracy. Any form of ideology is an abandonment of the individual and of the democratic process.

Lasswell was instrumental in shifting away from methodological individualism. He sought to shift away from "preference automation" that game theory suggested.(Torgerson 1985) Torgerson quoting Lasswell, "In effect the player becomes a computing machine operating with 'built in' rules in order to maximize built-in preferences."(Torgerson 1985) If an individual is not operating under built in rules as game theory suggests then by whose rules is the individual to operate under. This is a fundamental point in methodological individualism. It is the individual operating under his own preference for his own preference is the individual who is free and who values all life. Torgerson confirms the observation of Lasswell's advocacy of collectivism, "Profoundly influenced by Freud and Marx, Lasswell emphasized the importance of the contextual orientation of policy analysis, both individually and collectively."(Torgerson 1985) The context that Lasswell built was of class awareness. In effect, what he was doing was segregating the individuals into groups defined by class. Von Mises created a very strong argument against this in Socialism creating a proof against the ideas of Marx.(Mises 1922)

So how is it that Keynes development of macro economic theory abandoned individualism and is ideological? To begin will require a detour in mathematics and the underlying assumptions of macroeconomic theory, we will keep the discussion as top level as possible. Macroeconomic theory is based on an optimization using Lagrangian mechanics that is reformulated into the aggregable representation of Hamiltonian mechanics. It is this point that von Mises and others

disagree so fundamentally with a “physics based system of economics”.(Buchanan and Wagner 1977; Mises 1998) We will show that their disagreement and rejection of such a “deterministic method” rejects the possibility of reexamination or even use of the vital concepts. Blaug notes this:

“At this point, it is helpful to note what methodological individualism strictly interpreted (or *Verstehen* doctrine for that matter) would imply for economics. In effect, it would rule out all macroeconomic propositions that cannot be reduced to microeconomic ones, and since few have yet been so reduced, this amounts to saying goodbye to almost the whole of received macroeconomics. There must be something wrong with a methodological principle that has such devastating implications.”(Blaug 1992)

Blaug however completely misses the importance of methodological individualism and is ready to abandon such a profound principle for the sake of expediency. Liberals² such as von Mises, Buchanan, Llosa, and Hayek are right to cry foul. What is it that both sides of the debate are missing?

We start by taking the differential form of conventional macroeconomics’ Hamiltonian:

$$dU = \sum_j^M \frac{\partial U}{\partial a_j} da_j + \frac{\partial U}{\partial t} dt \quad (2)$$

The summation are the macroeconomic, extensive, variables that define the system. The other term is related to time. It seems like this is complete. It is however not. It looks only at the societal averages and optimizes the “social good”. The complete formulation is significantly different.

$$dU = \sum_k^\lambda \sum_i^N \frac{\partial U}{\partial q_{k,i}} dq_{k,i} + \sum_j^M \frac{\partial U}{\partial a_j} da_j + \frac{\partial U}{\partial t} dt \quad (3)$$

The formulation of (3) represents the inclusion of the N unique actors with λ degrees of freedom into the economy.(Abel 2011) This is the fundamental difference between Keynesian macroeconomics and statistical economics. The actors represented in (3) can be anything that has physical form, from a subatomic particle to an insect, to a bird, to a tree, to a fish, to a human being. It only depends upon which you define the system. The definition of the system is based in part off of the information that you have and what it is that you are trying to understand. (3) represents a very generic formulation that can be applied anywhere as it is a fundamental property of the space of the universe.

This author (Abel 2011) shows that if we select $\lambda = 2$ and describe an objects position, q , and momentum, p , as its degrees of freedom, then (3) takes the form of:

²The definition of liberal used throughout this paper is that of what is considered a classical liberal, an advocate of individual liberty.

$$dU(q_i, p_i, a_j, t) = \sum_i^N \left(\frac{\partial U}{\partial q_i} dq_i + \frac{\partial U}{\partial p_i} dp_i \right) + \sum_j^M \frac{\partial U}{\partial a_j} da_j + \frac{\partial U}{\partial t} dt \quad (4)$$

Equation (4) reduces directly to the form that Gibbs uses to lay the rational foundation for statistical mechanics.(Gibbs 1902) Utility is then constrained by the laws of motion. It is a measurable quantity that is common to every physical object, energy. Furthermore the utility of something is not an intrinsic property, just like probability is not intrinsic to an object such as a coin. The utility of something depends on the knowledge of the user and when aggregated the average knowledge of the society as seen in equation (5), where the brackets indicate averages over the ensemble, and the Tds term represents the macroeconomic, extensive, description of all of the individuals, the ensemble. T represents the temperature, average kinetic energy of the population, and ds is the entropy differential. The traditional macroeconomic analysis leaves out the Tds portion of equation (5). Ignoring the uncertainty, entropy, of the population is how conventional macroeconomic theory is ideological.³

$$d\langle U \rangle = Tds + \sum_j^M \left\langle \frac{\partial U}{\partial a_j} \right\rangle da_j \quad (5)$$

To deny the energy approach as being reductionistic is in itself ideological. An individual is constrained by space, time, and the laws of physics. To deny this is to deny the ontology of the physics of the world around us. It is perhaps why collectivists seem to attack science with such zeal, or to cloak their ideology in the trappings of reason to hide their true intent.(Mises 1922; Rand 1971)

The importance of placing debate over scientific valuation such as advocated by Sagoff (Sagoff 1998), represents an incremental abandonment of reason for who can ever give the most moving argument that appeals to “social” values. The question then becomes, “Who’s values?” Sagoff emphasis the importance of political discourse. However, the discourse of the policy is not to determine the outcome or winner, but to provide the constraints to action that is defined by the social values as represented by the code of law. He misses the purpose of methodological individualism by suggesting that libertarians would charge far more than what is economically efficient.(Sagoff 1998) In the Reintegration section we show how a liberal will seek to value the pollution at that level which eliminates dead weight loss, and is as such Pareto optimal. Sagoff and many others place an artificial requirement that *people* are rational.(Sagoff 1998) We make no such claim, we claim on to seek a rational and consistent *framework* for evaluating reproducible events around us, which includes individual behavior.

By attacking something as being unknowable (through science or reason) or to borrow a phrase “a wicked problem” deny’s the opportunity of being able to apply reason to address the problem. If reason is not allowed to create understanding, then “understanding” comes from a

³ Equation (5) was derived under equilibrium conditions and is why the time variable is excluded. Equilibrium is defined as invariance over time. The non-equilibrium discussion of this will be done latter in the paper. The concept is easier to describe initially in the context of equilibrium conditions with later development of non-equilibrium conditions.

minority, whose purpose is to control.(Mises 1922) Borrowing from Orwell,“All animals are equal, but some animals are more equal than others.”(Orwell 1945) This is fundamentally, what the objective of Lasswell and other collectivists is, to create a world that is ruled by an elite class, the inner circle, with the “right” knowledge to specify the “correct” way through a difficult situation by placing it in a “universal” context. Buchanan throws Keynes into the elitist crowd as well.(Buchanan and Wagner 1977)

Funtowicz and Ravetz are more assertive in their attack on the scientific method, creating an entirely subjective scientific method not rooted in the principles of scientific reasoning, but instead on values.(Funtowicz and Ravetz 2003) The question is, who's values? By what rational principle do we evaluate the merit of the values to which we are supposed to adopt? The arbitrariness of this value structure suggests a simple answer to these questions,“Mine.” Post-normal science if adopted, serves a s way of abandoning the scientific process for adopting somebody else's values.

We are seeing the unfortunate consequences of political elitism in Germany. Influenced by the writings of Habermas and of other collectivists, they are eliminating nuclear power from their grid to replace it with the “right” combination of gas turbines and wind farms. The unfortunate reality of this is that Germany with little reserves of natural gas will become dependent on Russian gas. This will give Russia considerable influence over the actions of NATO and the EU. Not to mention the price of energy in Germany and across Europe will rise significantly placing an additional burden on the already strained EU. By choosing the “correct” energy technology Germany is throwing prudence to the wind. The decision was purportedly based on trumped up fears of the effects of radiation after the accident in Japan. Fukushima Dai-ichi released 1/10th of the total activity released from Chernobyl from 3 reactors and potentially a spent fuel pool. This represents roughly 2800 MW of capacity for Fukushima compared to the 1000 MW of Chernobyl. Thus if taken separately each reactor at Fukushima was 3% as devastating as Chernobyl. In the over 20 years since Chernobyl, the World Health Organization predicted there would be 4000 cancer deaths. So far according to UNSCEAR as of 2008 there are 64 total fatalities. According to BEIR VII, the latency period for the cancers that develop from radiation exposure is 20 years. 2011 marked the 25th anniversary of Chernobyl.

Almost a year after after the Tohoku earthquake, there are no attributable deaths, compared to the tsunami that killed almost 20,000. There is no rational explanation for Germany's decision to move away from nuclear power other than to begin an intentional deconstruction of their industry and standard of living, which supports Rand's view of the environmental left.(Rand 1971) The reduction in standard of living for the entire population is the ultimate outcome of pursuing a collectivist agenda.(Mises 1922; Rand 1971)

Importance of respect

From reason comes respect, which can be divided into three separate parts, each integral with the other:

- respect of the democratic process, also known as the rule of law
- respect of the rights and voice of the participants of the democracy

- fundamental respect for all life

Thus it becomes important as to what values are referenced, or rather what our shared values become. As homo-sapiens, we have comparatively well developed brains to other species on the planet. We refer to this as intelligence. It can also be referred to as having a large number of degrees of freedom in our thinking, and as such there are many degrees of freedom in our actions manifested by the choices that we make. The degrees of freedom in our minds are the sole distinction that we have to other lifeforms on the planet. Death then becomes the loss of our degrees of freedom in thinking, and we become a mass of organic compounds broken down by other organisms and serve to provide the building blocks for other life on this planet.

Choice is not something that is uniquely human. The degree of choice that we can access is something that is uniquely human. How a choice is made is not necessarily important to describe the action that results from that choice. There are people who sincerely believe that animals do not choose because, "Instinct is what drives their actions." Instinct represents a form of cognitive ability that is a simpler and faster form of thinking. It exists in humans too, we just call it things like reflex, and can be thought of as a form of self preservation or life support.

The fundamental respect for life given here is not Regan's preservation principle, "a principle of non-destruction, non-interference and, generally, non meddling." (Regan 1981) Naess suggests this, "is a slogan that lends itself to passivist, Utopian interpretations, especially out of context." (Naess 2005) Naess in his understanding of ecosophy describes the purpose of it as, "[saying] yes to the fullest self-realization of man." (Naess 2005) (emphasis in original) The fullest self realization of man is done at and fundamentally on an individual level. It is not something that can be prescribed by another. It can only be achieved by the individual for the individual. Naess, quite rationally, states that man and environment evolve together each shaping the other. (Naess 2005) The fundamental historic breakdown that we have is that we have not held or were able to formally evaluate the benefit the world is to humanity, more than a source of resources to be extracted, but more fundamentally as a place which we are inseparably a part. Thus respect must be taken within full context of our environment.

We are then faced as a choice to define our society. If we remember our history, we can take the lessons from our past generational experience and apply that experience to our present state. It is a pure act of rationality – the cognitive power that defines us. It is a selection in choice of the information to which we serve to base our actions off of. The restriction of information used to make decisions is the defining characteristic of ideology. Control of information is how *Ingsoc* maintained control of the *Proles* and the *Outer Party* in 1984. (Orwell 1949) It is a key tool in how North Korea maintains control of its population for as long as it has.

The other key tactic in 1984 was *newspeak*. Llosa identifies an example of this in in our current lexicon,

"In the United States, the term "liberal" has come to be associated with leftism, socialism, and an ambitious role for government in the economy.⁴ Many who describe their politics as "liberal" emphatically favor measures which desire to push

⁴ It is the writings of Llosa, that influenced this author to take back the original definition of liberal.

aside free enterprise. Some who call themselves liberal show even greater hostility toward business, loudly protesting the very idea of economic freedom and promoting a vision of society not so different from the failed utopian experiments of history's socialist and fascist regimes."(Llosa 2011)

The consequences of restricting or controlling information act only to usurp reason. Orwell's thought experiment of 1984 show plainly how successful this can be in real world application, e.g. North Korea. If liberty is to be preserved, any act of omission or commission that is based on ideological tenets, must be ruthlessly eradicated as a viral pestilence. Llosa reinforces the consequence of abandoning reason, "When the liberal truth is forgotten, we see the horrors of nationalist dictatorship, fascism, communism, cult fanaticism, terrorism and the many savageries that have defined all too much in the modern era."(Llosa 2011) We will see that if a collectivist regime is made sufficiently resilient it can persist for a long time with a considerable amount of suffering. It will however degrade to a state that can no longer maintain adequate resilience and will eventually collapse due to some outside perturbation.

Consequences of Reintegration

The web of life can be thought of as a Bayesian network of each member of each species interacting with the world around them. The act of interaction imparts information between the entities. The act of communication can only be done through physical interaction with the world.

At this point, we need to take a step back and define in more generic mathematical terms what exactly is a species. A particular species can be thought of as a grouping of entities that share similar reproducible features defined by their taxonomy with certain topological features such as density and measurable positions in relation to one another.⁵ The mathematical construct that has these properties is a manifold, which can be embedded into the physical world.⁶(Abel 2011) The act of defining a species on a manifold allows the aggregation of the individual members in a formal process.(Abel 2011) The manifolds can then through the Bayesian network be set up to interact with each other. The constraints of the physical ecology (i.e. river water flows, wetland area, etc.) can also be incorporated effortlessly. This is the exact same formalism of Gibbs' grand canonical ensemble. This places the men, the cattle, the deer, the wolves, the underbrush, the topsoil, and the mountain all within one common context. Leopold would describe this as thinking like a mountain. (Leopold 1949)

The limits as to what can be evaluated are only constrained by our need, our processing capability, and access of data. Any ensemble that is defined will have a specific modulus (temperature) and an associated entropy. Our modeling may stop when we have achieved a system entropy adequate to fill our needs. Incorporating interactions that do not change the system's entropy add no value to the model and may be rationally excluded.

⁵The use of mathematical and physics definitions throughout this paper is important. These definitions have very precise and defined meanings and therefore properties that avoid confusion or obfuscation. However, the difficulty can be in beginning to understand what each of these definitions mean. Wikipedia has readily accessible and cross referenced encyclopedia of all of the terms used in this paper and is an invaluable resource for one to understand what is being said.

⁶The use of a manifold to describe a particular grouping is what Gibbs would refer to as an ensemble.(Gibbs 1902)

“We think that this scenario will be repeated many times in the future, particularly as the method moves into biology. Most maximum entropy inferences will be correct, serving a useful predictive purpose. But some of the predictions will be wrong; those instances, far from being calamities, will open the doors to new basic knowledge.”(Jaynes 1991)

Jaynes insight into the power of Gibbs methodology as a means of advancing our understanding of the physical world is profound. As powerful as Gibbs' methodology is it is not the most fundamental version of scientific inference, Bayes' theorem is.(Jaynes 1986) The value of a scientific idea can be expressed quantitatively by the entropy reduction it achieves in our ability to predict the behavior of whatever system.(Abel 2011) This concept is what is lacking in the social sciences. Until the development of the theories in this paper, there was no yard stick to measure “better”. Someone proficient at twisting words to suit their purpose will say that the adoption of a philosophy based purely on reason is a normative system. It is the axiom of reason that is the source of the love of life, the respect of all living things, the scientific method, and the only way to achieve sustainability. The axiom of reason assumes nothing beyond using the full faculty of our mind and all of the information at hand to make decisions. Is that such an unreasonable proposition? Excuse the pun. If not reason then what?

Intergenerational equity

An interesting outcome of general equilibrium problems is that if the Lagrangian is set up for two separate linear constraints, the conservation of utility and the conservation of mass, the unique stationary point that evolves is the Walras equilibrium.(Smith and Foley 2005) This is in keeping with what we would expect. As utility and energy are functionally equivalent we can see that in setting up a general equilibrium problem in such a way only results in to what an engineer would be obvious, the first law of thermodynamics. Once one understands utility as a conserved quantity, it becomes obvious how Ashiem's “Equity (of R) Axiom” violates the first law of thermodynamics. There can be no infinite generational equity. Solow states the simple fact about moral obligations succinctly:

“Pretty clearly the notion of sustainability is about our obligation to the future. It says something about a moral obligation that we are supposed to have for future generations... Could I be morally obligated to be like Peter Pan and flap my wings and fly around the room? If I fail to carry out a moral obligation, you must be entitled to blame me. You could probably say unkind things about me. But you couldn't possibly say unkind things about me for not flying around the room like Peter Pan because you know, as well as I do, that I can't do that.”(Solow 1992)

To describe a moral obligation of inter-generational equity, one must look elsewhere. Norton suggests a hybrid framework that consists of three criteria: measure economic efficiency as delivering welfare to the market, some equity criterion such as “an idea of fairness and designed to protect individuals from losses...[from] policies [that] make others better off, and “indicators that might emerge from a process of choosing the communities most cherished stuff.”(Norton 2005) He suggests that these require different information and represent different logical evaluation. (Norton 2005)

By adopting the axiom of reason, one can readily see that the three criterion of the hybrid approach to sustainability are entirely subsumed or summarily abandoned as not possible. The first statement is Pareto optimality which is a consequence of adopting the principle of maximum entropy. The third is also a consequence of maximum entropy, but only after integrating the individual with macroeconomic theory. The integration of the individual, methodological individualism, is merely an acknowledgement of the value of life, all life in relation to other life and to the whole. In Norton's second claim is implicit the assumption of no worse than for all generations. This is not possible as it would require an infinite amount of energy to be able to implement. Which leaves us still no better than where we were previously.

Non-equilibrium statistical mechanics

We will use an allegory to illustrate the point. Imagine that we are driving a motorcycle down a windy country road at night. Our only light is our headlight that can see a fixed distance in front of us and only to the edge of the beam. What path do we take, and how fast do we travel are obvious questions. It depends is an appropriate answer. It depends on how bright the light of reason is, it depends on how many times we have been down the road, the weather conditions and and how confident we are that we know where the potholes, washouts, fallen limbs, and curves in the road are, or even for that matter if we know where we are going.

Jaynes proposed a method of statistical mechanics called predictive statistical mechanics generalizing Gibbs formalism to allow it to be able to do handle such predictive information.(Jaynes 1985; Jaynes 1986; Luzzi,Vasconcellos et al. 2002) "But the characteristic feature of an irreversible process, which one would think it the main purpose of theory to predict, is the appearance of fading memory effects; the behavior of the system depends on its past history."(Jaynes 1985) Jaynes goes on to describe how equilibrium conditions contain no memory effects.(Jaynes 1985) Jaynes comes to the result of deriving the diffusion relationship for the process using a short memory approximation.(Jaynes 1985) The diffusion equation is short memory approximation of the transport equation.(Lewis and Miller 1993)

Thus a well understood computational method would be use Boltzmann's transport equation to solve the problem over a number of iterations. Then look at the density for each time step to assess the entropy of the prediction and what the predicted value would be. Once there was a increase in entropy ratio, $s(t)/s_0$, reached a defined value, say 4, would define the prediction and the range of the prediction. This however is limited as it implicitly assumes that the entropy gradient is convex., which may be a poor assumption as we will see later. Jaynes suggests another and more general method would be to use a time dependent probability density $P(a_j;t)$ which represents a "bubble" of probability in the macroscopic world.(Jaynes 1985) This leads to a diffusion equation of the bubble, where D is the diffusion tensor and S is the dimensionless entropy.(Jaynes 1985)

$$\frac{1}{D} \frac{\partial P}{\partial t} - \nabla^2 P + \nabla \cdot (P \nabla S) = 0 \quad (6)$$

Jaynes identifies two things that can cause the bubble to stagnate, loss of the entropy gradient and loss of the dither.(Jaynes 1985) The loss of the dither can be thought of as reducing the temperature to such a low point that the actors have such low activity as the system gets stuck. Numerical calculations show this phenomena and suggest a heavier tail qGaussian that rapidly becomes Gaussian as the temperature increases.(Pluchino, Rapisarda et al. 2007) The development of the human economy can be thought of in these terms, that the measure of economic activity has steadily increased allowing the economy to be modeled with reasonable accuracy using a Gaussian function to represent the dither. Conversely natural system would tend to exist at lower temperatures and be more sensitive to shocks, an example of this would be in comparing a desert or arctic ecosystem to a tropical jungle. The arid ecosystems have a much lower level of life activity (temperature) that any shock can have drastic impacts. Whereas, a jungle can absorb shocks much more quickly.

Resilience as entropy gradients

Adaptive management and resilience theory made great strides in quantifying and detailing the theory behind how ecological systems respond to perturbation.

“When considering systems of humans and nature (social-ecological systems) it is important to consider the system as a whole. The human domain and the biophysical domain are interdependent. To consider one in isolation of the other is to come up with a partial solution that can lead to bigger problems down the line.”(Walker and Salt 2006)

Walker and Salt lay out three fundamental concepts for resilience thinking: “Concept 1, We all live and operate in social systems that are inextricably linked with the ecological systems in which they are embedded...Concept 2: Social-ecological systems are complex and adaptive systems...Concept 3: Resilience is the capacity of a system to absorb disturbance; to undergo change and still retain essentially the same function, structure and feedbacks.”(Walker and Salt 2006) We showed how Concepts 1 and 2 are contained by adopting the rationality axiom. Concept 3 as we will see is analogous to the entropy gradient. As discussion of the entropy gradient is contained in the rationality axiom so too will resilience thinking be contained within rationality, however in a much more formal sense.

Jaynes describes the dither as what “drives us up the entropy hill”.(Jaynes 1985) He continues,

By this means, the macrostate is constantly “exploring the possibilities” of neighboring states. But in this exploration the system is always more likely to move to one of higher than lower entropy, simply because there are more [allowed microstates] (greater multiplicity).”(Jaynes 1985)

If we are defining the entropy gradient as a measure of resilience, then why is it that things do not move “up the entropy hill”? The reason is simply that the earth is a closed system and to reduce the entropy in a closed system requires the addition of useful work. It can be a storm, a flood, an earthquake, or a bulldozer. If the system is not given enough time to respond to the shock the entropy gradient can be reduced. If the gradient becomes near zero it becomes unstable and is at risk of undergoing a regime shift. If the gradient becomes negative the system will

undergo a fundamental shift – a bifurcation. If this is a social system, we call it a revolution. If it is a fishery, we call it a collapse. If it is a business, we call it a bankruptcy. The mathematics is equivalent. Only a positive (convex) entropy gradient will allow a system to be stable, the more positive the entropy gradient the more resilient the system. It is to this that Jaynes commented that politicians of the future will ensure a positive entropy gradient.(Jaynes 1991)

We now have sufficient conditions to describe sustainability in a general form. Sustainability is the set of Pareto optimal configurations over the entire socio-ecological system that maintain at least a positive entropy gradient. We use the entropy ratio, $s(t)/s_0$, to evaluate how far into the future we need to plan based on a prescribed increase. The prescribed entropy increase as well as the minimum allowable entropy gradient are arbitrary numbers that can be decided as a general constraint – policy that is determined in the discourse of a democracy. The purpose of the policy is not to restrict the possible outcomes, but to allow the most allowable outcomes under a given policy that satisfy the stated objectives.

Critique of Sen’s “Liberal”

NIMBY’ism is an idea that is contrary to this. It states that I have a right to say what you do in your back yard even if I am not negatively impacted by it.(Norton and Hannon 2005) The justification is a “fuller sense of place”, however the impact of this is to intrude on an individual’s property rights in our democratic society. What is to prevent someone from saying that they don’t want you to do y on your property, as a value of place, even though it does not impact them. **This is what Sen missed fundamentally in his argument about liberalism.**

As we showed, liberal principles are based upon mutual respect. Thus individual freedom cannot come at the expense of others. An individual that takes at will from others for his pleasure is not a liberal by our definition. Instead it is the liberal that Sen describes.(Sen 1970) The respect and valuation of others opinions as well as one’s own are the foundation of liberalism. Any form of political thought that does not do this is heading toward totalitarianism of one flavor or another. (Mises 1922)

The Theorem

Let R_i represent the i^{th} individual’s preference over the finite set of X discrete social choices. We note R_i represents a state unit vector of the likelihood the occupancy of the i^{th} individual’s preference state over a set of accessible occupancy X . That may seem a little obtuse, however, from the perspective of a physicist it represents a simple problem in quantum mechanics.

We represent the system of voters as a the density matrix of a “mixed state” using Dirac’s “bra-ket” notation.(Neumann 1955)

$$\rho = \sum_{i=1}^n p_i |R_i\rangle\langle R_i| \quad (7)$$

The density matrix of the mixed system, ρ , is the weighted average of the votes of the individual constituents based off of their “importance”, p_i .

DEFINITION 1: The normalized diagonal of the density matrix represents the *collective choice rule*. This satisfies Sen’s conditions on definition 1. (Sen 1970)

We adopt the remaining two definitions from Sen without modification. (Sen 1970)

We adopt Unrestricted Domain (U) and Pareto Unanimity (P), the same as Sen and Arrow.

We do not adopt Sen’s definition of Liberalism (L), “For each individual i , there is at least one pair of alternatives, say (x, y) , such that if this individual prefers x to y , then society should prefer x to y , and if this individual prefers y to x , then society should prefer y to x .” (Sen 1970) We define liberalism differently.

CONDITION L (Liberalism): In a liberal society, each individual has an equal say in the process not in the outcome. A liberal society occurs only when $p_i = 1$. This is a modification of Arrow’s “No Dictatorship” axiom. (Arrow 1951)

Arrow’s other two axioms, “Rationality” and “Independence of Irrelevant Alternatives” are contained in the axiomatic approach used to derive the utility function. (Abel 2011) At this point we rely on von Neumann’s derivation of the density matrix to serve as a disproof to Arrow’s impossibility theorem. A more rigorous derivation is beyond the scope of this paper.

Sen’s argument in the footnote on the page where he describes liberalism misses the fundamental aspect of classical liberalism—methodological individualism instead defining a dictatorship where one individual has the say over the outcome of the entire society. (Sen 1970) The intention of “permit[ting] each individual at least one social choice” is not liberalism it is socialism. (Mises 1922) Arrow refers to this as “the sacred code” which supersedes the rule of law. (Arrow 1951) Thus there is no such thing as a Paretian socialist. A democracy is not about the outcome to which we abide, it is about our representation in the decision process and then respecting the decision in the outcome – the rule of law.

An Example

We will use Sen’s example of reading *Lady Chatterly’s Lover*. (Sen 1970)

We represent indifference as equal plausibilities. If one cannot decide between two outcomes they share an equal likelihood. Each individual is the vector $R_i = \{A\bar{B}, \bar{A}B, \bar{A}\bar{B}\}$, and each position is the individual preference for a specific outcome: A reads the book AND B doesn’t, A doesn’t read the book AND B does, neither read the book. For $R_A = \{1/2, 0, 1/2\}$ was assigned. For $R_B = \{1/2, 1/2, 0\}$ was assigned. Based on the majority vote if A is indifferent to himself reading

the book or no one reading then book then it is acceptable for him to read the book. A is not forced into reading the book if he doesn't want to.

Say for example, he is particularly vociferous about not reading the book

$R_A = \{0.365, 0, 0.635\}$, then the society is indifferent about A reading the book or no one reading the book the more that shifts, then the society strictly prefers no one read the book. Keep in mind this is with each individual carrying an equal say in the matter. This result should not be surprising to someone who is in a healthy relationship with a partner. A healthy relationship is defined here as being based off of mutual respect and self respect, thus each partner has equal say in the relationship. This is how, in a healthy relationship, it is ok to do something that one does not want to do per say. If one has strong feelings about it then it is ok to say no too and their partner will respect their wishes.

Conclusion

This paper made several surprising statements showing that only through upholding and advancing individual liberty – methodological individualism as the only rational path forward to sustainability. A consequence of the philosophy is a love and respect for all life, and showing perhaps radically, that all life is interconnected and shares a common metric for values, energy. We then established a comprehensive framework for being able to evaluate welfare, and expanded Pareto optimality to formally include ecological systems and anthropogenic systems, e.g. the economy. We then formally defined resilience as $\partial s / \partial t$ and suggested how it can be used and what criteria can be used to evaluate human impact to the ecology and the economic value of the ecology. Where economic analysis is done within context of each ecology and society. We finished by rebutting Sen's Impossibility of a Paretian Liberal, showing that only under methodological individualism can a relationship based on self and mutual respect exist.

Perhaps, on an even more fundamental basis, we described in precise terms Adam Smith's "invisible hand." We showed, how entropy serves as the universal "optimizer" and placed the footing of economic theory on bedrock. This bedrock allows the building of a comprehensive and consistent model to help us humbly understand the world around and within us with greater clarity.

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