

A Paradigm for Systems Thinking as a Real-Time Approach for Human Adaptation in the 21st Century

Melissa J. MILLS, M.B.A., M.T.S.
Cultural Consultant, Mills Consulting, LLC
P.O. Box 62015, Durham, NC 27715, United States

ABSTRACT

Contemporary neuroscientists, human anthropologists, biologists, and psychologists suggest that the human species is still evolving. The productivity of science, research, education and capital investment can be seen in the phenomenal growth of the human population. Yet the trajectories that have brought us to the present-day apex of material well-being and social health are not sustainable. How can we take the deep advances in distinct academic disciplines and bring them together in ways that inform and coordinate human ingenuity to meet and address the challenges of the 21st century? By taking contemporary research results from a broad range of disciplines and applying them to human dynamics through definable structures, humans are empowered to leverage their capacity to find solutions through joint intention.

Keywords: Evolutionary anthropology, systems thinking, sustainable cooperation, positive psychology, feedback loops, second-order cybernetics, joint intention.

1. INTRODUCTION

The question is what kind of organizing principles might be adopted that would serve to empower us to meet the enormous environmental, social and economic challenges we face as a species. For example, Adam Smith suggested the metaphor of “the invisible hand” of self-interest as an organizing principle for economic activity. The invisible hand is an effective organizing principle because it recognizes that the human individual is the font of ingenuity and production; and that individuals are empowered by what they subconsciously think is their self-interest. What is it about that metaphor that is so fundamentally correct, and how might we re-contextualize it to build a framework for joint intention in the 21st century?

To answer this question in ways that are practical and applicable to the everyday activities of individuals, it is helpful to integrate research from many fields. The exploration begins with the question, “What does it mean to be human?” Human anthropology, psychology, philosophy, religion, history, economics, political science and neuroscience all contribute information and stories out of which dominant themes become evident. Taking lessons from a broad array of academic disciplines may seem challenging until one recognizes that each individual naturally integrates all of them on a daily basis at a subconscious level. When one takes oneself as the locus of integration, one is embarking on the practice of systems thinking. Systems thinking looks at the whole, including trajectories of movement, the forces that power the movement, and their interactions - past, present and possible [1]. Cybernetics, especially second-order cybernetics, understands that each individual is both a product and a force [2]. Among

human capabilities is the capacity to imagine the whole as if we weren't part of it, even while that imagination is itself part of the force. One's intentional imagination, the self-perceived ability to direct one's own thoughts at will, is a skill that can be developed and strengthened. That is, humans get to choose their imagination. This paper takes on the exercise of imagining the integration of evidence across fields of human endeavor in order to use the patterns that are common to all fields as guideposts as we strategically use our reason and our imagination to adapt to an uncertain and changing world. The paper suggests a framework for objective, measurable structures based on the principles of positive psychology and the dynamics of sustainable cooperation that can be used to develop and maintain joint intentions to engage human capacity to meet the challenges of the 21st century.

2. MOTIVATION

The paper is motivated by three things. The first is the sense that the stories we tell ourselves about what constitutes “success” have become incoherent and collectively self-destructive. That is, while these stories may each be based upon research, experience, and reference to long-standing moral and philosophic traditions, we have not yet come up with a meaningful way to integrate them. Might something analogous to Einstein's Theory of General Relativity provide a common framework to guide us through the multifaceted and culturally diverse societies in which we live?

Adam Smith's “invisible hand” has been demonstrably productive. What is it about “self-interest” that fuels flourishing societies? How might we reconcile the goodness that has resulted from Adam Smith's concept of self-interest in order to avoid a more narrow interpretation's harmful and destructive inconsistencies? Is there an approach we can take that integrates our self-interest in a way that reduces the magnitude of unintended consequences? What might constitute a paradigm to view “general relativity” in human relations?

These questions lead to the second motivation behind this paper: the interdependence of the challenges faced by humankind today. The challenges are not new. There has always been flood and famine, war, disease, and drought. Justice has to do with fair balance, and balance is something each of us works to accomplish every day. What is new in the history of our species are three related facts: the growth in the human population of the world; the scope of the global pressures our life-styles place on the physical environment; and the technologies that enable us to connect with one another in real-time, point-to-point, from virtually anywhere on the planet. In short, we are densely packed, interdependently connected, in environments facing toxic stress. The situation is unsustainable. But is there a practical alternative?

The third motivation is the realization that such an alternative exists. Bolstered by the research shared below, the reader may tentatively explore that possibility by considering any negative view of contemporary trends and events as local fluctuations in a much larger and longer-lasting trajectory of evolution. The human genome has been around only a short while from the standpoint of cosmic or even geological time, and there is no guarantee that our species will survive. Yet in that short time, estimated at 100,000 years on a 4 billion year-old Earth, our collective intelligence has been accumulating in a discernible direction. The over-arching trajectory is increasing complexity and interactive order. Human evolution is continuing, and this paper points out that the trajectory aligns with the trend of cosmic evolution, as well as the mechanics of natural selection.

What is the magic sauce that makes this work? The history of human civilization demonstrates the natural proclivity of our species to look beyond immediate obstacles and to imagine visions of what might be. This is the essence of what has brought us so far. As a species, we excel at meeting challenges and adapting to changing circumstances. This paper is about what has worked.

3. ASSUMPTIONS

The first implicit assumption is that the human species is continuing to evolve. Humans are a highly social species. Our evolution has been marked by the development of language, which has contributed to our ability to solve social problems. Our evolution is in the direction of increasingly complex interdependencies and connections. These are made possible through our ability to empathize, cooperate, and share joint intentions [3-4]. These are key points that are developed below.

The second assumption is that the patterns that govern physical systems also govern human systems. This is an observation made by the relatively recent discipline of systems thinking, a field that is developing as a means to respond to complex business and social challenges [1]. All systems have elements, interdependencies, and functions. They have inputs and outputs. There are feedback loops of two types: reinforcing feedback loops, and balancing feedback loops. There are rates of input and output, and there are delays in the feedback loops. In physical systems, one isolates which parts one wants to examine in order to study the dynamics. In human psychology and social systems, one defines the system in such a way to represent the salient factors given the issue at hand.

There are an infinite number of possible systems. The process of describing the system provides the exercise of developing mental models, building shared visions and learning how to learn as a team. Modelling the dynamics of a system's parts provides the opportunity for considering ways of leveraging small changes to achieve large effects. Understanding that the patterns governing physical systems apply to biological and social systems makes available an expanded set of metaphors and analogies with which to model human and social dynamics.

This leads to the third assumption: Whereas the dynamics of physical systems are governed by the four known forces - the electromagnetic force, the gravitational force, the strong force and the weak force - this paper assumes that the force that drives individuals and social groups is emotions, more

specifically, the electro-chemical phenomenon of the molecules of emotion. More will be said about this below. For now, two contextual refinements may help ground this assumption. The first is the fact that the great majority of these electro-chemical phenomena are somatic and/or subconscious events. We become consciously aware of our automatic responses after the fact. We notice that our hearts are beating fast when we are excited or afraid. We find ourselves listening with sharpened attention when we hear our name spoken across the room. Our cognitive awareness arises from events generated through neural pathways established through a combination of genetic disposition, and environmental experience. Interestingly, the experience component provides a subjective avenue that includes interpretation as well as perception.

The second contextual refinement follows: Emotion can be interpreted in rigorously rational ways. Consider, for example, the seemingly tireless passion with which many scientists and business people pursue their goals. Furthermore, one can choose whether or not to pay attention to an emotion, and even whether to bring into play alternative interpretations that lead to completely different sets of emotion. All of this is basic to human capacity and human experience.

A fourth assumption is that acquisition of money has come to occupy the place of a globally shared "common goal." After all, money represents value, and the creation of value is the basis for community well-being and personal standing. Money is the medium of exchange. It is the stand-in for value. By abstracting value to a common denominator, apples and oranges can be compared. In Adam Smith's words, money is the wheel of exchange [5]. Exchange is a form of social collaboration, and money vastly simplifies and clarifies the process.

The problem isn't money. The problem is that, in spite of its exceedingly useful role in exchange, value is in the eye of the beholder. As fluctuations in the daily stock market and international currency rates readily demonstrate, the equation of value with the abstraction of money is unstable. Adam Smith warned explicitly and repeatedly of the dangers in using money as a means of calculating value [5].

The distinction may seem academic until we recognize that the universally accepted quest for money as an end in itself is threatening the regenerative capacity of the systems that support human life. Money is good. What is to be avoided is *love* of money. The alternative is to love value.

4. OBJECTIVE

The main objective of the paper is to propose a framework that supports a love of value while leaving the definition of value to individuals and groups. The framework is simple and objective enough to be used in any situation. It provides a means for measurement in terms that are transparent and can be compared. It is based on dynamics that are hard-wired to generate neural rewards in humans. That is, it is based on developing an extended understanding of self-interest.

How we as a species understand our self-interest has a profound impact on our well-being. The paper argues that a tiny shift in meaning has taken place: Where formerly our self-interest was intricately bound to the well-being of a more or less well-defined community, and our reputation in that community, in the post-World War II world of social, economic, cultural, and

geographic mobility, money has inadvertently unseated community. With economies that scale the globe, the feedback loops that regulate systems are experiencing delays so great the stability of the overall system is threatened. In looking at the environmental, social, political and economic challenges we face as a species through the lens of systems dynamics, we begin to understand that the forces of institutional and national dynamics are governed by whatever the common understanding of “self-interest” is. When we change the understanding of “self-interest,” we shift the priorities that govern our reason.

5. METHODOLOGY

The approach of the paper begins and ends with humans. Humans are the subject of research, and humans are those who assess, absorb, and apply what has been learned, individually and collectively. The objective of the paper is to propose an overarching interpretation of accepted research and data to tell a story that is simple and useful in the conduct of daily life. That is, in our physical lives, our social life, and our economic life. When you think about it, the Universe is a single system with layers of overlapping and inter-relating subsystems. It is relational and responsive. We can try to envision this. For example, we can try to imagine what the concept of four-dimensional spacetime implies about the principles of movement, and then use this knowledge to build strategies that transform tiny possibilities to mainstream actualities [5].

To begin, let us take as implicit a premise that has been put forward by others [6-9], but has not yet been accepted as a mainstream tenet: Namely, that the patterns of dynamic interplay and emergence found in the evolution of the physical systems of the Universe have analogies in the dynamics of human psychology on the one hand, and of social dynamics on the other. After all, everything we think and do takes place in spacetime and is governed by the same four fundamental physical forces.

To make this qualitative jump, let us conjecture that emotion is the driving force in humans that is analogous to the attraction and repulsion of electromagnetic energy in physical systems. At the neurological and cell biological level, the coordination of our entire bodies is orchestrated by electrochemical activity that we experience as emotions [3,4,10]. The difference is that unlike inorganic systems, humans are able to change the electrochemical activity of their systems by *reframing*, that is, by shifting and re-ordering their thoughts and attention [11-14]. This is the implicit power of human imagination. In positing continuity between physical, dynamic systems and human psychological and social dynamics, the way opens to imagine the flow of energy involved in our thinking and activities. At the neural networking level, Shakespeare’s line, “Thinking makes it so,” turns out to be literally true [15]. While energy flows anonymously at the quantum level, we can track its macro patterns over geological history. For example, we can trace the path of chemical energy in the evolution of the metallome, the set of inorganic chemicals essential to life [16]. The pattern we find – pressure, adaptation, emergence, new idea – is familiar as the adage, “Necessity is the mother of invention.” The pressure of necessity fuels a phase change.

Pairing the cosmic and geological patterns of the emergence of order, i.e., order from disorder, and increasing order from order [17], with the human capacity for, and prolific history of imagining what is not yet, allows us to find our stride as a

species. While we have no objective basis for proving one way or another *why* we are here [18], we are very good at imagining what could be better and collaboratively bringing it into being.

Thus, the methodology of the paper is first to describe the salient operating principles, motivations, and structural components that have been identified as characteristic of the human species, and to recognize and celebrate their role in the occurrence of the phenomenal accomplishments of the human species. We have a solid base and rich history and practices from which to grow.

Next, the next section tells a story about our story. “Our Common Challenge” may be to understand how we can understand “self-interest” in a way that allows for sustainable cooperation. The question itself demonstrates what Harvard Business School professor Chris Argyris named “double-loop learning” [19]. That is, rather than continuing to use the same set of decision rules that have worked in the past without consideration of feedback systems, double-loop learning is based on organizational structures designed to make use of information feed-back loops. As in physical systems, the information leads to adjustments and auto-corrections. In the language of management systems, the adjustments are made to the mental models that proceed the activity of defining decision rules. See Figures 1 and 2 below.

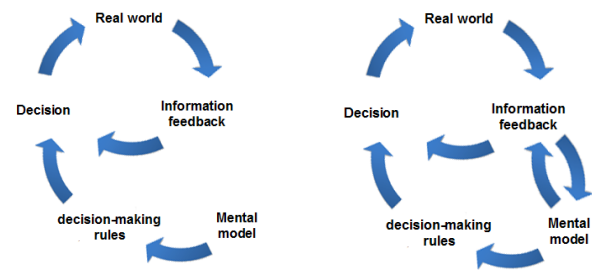


Figure 1: Single-loop Learning [20]

Figure 2: Double-loop Learning [21]

The next section brings to bear recent developments in positive psychology, neuroscience, and evolutionary biology to tell a new story. This is a story that we recognize. It is the ancient story of human happiness and the flourishing of civilizations. What makes it new is understanding the ways that humans are wired for connection and happiness, and learning the structural attributes that provide the information feed-back loops critical to sustainable cooperation.

The methodology of the paper is not proof, but rather proposal. The second-order cybernetic nature of human experience makes it impossible to replicate social sciences experiments, so how can we gain meaningful insight on humans? To understand the potential embodied in humans, we can follow the trajectories of human cultural evolution over the millennia. The whole of human history is the laboratory. The test of the validity of the proposal is its simplicity and its productivity.

6. WHAT DOES IT MEAN TO BE HUMAN?

“What makes humans different from the other animals?” It is no surprise to hear that one of the most powerful human drives is curiosity, but the answer is not as simple as that, and it is helpful to consider why. Here again we use the metaphor of

the continuity in structure and pattern between what we find in the physical world to what we experience as humans. In this case, the focus is the idea of emergence. The key concept underlying emergence is the same concept that underlies the success of capitalism. It is the concept that one plus one is more than two. The concept is based on empirical observation. Simply looking at a graph of human population over the millennia gives a graphic sense.

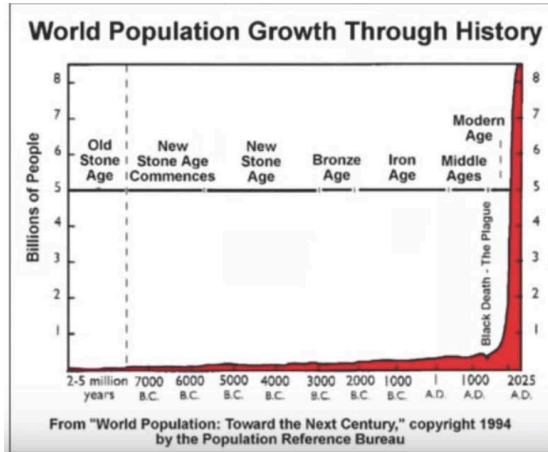


Figure 3: World Population Projection in 1994

In linear terms, the concept can be understood as the equation

$$1 + 1 > 2 \quad (1)$$

The concept of emergence describes how new qualities emerge when basic elements are combined in novel forms. A simple example is what happens when molecules of hydrogen and oxygen come together to form water. The new quality of wetness emerges. In capitalism, when resources are invested to support the efforts and ideas of enterprising individuals, new products, services and technologies emerge. One result has been the spectacular drop in child and maternity mortality rates.

The point is that we will not find what it means to be human from any single characteristic, but rather through a blend of tendencies that are constantly in interplay [22]. This is a broad stroke description. It is a suggestion, not a proof. The question is, can these characteristics be used to describe human history so far? Further, do you recognize them in your own experience? Your life and experience are also a laboratory.

Consider that over the approximately 100,000 year span of the completed human genome, the following salient characteristics have defined the trajectory of the evolution of our species.

- We are driven by desire.
- We are a highly-social species.
- We are curious, imaginative, innovative and adaptive.
- We seek meaning.
- We are restless to make things better.
- We need to feel “right.”

These ideas are developed briefly below.

Driven by Desire

In all forms of life, we witness the attraction towards what sustains life, and the repulsion from that which is toxic. We see

this in the growth of the weeping willow’s tree roots, well-known for cracking city water lines in search of water. We see this in the movement of bacteria cells in petri dishes, attracted to nutrients and fleeing toxins. The thing that complicates this in humans is that what is “good” and what is “bad” are subject to individual and cultural interpretation. We need ordering principles that, like Einstein’s Theory of General Relativity, honor the validity of the other from where we are. The key points for us to recognize here are:

- “Desire” is a neurochemical experience that induces learning, as in the reconfiguration and growth of neural pathways [23].
- At a basic level, we balance between the desire to feel safe, and the drive to learn and explore.
- We are not consciously aware of all of our desires [9, 12, 13, 14, 15].
- Our implicit, hidden desires we call “values.”
- Our values can be contradictory without our knowing it.
- Conscious cognitive capacity is on the order of 40 mbs relative to our total brain sensory activity which is on the order of 11,000,000 mbs [24].
- Our thoughts themselves generate electrochemical activity that cascades into the chemistry that orchestrates the functions of our body [11].

When we put these observations together, we begin to gain a deep appreciation for the practice of mindfulness, the real-time ability to chose the focus of our own thoughts [25]. Through awareness and reflection we find contradictions and choose priorities. Reflecting on, prioritizing and acting on desires in a consistent way works to align subconscious desires. In this, we make use of our capacity for free will.

A Highly Social Species

Evolutionary biologist E. O. Wilson named *homo sapiens* as one of a handful of “ultra-social species” [26]. Human anthropologist Michael Tomasello has suggested that more than cooperation, humans have the ability to develop “joint intention” [6]. Joint intention assumes that not only do we *have* a common purpose, but that I know that you know that I share the common purpose; and that you know that I know that you share the common purpose. Tomasello emphasizes this final step as critical: knowing that each other knows. This mutual knowledge seems to close the loop of second-order cybernetics in a way that enables full trust. It creates a stable system. In that environment of trust, individuals are empowered to direct attention fully to the common purpose without needing to dedicate any portion of their limited cognition towards maintaining safety.

Another way we can understand the fundamentality of our social nature is through the notion of civility. While it has become more in vogue to speak in terms of human *culture* than *civilization*, it is worthwhile remembering the underlying concept of civility. Here I draw on a speech made by Lord John Moulton, Minister of Munitions for Great Britain at the outbreak of World War I, parliamentarian, and noted judge. He described three great domains of human action, and identified the range of these as running between poles of “Free Choice” and what he called “Positive Law.” He noted that “between these two there is a third large and important domain in which there rules neither Positive Law nor Absolute Freedom. In that domain “there is no law which inexorably determines our

course of action, and yet we feel that we are not free to choose as we would" [27]. He calls it "the domain of Obedience to the Unenforceable" and also, "the domain of Manners." His profound observation is that both the tendency to extend the reach of Positive Law and the tendency to increase "the absence of Law which is miscalled Liberty" serve to undermine the responsibility of individuals to exercise "self-imposed law." He correlates the greatness of a nation with the extent to which its citizens may be trusted to obey self-imposed law.

Humans are highly social, and we direct large amounts of thought and energy towards considering and arguing about appropriate social motivations and organizational structures and laws. *As a species we have elevated the practice and development of self-imposed law, within a framework of cultivated good-will for the whole of our communities and world.* This has been the hallmark of the evolution of our species, and demonstrates the human capacity for free will. I apply this idea in the structure proposed below.

Curiosity, Imagination, and Adaptation

Curiosity is plausibly a fundamental trait defining our species because it is one characteristic that seems to distinguish us from Neanderthal man. I cite here two examples based on archaeological evidence. The first concerns the development of increasingly sophisticated spearheads among *homo sapiens*, while Neanderthal spearheads remained unchanged for a period exceeding 20,000 years. The second is the observation that in neighboring sites along the banks of European rivers teeming with fish, in Neanderthal sites only the remains of land animals have been found, while *homo sapiens'* sites had fish, too [22].

Curiosity, imagination and adaptation are different concepts and activities, yet curiosity is incited by imagination. Imagination, empathy, strategy and planning are all associated with the human prefrontal cortex. Adaptation refers to neural plasticity and the lifelong ability to generate new neurons and neural pathways. Culture itself is described as the iterative development of neural complexity, passed from generation to generation [5]. Our physiological wiring for adaptation grounds our drive to explore and imagine. With adaptation, our imagination and exploration can become reality.

Humans Seek Meaning

Contemporary psychology has identified the need to establish meaning as one of the fundamental components of the healthy human psyche. If one considers that meaning is the ability to connect the various experiences of one's life in a story that seems reasonable, we might postulate that the human search for meaning is associated with what Kant suggested was a fundamental function of the human brain: the assignment of cause and effect.

Restless to Make Things Better

We often speak of evolution as being "survival of the fittest." Since the latter half of the 20th century, our dominant economic system shifted to an understanding that competition was the reigning mechanism for assuring optimal use of resources. Research cited in this paper suggests that we may prefer to think of "competition" as the restlessness of the human spirit to make things better.

We compete both with ourselves and with others. Considering circumstances as a challenge can be pleasurable, while regarding the same set of circumstances as a problem might be

exhausting. Within the framework of a human spirit that is never completely satisfied with the status quo, the language of challenge might be a more productive way of viewing our observable competitive nature.

The Need to Be Right

A great deal of contemporary cognitive research has brought to light some fundamental gaps in humans' reasoning capacity [12, 13, 15, 24, 28]. Peter Senge quotes physicist David Bohm as describing individual human thinking as "incoherent" [1], the point being that we benefit from dialogue, receiving response from each other and our communities. Among the cognitive biases that have been identified by contemporary psychologists, the "hypocrisy bias" might exemplify this best. This bias describes the human propensity to evaluate the same conditions as "wrong" or "right" depending upon whether the conditions apply to groups one considers one's own, or "outsider" [15, 28].

There seems to be a deep-seated physiological need to feel "right" as a precursor and marker to acceptance within social groups. The willingness to commit atrocities that have been identified as "good" by leaders of one's group, the willingness to die for one's group and for what it stands, the willingness to go without food or shelter in pursuit of some objective larger than oneself are all examples of this need.

Summary Observations on Humans to Date

Humans want to do the right thing, and then they want to do it even better. As demonstrated by the enormous growth in the human population, we have made spectacular progress in filling the physiological and safety needs of humans. However, this has not been without unintended consequences. Globally, these unintended consequences are becoming our common challenge.

7. OUR COMMON CHALLENGE

We humans need a new story. We are meaning-driven creatures, guided by our subconscious values. We all have a story, and we see ourselves as part of a larger, cultural story. Today, the dominant cultural story, the one that is "safe," the one that lands jobs, wins promotions and bonuses, is the story of competition. It is widely accepted that natural selection is based on "survival of the fittest," and this understanding has been guiding what we hold as exemplary in our economic undertakings. Only recently has a more nuanced understanding of natural selection begun to find traction, a natural selection that favors cooperation [29-33]. Because the challenges of the 21st century, whether they be social, environmental, or economic, all require economic innovation and investment, it is in our self-interest to consider how a more nuanced understanding of evolution's trajectories could be used to guide economic thought and daily economic activities.

The intuitive difficulty in understanding that natural selection favors cooperation stems from the inherent fragility of cooperation. It is based on principles of trust, generosity, kindness, and forgiveness. These are attractive, but they sound utopian. No wonder it is fragile!

How might we imagine a way of sustaining cooperation among humans globally? I suggest that we consider organizing our social and economic activities around the principles of sustainable cooperation. The unintended consequences of the extraordinary progress of the 20th century present us with a

challenge we may use globally as our “joint intention.” How to meet the physiological needs of all – clean air, clean water, healthy food – so that each individual may, through self-imposed law, grow in ability and contribution to the world?

Are we foolish to even attempt such a goal? As Holocaust-survivor, psychiatrist, and author of *Man’s Search for Meaning*, Viktor Frankl noted in a 1972 presentation to Toronto youth, human aspiration needs to follow the same laws that airplane pilots use. Just as a pilot calculates the direction and speed of the winds and takes a trajectory that integrates their force into the ultimate destination, our aspirations need to aim high enough above the human norm to compensate for the known cognitive biases of human thinking [34].

8. A NEW STORY

Contemporary research brings to focus a new story based on the principles of positive psychology and sustainable cooperation. Such a story aligns with the principles of evolution, and with the trajectory of human development. It can serve as a dynamic framework to support growth of individuals within their various communities, and at the same time, take advantage of our technical ability to network together communities across the globe. The story may provide the basis for the kind of joint intention that Tomasello identifies with the collaborative power of the human species to tackle common challenges [6]. It provides frameworks that operate along the same principles as the communities of Adam Smith’s day, and of America’s historical economy. This paper raises the proposal for discussion and consideration. How it may be done is itself a challenge and a joint undertaking.

The following proposal is a two-pronged approach. The one strategy is applicable to individuals; the other, to groups and communities. The strategy for individuals prioritizes intrinsic rewards over extrinsic rewards. The strategy for groups is to organize themselves around the principles of sustainable cooperation. Each of these is discussed briefly below.

Any viable alternative will be built on human characteristics and drives. It must also follow principles of second-order cybernetics, i.e. be self-correcting, auto-learning, and rigorous in withstanding mutation. Adam Smith’s notion of the invisible hand of self-interest guided us well in the past, because it fulfilled these conditions. Humans are driven by desire. The desire is for safety, standing in the community, and the pursuit, exploration, and investment to make things better. Maslow’s hierarchy of needs provides a useful graphic (Figure 4).

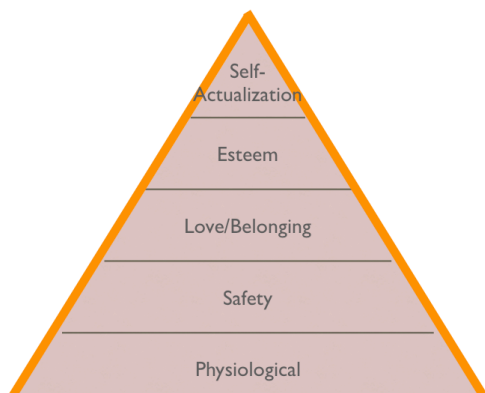


Figure 4: Maslow’s Hierarchy of Needs

Principles of Positive Psychology

Positive psychology studies the attributes that are present when humans are functioning at their peak. Not surprisingly, there are correlations between self-reported life satisfaction and overall health. Clinical experiments show that individuals are more observant and more creative when they feel safe and happy [35]. It seems to be in our best self-interest to self-impose the simple practices associated to intrinsic rewards.

Intrinsic rewards are 1) personal growth, 2) trusted, close friendships, and 3) the feeling that you are making a contribution to the world. In prioritizing these activities, one may achieve the external rewards: 1) money, 2) reputation, and 3) power. Irrespective, one is guaranteed reward, because one’s own brain provides it. The inverted Maslow’s Hierarchy (Figure 5) is an appropriate graphic to model individual endeavor, while Maslow’s Hierarchy appropriately models the attributes of a society or civilization. Overlaying the two provides a model for human social life.

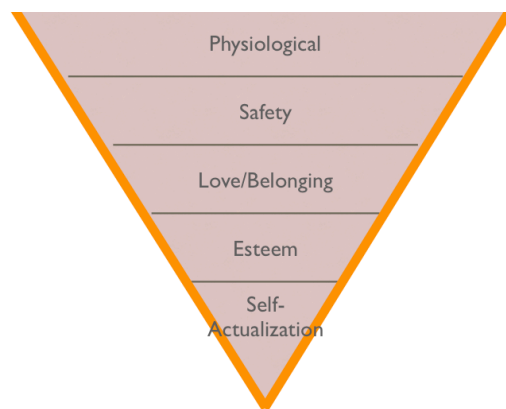


Figure 5: Individual Process within Community

Sustainable Cooperation

Harvard University mathematical biologist Martin Nowak observed that the cooperation of the human species is stunningly evident in their collaborative accomplishments over history. When one looks at the evolution of humanity over the long term, nature *has* selected for cooperation. As an evolutionary biologist, Nowak dedicated the over twenty years to developing iterative game theoretic models to capture quantitatively the conditions that allow cooperators to survive the inevitable interaction with “mutations,” what in game theory language are sometimes called freeloaders, cheaters, or defectors [31]. Nowak and his collaborators were driven by the undeniable observation that while competition certainly plays a role in evolution, evolution itself displays a pattern characterized by cooperation. From the earliest forms of life on Earth almost four billion years ago, it has been cooperation at the cellular and organism levels that has resulted in what we today call evolution.

Nowak and his colleagues have identified five characteristics, at least one of which must be present in a group or community in order to sustain its ability to operate cooperatively in an ongoing fashion. The issue is that cooperation involves generosity, forgiveness and self-sacrifice. In an environment in which defectors or cheaters are rewarded, the cooperators do not survive to reproduce. The model is a proof of concept, and provides means of modeling relative costs and benefits. The

core characteristics Nowak and his collaborators identified are 1) direct reciprocity, 2) indirect reciprocity, 3) spatial or network reciprocity, 4) group-level selection, and 5) kinship selection.

The point is that without cooperation, humans are not able to survive. Because cooperation is so central to our survival, direct reciprocity (being kind to one another in direct relationships) and indirect reciprocity (developing reputations through third-party impressions and experiences) are “what made us human [36]”. Those with social intelligence developed their ability to communicate and cooperate over the millennia, and survived to pass along their genes to future generations.

Nowak and his collaborators developed cost/benefit equations to iteratively model in computer simulations a rigorous demonstration of Charles Darwin’s observation:

“There can be no doubt that a tribe including many members who [...] are always ready to give aid to each other and to sacrifice themselves for the common good, would be victorious over other tribes; and this would be natural selection [37].”

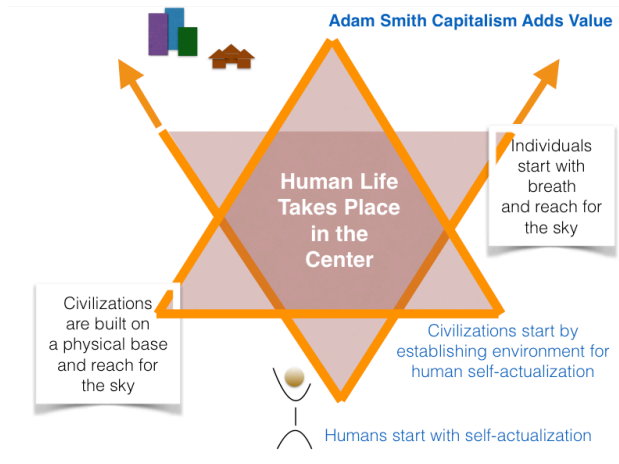


Figure 6: Overlay of Individual and Society

There are two points to highlight in Nowak’s model that are analogous to functionality in cell biology. The first is that for a group (or a cell) to be able to maintain its functionality, it needs to regulate the entry and exit of elements. In the context of sustainable cooperation, this simply means that we need to provide feed-back to cheaters, free-loaders or defectors to provide an opportunity for self-correction and learning. This is difficult to do if it goes against social norms. It is also difficult when the society views feedback as punitive rather than corrective. It would be good for us to adopt principles of kindness and forgiveness in our feedback mechanisms.

The second point that Nowak elucidates in his work is that the size of the group matters. In a cell, one might think of this as the ratio of volume to boundary area. If a cell becomes too large, its boundary is no longer capable of regulating the conditions required to maintain the cell. In the case of human groups, be they social or corporate, there is a limit to how many individuals any one individual is able to know, even indirectly. The idea is an ancient idea: every individual in a community is

responsible for the integrity of the entire community. This provides the motivation to give appropriate feedback when freeloading or other behavior injurious to the group is observed. Of course, the freeloader may not be freeloading at all, and the exchange provides an opportunity for two-way learning.

The principle is simply that group size matters. Transparency is lost when group size becomes too large. To accommodate sustainable cooperation in scale, the principles of networking and geographical proximity come into play.

Rotary International provides a real-world example of the framework of sustainable cooperation. With over 1.2 million members in over 200 countries around the world, each Rotary Club is self-organized with a relatively small number of members. Clubs cluster into geographically located districts, areas and zones. They network with one another with facilitation from Rotary International, in a model that values personal relationships, excellence in work, and contributions to the world in the Rotary motto, “Service Above Self.”

9. CONCLUSION

Humans are most basically driven by a desire to be right, and to make things better. This may be related to the deep-seated sociality of the species. We want to be accepted. If we are right, and make things better, that helps with our reputation.

Adam Smith’s invisible hand has been so tremendously effective because the invisible hand is itself reputation and standing. An individual’s self-interest is inextricably tied to his reputation. In a society that is relatively closed, as most societies were before World War II, with limited mobility, the butcher’s self-interest was constrained to fairness and honesty because he knew that if he cheated Widow Jones, Lord Ashby might hear of it. In the words of Alexis de Tocqueville, “...the inhabitants of the United States almost always manage to combine their own advantage with that of their fellow citizens; my present purpose is to point out the general rule that enables them to do so. In the United States hardly anybody talks of the beauty of virtue, but they maintain that virtue is useful and prove it every day. The American moralists do not profess that men ought to sacrifice themselves for their fellow creatures because it is noble to make such sacrifices, but they boldly aver that such sacrifices are as necessary to him who imposes them upon himself as to him for whose sake they are made.... They therefore do not deny that every man may follow his own interest, but they endeavor to prove that it is the interest of every man to be virtuous [38].”

Since World War II, with the opening of global society and increase in global mobility, money has increasingly replaced personal reputation as the proxy for acceptability. Perhaps due to the scale of global business, and the disconnect in balancing feedback loops, unintended consequences have been left out of the value equation. We have inadvertently done this as a society because money and value have become disassociated.

Through individual action to prioritize intrinsic rewards and pay attention to the size and integrity of the groups to which individuals belong and support, alignment can again be reached between money and value. The development of categories of business such as Benefit Corporations and the Triple Bottom Line accounting are steps in this direction.

The characteristics of positive psychology and the prioritizing of intrinsic rewards direct individuals' attention to activities that increase their own capabilities, enrich their direct relationships with close friends, and contribute to the greater world. The characteristics of sustainable cooperation provide a pattern of self-organization that allows any and every group to be accountable for its own integrity.

In the 21st century, humans are confronted with a confluence of inter-related challenges, social, environmental, and economic. Systems thinking is an approach that takes into account the whole and imagines dynamics and trajectories including those that are not close in space or time. The Universe is an evolving, auto-correcting, open system. Human self-imposed law and social structures have contributed to the safety and sustenance of human life. By recognizing that human desire is the engine driving us, we are motivated to align our desires in the direction of evolution. We can use the practice of prioritizing intrinsic rewards, and the organizational structures correlated with sustainable cooperation to provide a flexible objective and measurable framework for feedback in relative context, elevating and honoring persistent effort to grow in harmony with the whole in which we find ourselves.

REFERENCES

- [1] Peter M. Senge, **The Fifth Discipline: The Art and Practice of the Learning Organization**, New York: Doubleday/Currency, 2006.
- [2] Wikipedia, "Second-Order Cybernetics," https://en.wikipedia.org/wiki/Second-order_cybernetics , accessed May 28, 2016.
- [3] C. Pert, "The Science of Emotions and Consciousness," **Measuring the Immeasurable**, ed. D. Goleman, Boulder, CO: Sounds True, Inc., 2008.
- [4] Bruce Lipton, **The Biology of Belief: Unleashing the Power of Consciousness, Matter & Miracles**, U.S.: Mountain of Love Productions, Hay House, Inc., 2008.
- [5] Melissa J. Mills, "Continuity in General Relativity and Quantum Field Theory," April 5, 2017, <http://millsconsulting.org/publications.html> .
- [6] R. Pirsig, **Lila, An Inquiry into Morals**, New York: Bantam Books, 1992.
- [7] G. Hüther, **The Compassionate Brain: How Empathy Creates Intelligence**, Boston: Trumpeter, 2006.
- [8] Michael Tomasello, **A Natural History of Human Thinking**, Cambridge, MA: Harvard Univ. Press, 2014.
- [9] R. Gière, **Science Without Laws of Nature**, Chicago: University of Chicago Press, 1999.
- [10] A. R. Damasio, **Descartes' Error: Emotion, Reason and the Human Brain**, New York: G.P. Putnam, 1994.
- [11] Jill Boyle Taylor, **My Stroke of Insight: A Brain Scientist's Personal Journey**, New York: Plume, 2009.
- [12] Dan Ariely, **Predictably Irrational: The Hidden Forces that Shape Our Decisions**, New York: Harper, 2009.
- [13] Daniel Kahneman, **Thinking, Fast and Slow**, New York: Farrar, Straus and Giroux, 2011.
- [14] Michael S. A. Graziano, **Consciousness and the Social Brain**, New York: Oxford University Press, 2013.
- [15] Jonathan Haidt, **The Happiness Hypothesis: Finding Modern Truth in Ancient Wisdom**, New York: Basic Books, 2006.
- [16] Alvin Crumbliss, "The Classic Metal Behind the Origin of Life," **Nautilus**, March 24, 2016, <http://nautil.us/issue/34/adaptation/the-classic-metal-behind-the-origins-of-life> , accessed May 26, 2016.
- [17] Ernest Schrödinger, "Order, Disorder, Entropy," **What is Life?** Cambridge: Cambridge Univ Press, 1967.
- [18] Thomas Nagel, **Mind and Cosmos: Why the Materialist, Neo-Darwinian Conception of Nature is Almost Certainly False**, Oxford: Oxford University Press, 2012.
- [19] Chris Argyris, "Teaching Smart People How to Learn," **Reflections, The SoL Journal on Knowledge, Learning, and Change**, 4 (2), 1991.
- [20] Xjent03, "Single-Loop Learning," https://commons.wikimedia.org/wiki/File%3ASmycka2en_g.png , accessed May 20, 2016.
- [21] Xjent30, "Double-Loop Learning," https://commons.wikimedia.org/wiki/File%3ASmycka3en_g.png , accessed May 20, 2016.
- [22] A. Alda, G. Chedd, L. Engel, Chedd-Angier-Lewis Productions, **The Human Spark** (video-recording), WNET Boston, MA: PBS Distribution, 2010.
- [23] Timothy Schroeder, **Three Faces of Desire**, New York: Oxford University Press, 2004.
- [24] Tor Nørretranders, **The User Illusion: Cutting Consciousness Down to Size**, New York: Viking Penguin, 1998.
- [25] Jon Kabat-Zinn, **Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life**, New York: Hyperion, 1994.
- [26] E. O. Wilson, **The Meaning of Human Existence**, New York: Liveright Publishing, 2014.
- [27] John F. Moulton, "Law and Manners," **The Atlantic Monthly**, 134 (1), 1924.
- [28] Robert Wright, **The Evolution of God**, New York: Little, Brown and Company, 2009.
- [29] Martin A. Nowak, "Five Rules for the Evolution of Cooperation," **Science**, 314 (5805), 2006.
- [30] Robert K. Fleck, "Natural Selection and the Problem of Evil: An Evolutionary Model with Application to an Ancient Debate," **Zygon**, 46 (3), 2011.
- [31] Martin A. Nowak, R. Highfield, **SuperCooperators: Altruism, Evolution, and Why We Need Each Other to Succeed**, New York: Free Press, 2011.
- [32] Roberto Cazzolla Gatti, "Evolution is a Cooperative Process: The Biodiversity-related Niches Differentiation Theory (BNDT) Can Explain Why," **Theoretical Biology Forum**, 104 (1), 2011.
- [33] Roberto Cazzolla Gatti, "A Conceptual Model of New Hypothesis on the Evolution of Biodiversity," **Biologia**, 71 (3), 2016.
- [34] Viktor Frankl, "Youth in Search of Meaning", **TEDxToronto**, TED, 1972, https://www.ted.com/talks/vikto_frankl_youth_in_search_of_meaning , accessed May 26, 2016.
- [35] Barbara Fredrickson, **Love 2.0: How Our Supreme Emotion Affects Everything We Feel, Think, Do and Become**, New York: Hudson Street Press, 2013.
- [36] Martin Nowak, "The Evolution of Cooperation: Why We Need Each Other to Succeed," IMA Public Lectures, University of Minnesota, accessed 4/5/2017, <https://www.youtube.com/watch?v=2yRnwgeE3ao>.
- [37] Charles Darwin, **The Descent of Man**, 1871.
- [38] Alexis de Tocqueville, **Democracy in America**, Chapter VIII, accessed 4/7/2017, http://xroads.virginia.edu/%7EHYPER/DETOC/ch2_08.htm .