

# A Paradigm for Systems Thinking as a Real-Time Approach for Human Adaptation in the 21<sup>st</sup> Century

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## 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 21<sup>st</sup> 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:** Human anthropology, systems thinking, sustainable cooperation, positive psychology, feedback loops, second-order cybernetics, joint intention.

## 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 21<sup>st</sup> 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. It is for humans to choose their imagination. This 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 21<sup>st</sup> century.

## 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 [3].

To begin, I take as implicit a premise that has been put forward by others [4-7], 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, I 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 [8-10]. 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 order 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 second 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.

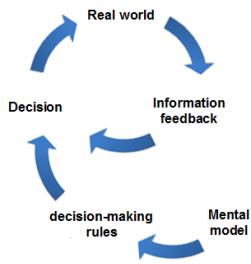


Figure 1: Single-loop Learning [20]

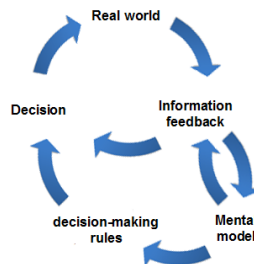


Figure 2: Double-loop Learning [21]

The third 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? I suggest that to

understand the potential embodied in humans, we 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.

## WHAT DOES IT MEAN TO BE HUMAN?

One night at dinner when my daughter was eleven, her father asked her, “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 a simple answer, and it is helpful to consider why. Here again I 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, I point to 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.

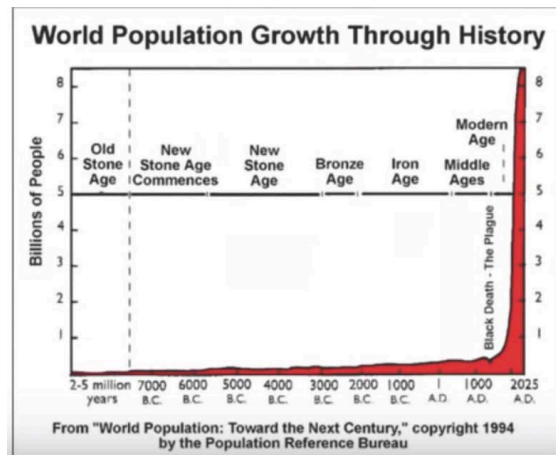


Figure 2: World Population Projection in 1994

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

$$1 + 1 > 2 \tag{1}$$

I use the concept of emergence to describe 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.

My 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.

I suggest 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.”

Let me explain briefly.

### **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 choose 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. *I am suggesting that as a species we elevate 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**

I suggest curiosity as 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].

I recognize I am pairing very different concepts and activities. Curiosity is incited by imagination. Imagination, empathy, strategy and planning have all been 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]. I have paired these concepts because 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 20<sup>th</sup> 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, I'm suggesting that the language of challenge is 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].

I suggest there is 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.

## **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 21<sup>st</sup> 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 20<sup>th</sup> 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].

## **A NEW STORY**

I suggest we adopt 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.

I suggest 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.

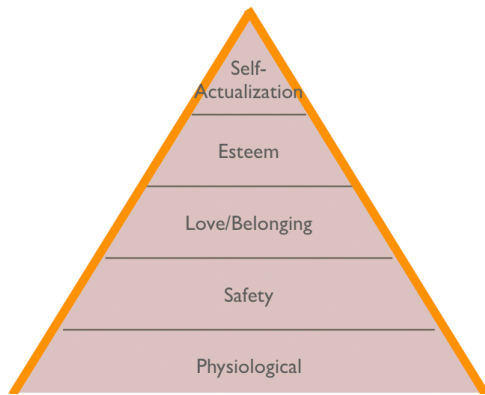


Figure 3: Maslow's Hierarchy of Needs

### 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.

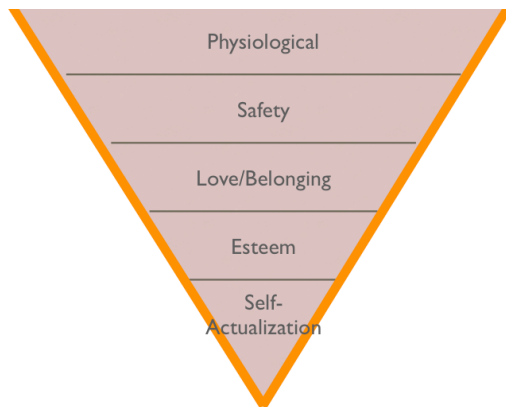


Figure 4: Individual Process within Community

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. I suggest that the inverted Maslow's Hierarchy (Figure 4) 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.

### 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 next 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].

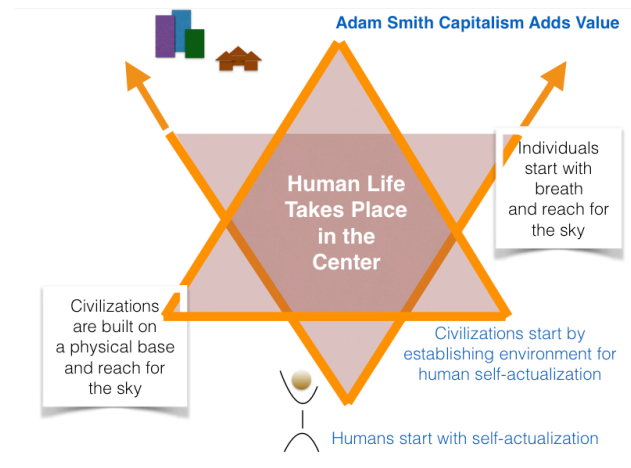


Figure 5: Overlay of Individual and Society

Nowak and his colleagues 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 and survive. The model is a proof of concept, and provides means of modeling relative costs and benefits. The target conditions are 1) kin selection, 2) direct reciprocity, 3) indirect reciprocity, 4) network reciprocity, 5) group-level selection. While the model of which I am aware doesn't take into account the dynamic second-order cybernetic principle, namely, that an individual or a group often experiences as a longer term benefit that which was initially considered to be a cost, the work provides an excellent foundation and makes a landmark contribution.

I would like to highlight two points in Nowak's model that are analogous to functionality in cell biology. The first is that for a 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 come into play. Rotary International provides a real-world example of the framework of sustainable cooperation.

## CONCLUSION

In the 21<sup>st</sup> 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.

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