Complexity Science and Myth in Big History

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Abstract: From early on, David Christian's vision of big history as a "modern creation myth" faced criticism for introducing elements of spirituality. This essay contends that the resulting controversy arises from a misunderstanding of the nature of myth. The mainstream model of myth depicts it as fanciful stories of supernatural agents that members of a society use to address their anxieties. While this is often the case, the author argues that myth can be more profitably explored as a neurobiological imperative that plays a critical role in cultural evolution. To make this case, he examines how the principles of complexity science helped him understand how human history has gone through periods, such as the Axial Age and Modernity, when the change produced by societies' greatest successes demanded new ways of thinking about the world *in order for those societies to survive*. He then examines current neurobiology to explain how reinventing myth has allowed such societies to transform in ways that enabled them to meet the challenges produced by change. With this understanding of myth, the essay concludes with a discussion of how the myth of big history can allow us to contribute to the new ways of thinking that are emerging today, as culture evolves so we can meet our current existential challenges.

Introduction

David Christian opens *Maps of Time* with the hope that the story of our universe from the Big Bang to the present could become a "modern creation myth," providing what he'd later call a "shared map" to help navigate our often confusing world (2004; 2018). This hope wasn't revolutionary. E.O. Wilson had described this story as "probably the best myth we will ever have" (1978, 201). Yet, by the time of the first IBHA conference in 2012, Christian's use of the word "myth" had become controversial. It was much discussed at that and subsequent conferences, as well as in print (i.e., Katerberg 2015). Many thinkers in big history feel that, as a scientific study, big history should not deal with the issues of religion and spirituality implied in the word "myth." Christian himself pulled away from the idea that the big history story is myth, switching to the term "origin story," as in his 2018 volume by that name.

In this essay, I want to look at myth from a different perspective and explain why, from this perspective, myth can enrich the study of big history. For the most part, the mainstream understanding of myth is reflected in Scott Atran's description: Myth is composed of stories about "a counterfactual and counterintuitive world of supernatural agents," which people use to address their anxieties (2002, 4). While this way of thinking about myth is accurate in many cases, especially with Western monotheism, it overlooks a vital historical function myth has served. That is, myth seems to serve as a neurobiological imperative that helps drive cultural evolution. At its deepest levels, myth addresses the key challenges of any society, and, historically, when those challenges shift, social survival can depend on reinventing myth to reflect the new challenges. As such, the study of myth is invaluable to big history.

Just this sort of cultural transformation appears to be going on today. It has been examined by thinkers ranging from Nobel Laureate in Physics Robert Laughlin (2005) to astrophysicist Lee Smolin (2013), and is key to Metamodernity, a recent movement in philosophy (e.g., Azarian 2022). I wanted to discuss it in this collection of essays on complexity, because complexity science offers a series of principles that, at least partly, inform this emerging worldview. The point I want to make is that, myth, apart from its spiritual or religious purposes, has served a key role in similar transformation throughout human history. By understanding myth as a matter of cultural survival, we in big history can reexamine Christian's description of our story as myth and, thereby, make a valuable contribution to constructing the emerging "shared map" of our world today.

To make this case, I'll examine five topics:

- How I stumbled, much to my own surprise, onto this realization
- The concept of *symbolic orders*
- Three key patterns from complexity science that illuminate cultural evolution

- Myth as a neurobiological imperative that allows societies to shift their worldviews
- How incorporating complexity science can help big history create a shared map for the 21st century.

Complexity science and history

I started studying complexity science in the late 1990s when I joined what would become the Institute for the Study of Complexity and Emergence (ISCE), which applied complexity science to human organizations. Although I never mastered the math behind its science, I soon realized that its principles offered the best model I knew for studying human behavior. At an ISCE workshop in 2007, I first applied complexity science to history and met Dmitri Bondarenko, with whom I would write *The Axial Ages of World History* (2014), a short book that explores the similarities between the Axial Age (c. 800-200 BCE) and Modernity (1500 CE-the present). Both periods, we agreed, were times when increases in population, advances in technology and communication, and rising available wealth combined to overwhelm the dominant social structures across Eurasia. Both periods would also witness vast social experimentation, horrifying warfare, and the emergence of new ways of thinking about the world. The most surprising discovery we made, however, was that the transformations we studied in both periods were largely driven by social elites *rewriting their mythologies*.

We also agreed that the 21st century seemed similar to the end of the Axial Age. At that time, the societies that successfully transformed themselves – China, India, Israel, and Greece – learned the lessons of their transformative experiences and defined the ways of thinking about the world that would bring them into the age of empires that followed the Axial Age.[1] Moreover, we speculated that, just as their Axial Age transformations made it possible for these societies to thrive in an age of empires, the modern transformation could enable societies around the globe to enter an age of global coordination, whether as a global government or a network of more local entities. At the heart of both these transformations is a reinvention of their societies' symbolic orders.

Symbolic order

As part of the process by which we perceive the world, our ancestors' brains evolved to organize our experience around a symbolic order. As I'll explain in more detail later, the process that creates human perception works as an act of subconscious storytelling so that we can decide what to do in any situation. So the perceptual world each of us constructs is unique. Organizing experience by a shared symbolic order made it possible for people throughout any society to experience the world similarly enough that they could cooperate. Discussing this shared symbolism as part of religious rituals – he calls them "Ultimate Sacred Postulates" – Roy Rappaport (1999) notes how they enable people to link the cosmological order they observe to social life.

Terrence Deacon finds this ability so critical that he calls *Homo sapiens* "the symbolic species." For him, this process allows us to "inhabit a world full of abstractions, impossibilities and paradoxes," the "defining attribute of human beings" (1997, 21-22). As a result, we live in a self-created "virtual reality," much of which members of any society share, due to their common symbolic order. Merlin Donald goes even further. Symbolic ordering, he notes, made

[1] In periodizing human history, Bondarenko and I focused on what we thought of as the three stable socio-politico-economic states that dominated Eurasian politics – hunter-gatherer bands (up to the end of the Ice Age, c. 9000 BCE), mostly agricultural kingdoms (c. 3000 to 800 BCE), and vast empires (c. 200 BCE to 1500 CE), interrupted by transformational periods – the Neolithic Revolution (c. 9000 to 3000 BCE), the Axial Age, and Modernity. Our intent wasn't to suggest that other periodization are mistaken. For example, Leonid Grinin's (2012) periodization – hunter-gatherer, craft-agrarian, industrial, and information-scientific – or Tyler Volk's (2017) – animal social groups, tribal metagroups, transplantable agrovillages, and geopolitical states – both seem accurate *from their point of views*. Bondarenko and I, however, focused on what we saw as the overall patterns of social organization. Consider the differences between kingdoms and empires, for instance. Kingdoms, from Greece to China, were generally limited in geographical size and culturally homogeneous; governed by semi-divine kings, supported by the loyalty of their inner circles; practiced polytheistic religions; depended on bronze technology; and were still learning how to use writing to manage their cultures. Empires, on the other hand, were vast territories with multi-cultural populations; governed by emperors, supported by bureaucracies; generally practiced religions that were universalistic and moralistic; depended on iron technology; and had become expert at managing their cultures with writing. In this paper, I focus mostly on the Axial Age for examples, because there are no written records for the Neolithic Revolution and the modern transformation is still ongoing. For a fuller discussion of the effects of writing, see Assmann (2011).

it possible for humans to create the mythic culture that characterizes our species' history, because "symbols 'define' the world (rather than vice versa)" (1991, 219). Brian Fagan adds that this ability was "the real edge" that *Homo sapiens* had over the Neanderthals who preceded us, making it possible "to plan ahead and to think of their surroundings as a living, vibrant world … that changed constantly over the generations" (2010, 14).

The symbolic order of any society seems to reflect the critical challenges its members face. For instance, Ancient Egypt relied on the annual flooding of the Nile and the abundant harvests it made possible. As a result, its symbolic order is grounded in a cycle of birth, death, and rebirth. Consider the myth of Isis, Osiris, Seth, and Horus. Osiris (the abundance of the Nile) is murdered and dismembered by his brother Seth (chaos), and Osiris' consort Isis (fertility) gathers the pieces of his body and brings him back to life long enough to impregnate her with Horus (protector of the abundance of the Nile), who grows up to engage in an ongoing battle with Seth. In this way, the Pharaoh, represented by Horus, is responsible for fighting off the powers of chaos (Seth) that beset an agricultural state dependent on a thin strip of fertile land on the Nile River, surrounded by desert chaos. This myth, then, is *not so much a story about a world of gods as it is a way for people to learn about the nature of the invisible forces that challenge them*.

While the *scientific* symbolic order most of us grew up with is very different, it reflects the key challenges of early Western Modernity just as Egypt's symbolic order reflected its challenges. The Western symbolic order – the clockwork universe[2] – emerged with the beginnings of scientific astronomy. At a time when mathematics was being perfected, astronomers such as Nicholas Copernicus, Johannes Kepler, Galileo Galilei, and Isaac Newton were astounded at the precision with which the heavenly bodies moved and began to think of the universe as a machine. The key to the map for this symbolic order appeared in Newton's *Principia* (1687), but, like all mythic symbolic orders, would be what Donald (1991) describes as debated, disputed, and filtered in its society over generations. As Stephen Gaukroger notes (2020), the mechanical symbolic order wouldn't be generally accepted until the mid-19th century.

This worldview teaches us to understand reality as a collection of solid, independent "things" that respond to other things in causal chains, just as one gear in Big Ben drives the next. These "things" are passive: Like atoms of gas in a bottle, they can move only when the invariable laws of nature drive them to move. As a result, events unfold deterministically, as one thing responds predictably to another (Berman, 1981). This is the logic that underlies most mainstream thought today. For instance, until recently biological evolution was understood to occur mechanically, with random mutations leading to changes in an organism's phenotype, and then tested by natural selection in the environment. According to this model, it is impossible for organisms to evolve as acts of intentional adaptation to environmental shifts. Change is driven purely by chance and the forces created by the laws of nature (Gould, 2002; Jablonka and Lamb, 2014). Grounded in such mechanical thought, our social institutions tend to operate mechanically. In contemporary public education, for instance, this model teaches people to think of students as little machines that teachers program with important information. That has resulted in an emphasis on measuring what students learn and teachers having to "teach to the test."

In many ways, this mechanical symbolic order has been wildly successful. It has allowed the West to create scientific medicine, to produce a wide range of consumer products available to the vast majority, to create mass literacy, and to generate an enormous, rapidly growing body of knowledge. Its calculations have allowed us to put people on the moon and send exploratory devices out of our solar system.

At the same time, it has driven the evolution of existential challenges, which seem insoluble. For the last century, we've treated the planet as a machine that exists for our own benefit, like a clock or printing press. The result is deforestation, major oil spills, and burning fossil fuels, contributing to a climate change that could destroy our world's ability to support complex societies. Yet, in spite of international conferences and widely signed treaties, these conditions continue to deteriorate.

What we need is a different way of thinking about the world – a new symbolic order, with a new shared map, that will create a shared virtual social reality where it *is* possible to address these challenges. Fortunately, scientific advances, in fields ranging from physics to paleoanthropology, have also revolutionized our understanding of the world. The world, we have learned, is composed of dynamic energy systems, continually responding to the changes around them, an

[2] As Kepler noted, "My aim is to show that the machines of the universe is not similar to a divine animated being, but similar to a clock" (as quoted in Dolnik 2011, 182).

evolving nested network of systems that are all interconnected. This is the model of the world developed in complexity science,[3] a model that we can apply profitably to big history.

Complexity science studies the patterns that emerge as complex, non-linear systems evolve. The world it describes is far more interconnected – and interesting – than the mechanical model of the world as a clockwork universe, which I had learned in school. As a result, applying its principles led me to see history differently. I want to focus on three of these principles:

- The world as a nested network of energy storage systems
- Evolution's oscillation between stable states and phase transitions and
- Evolution as emergence.

These principles can enhance our ability to contribute to developing Christian's shared map to help us meet today's existential challenge.

A universe of nested networks

The complexity science model of the world begins with Einstein's theory of relativity. Matter, he tells us in the well-known equation $E=mc^2$, is a form of energy, structured to store that energy. In the words of Mae-Wan Ho, matter can best be understood as "domain[s] of *coherent* energy storage" and the average time the energy remains in these domains is "a measure of the *organized* complexity of the system" (2008, 81; author's italics).

As opposed to the mechanical model's world of distinct, passive things, complexity science portrays the world as a deeply interconnected nested network of domains of energy storage that are continually adapting to each other. At the simplest scale we're aware of, quantum particles such as quarks, combine to form a variety of larger particles, including neutrons and protons. These entities can then network to form atoms, and atoms, sometimes with less complex particles, can network to form molecules. And so it goes – with networks all the way up – in material networks, such as minerals, planets, solar systems, and galaxies; living networks, such as macromolecules, cells, organs, organisms, and ecosystems; and cultural networks, such as hunter-gatherer bands, tribes, chiefdoms, kingdoms, and empires.[4] At each more extensive scale, these systems develop new capabilities, often difficult or impossible to predict by understanding only the smaller networks that make them up.

As an example, consider an oversimplified picture of the human body. The human body is a nested network of organ systems, such as the respiratory system, which, in turn, is a network of organs like the lungs. Those lungs, in turn, are a network of groups of cells, and each cell group is a network of cells. Similarly, each cell is a network of smaller structures, organelles, which are further networked from macromolecules like DNA, molecules, atoms, and quantum particles. *To be healthy, the body needs the cooperation of structures at all these scales*. Consider the way that the body needs the iron in red blood cells to pick up oxygen in the lungs, travel through the circulatory system, and drop the oxygen off at a cell. The fullness (and messiness) of such complex systems becomes even clearer when we put it in the context of the many other processes in the body – from cognitive to immune systems, from those that control motor activity to waste removal.

But the activities of these sub-systems of the body are not isolated. The body as a whole develops a series of capabilities as these sub-systems interact with each other to meet the challenges of the outside world, giving rise to one common definition of complex systems: The whole is greater than the sum of the parts, although it might be more accurate to say that the whole can do things which are only possible as its parts interact. In addition, each human body can be part of a variety of more extensive social and ecological systems – from families and organizations to the cultural ecosystem of New York City. When I think about an energy storage domain like New York City and all the scales working down to molecules, I can begin to understand why we call it a "complex system," as well as why the term has been so difficult to define.[5]

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[3] This model is also studied in other disciplines, such as systems thinking (see Capra and Luisi 2014), for example. I use complexity theory because I've studied it for more than 25 years now.

[4] This description of our world of nested networks is oversimplified. For a fuller, more precise discussion of this network formation, see Tyler Volk's *Quarks to Culture* (2017) or Gregg Henriques' *A New Synthesis for Solving the Problem of Psychology* (2022). They also provide a deeper dive into the three varieties of nested networks – material, living, and cultural.

[5] Readers who want to know more about the problems of defining complex systems can consult Landyman, *et al*. (2013). For a quicker insight into some of the ins and outs of defining the term,

Perhaps the reality of complex systems is too, well, complex to capture in a short definition. Still, even the example of the body makes a variety of qualities evident. Complex systems are composed of many different component systems, often on many scales, systems that have access to the information they need to adapt to and innovate in the changing world they're part of, without the assistance of an outside intelligence. At each scale, we can examine these complex systems in three ways – as a functioning whole, a component in a functioning whole, or the environment for other systems. At the scale of each functioning whole, the behavior of the components creates the behavior of the whole; the nature of the whole limits the behavior of its parts; and the conditions of the environment shape the nature of the whole. As a result, to study the behavior of a family, we must also study the behavior of each member of the family, their interactions, and the environment of communities in which they are grounded.

One interesting controversy concerns at what scale complex systems become full-fledged, decision-making *agents*. Many physicists, such as Nobel Laureate Murray Gell-Mann (1994), agree that quantum particles, atoms, and molecules respond mechanically. Others insist that it's decision-making agents all the way down. However, starting with macromolecules – that is, at the point around which they begin to be living systems – many become what are often called *complex adaptive systems* (CASs), which can learn and adapt, sometimes in unexpected ways. For instance, sub-systems in the body's immune system are able to identify and attack pathogens that their organism has never previously experienced. Similarly, some neural networks are able to filter out select objects that the senses perceive, so they don't appear in conscious perception. These omissions may occur because the unconscious mind judges them as creating contradictions, which may compromise the ability to make decisions (Gazzaniga 2011; Ramachandran 2011).

This understanding of the world as a highly interconnected nested network of energy storage systems, as opposed to the mechanical understanding of the world as a collection of passive things, suggests other important differences. The process of evolution, itself, becomes more dynamic, as these energy systems, embodied as matter, oscillate between periods when they are stable, acting from long-held habits, and those when they are transforming themselves through experimenting with alternatives.

Stable states and phase transitions

With the mechanical symbolic order, evolution had been presented as linear. For example, in school, I'd learned that evolution occurred gradually, one change at a time in chains of cause-and-effect. For example, *Homo sapiens* evolved in a chain of precursors, one leading inexorably to the next – through a string of australopiths, to *Homo habilis, Homo erectus,* Neanderthals, and then us**.** With this symbolic order, human evolution was viewed as "a long, gradual slog from primitiveness to perfection," as Ian Tattersall and Jeffery Schwartz put it. But, in recent decades, scientists realized that human evolution wasn't so linear – that evolution seemed more like life struggling to find its way, through the trial-and-error of mutational experimentation, in a continually changing world. In this way, *Homo sapiens* emerged in "a history of experimentation, of constant exploration of the very many ways there are to be hominid" (Tattersall and Schwartz 2001, 46; 52). Moreover, current research indicates that the origin of this development is not merely random mutations, which mechanically produce body changes to be tested by the environment, one at a time. This was the model of evolution I had learned in school.[6] Rather, the new environments our ancestors faced when they became nomads on the savannah resulted in a wide variety of genetic shifts that interacted, enabling them to meet new challenges (see Rappaport and Corbally 2020, and Turner, *et al*. 2018).

Complexity science suggests that with this dynamic model of the world, evolution follows a pattern alternating stable (orderly, gradually changing) and dynamic (chaotic, experimental) periods. Here's the back-of-the-cocktail-napkin diagram I drew when I was thinking about this conception of evolution:

compare two first-class definitions – in Cilliers (1998, 3-5) and Mitchell (2009, 13).

[6] For a full examination of this model – the Modern Synthesis – as well as the theory of Punctuated Equilibrium we'll examine shortly, see Stephen Jay Gould's *The Structure of Evolutionary Theory* (2002).

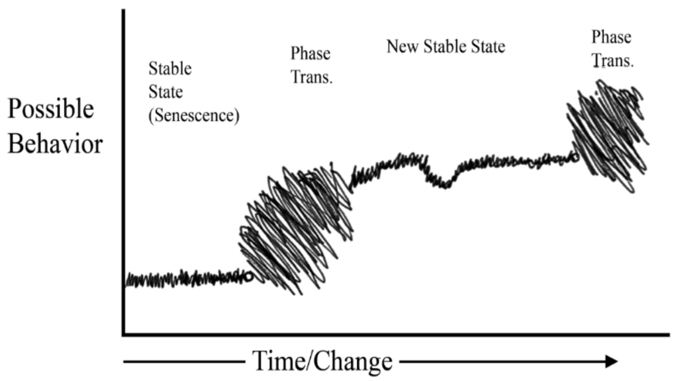

Figure 1: Life Cycle of an Attractor (Baskin 2008)

Some readers will immediately recognize that this figure illustrates punctuated equilibrium, the theory Niles Eldredge and Stephen Jay Gould developed to explain the evolutionary jumps that follow mass extinctions (Gould 2002). I call this figure the life cycle of an attractor. "Attractor" is a term from higher math that complexity scientists use to indicate those behaviors, among all possible behaviors, that a complex system tends to evolve toward in a particular set of conditions. That is, an attractor defines a system's habitual behaviors – its default responses – in its environment.

For instance, when you throw a chunk of ice into a pot and heat it on a stove, it will cycle through three "phases" – solid, liquid, and gas. At first, it will remain ice, until it approaches the melting point, becomes turbulent, and turns into liquid. It then remains liquid until it approaches the boiling point, again becomes turbulent, and becomes gas.

Or consider what happened, when earth was struck by a comet about 65 million years ago. Starting at the far left of the figure, we see that, the end of the period during which earth's ecosystems were dominated by dinosaurs. The comet destroyed those ecosystems, driving them into a 10 million year phase transition, leading to the dominance of mammals. Mammal dominance then proceeded until our own period in the senescence of human domination, followed by the possibility of another phase transition (far right).

Similar dynamics appear in market cycles of boom and bust, or in human development, where a stable childhood personality is interrupted by adolescence, leading to a stable adult personality, often ended by a mid-life crisis. The figure can also represent the period that Bondarenko and I wrote about, starting, from the left with about a century before event that undermined the kingdoms, like Ancient Egypt or Zhou China, that preceded the Axial Age. We then see the Axial Age as about 600 years of social experiments, ending around 200 BCE, as vast empires, such as the Roman Empire or the Han Empire became dominant powers. Finally, as the line approaches the far right, we can see another experimental period in Modernity, after about 1500 CE. In this way, order begets chaos, which, in turn, begets order, in a positive feedback loop, and this tension between order and chaos "is at the heart of all creativity" (McGilchrist 2021, 818).

Once we get beyond the simplest examples, such as heating ice, the dynamics of this pattern shows how evolution works in a world of nested networks: Toward the end of the stable state, the component systems have a long successful history of following a limited number of all possible behaviors. Their survival had depended on interacting successfully with other component systems, whose behaviors may have had an equally long history. As conditions shift over time new challenges are likely to emerge. Yet the old, habitual behaviors, which allowed them to survive, are likely to continue, in a period Stan Salthe (1998) calls "senescence," until some kind of catastrophe reinvents the environment and breaks the hold of the old "attractor," and a phase transition begins. I saw how senescence works up close in the early 1990s, when I worked for a bureaucratic corporation that was trying to institute a culture change. Managers talked a good game, but even though they recognized the problems that had to be addressed, actually doing anything about them was so dangerous – to their prestige and even their livelihood – that even attempts to change pushed them back into old behaviors.

In the phase transition, the system's components – free of the constraints of the old attractor – experiment with new behaviors with which they may be able to succeed in their new conditions. Those experimental behaviors may be entirely new – the downward strokes moving forward in time – or the reintroduction of old behaviors – the upward strokes that appear to be going *backward* in time. Which, of course, is impossible. But I wanted to suggest that component systems don't merely innovate; they also try out old experiments that may not have been successful. Finally, when the component systems find the range of behaviors that do work in current conditions, their interactions will develop a new attractor for the system as a whole. So, in human personality development, people in adolescent phase transition experience new powerful feelings and, most often, are expected to behave in a far less dependent way. To meet these shifts, they often begin experimenting with new behaviors that will lead to new habits and an adult personality.

Let me finish this section with a thought I offer provisionally. The way complex systems evolve by moving through stable and transformational periods is a result of the way existing complex systems combine to form more complex systems with new capabilities. Unstructured energy is chaotic. Order appeared in the universe with the big bang, which led to energy structured as quantum particles, and that order increased as the universe cooled following the big bang. Over time, those particles formed matter at scales that became more and more complex, until, today we have galaxies, which average 100 million stars; relatively small four-square-mile patches of rainforests that can contain more than a thousand flowering plants, several hundred species each of trees and birds, and more than 100 species of butterflies; and cities with populations as large as 30 million humans, as well as ways of accessing all the goods and services that they need.

However, as Marc Widdowson noted (2023) at a recent IBHA conference, the more complex – and highly ordered – these energy storage systems become, the more likely it is that they will not be capable of addressing the challenges emerging *in a continually changing world*. To put it another way, order makes it possible for domains of energy storage systems to remain stable, but it also restricts their ability to adapt in innovative ways. In order for their sub-systems to survive, they may need to be released from the attractors that hold them together. It is only when they are plunged into the resulting chaotic phase transition that they are able to fully explore the environment for new, more appropriate behaviors.

From this perspective, then, order and chaos are not diametrical opposites, but "contraries [that] *fulfil* one another" (McGilchrist 2021, 816), a perception recognized in many cultures. This dynamic is the central significance of the ongoing battle between Horus (order) and Seth (chaos) in Ancient Egyptian myth, as it is in the concept of yin and yang in Chinese philosophy. This understanding, however, is denied in the mechanical modern Western model of the world. On the other hand, the model embodied in complexity science indicates that such opposites *are complementary*. As one of my mentors in complexity science, Jack Cohen, used to love to point out, in complex systems, opposites are frequently both true. In presentations, he would show a photograph of a "lost and found" sign.[7] This is also the dynamic Peter Turchin (2023) identifies through much of human history as societies oscillate between stable and "disintegrative" periods.

This last set of comments is still in a rough form. They require more research and exploration. But they also point to an understanding of how complex systems unfold that differs from the one we find in the clockwork universe model. Here, we are talking about emergence.

Emergence

In a world composed of nested networks, many of which can become decision-making agents, events unfold as agent/networks at many scales adapt to the changes in other networks, sometimes cascading to produce surprising combinations. Consider the recent COVID pandemic. It began with changes in the genetic macromolecules of a virus – whether they resulted from random mutations or intentional manipulation in a laboratory – and quickly spread across the globe. What made the pandemic so damaging was the combination of how easy it was to communicate the virus, advances in travel technology, the effort of Chinese officials to hide it, and the refusal of some governments and portions of their populations to treat the pandemic as a threat. As a result, the changes in that tiny virus's genome would lead to extensive social, economic, and political damage, as all these CASs interacted, resulting in cascades of adaptation.

This is a far cry from the mechanical clockwork universe of the late 19th century, whose causal chains no longer seem adequate. In a world populated largely by CASs, a wide range of events have many causes. As a simple example, apple trees don't simply grow because someone plants one. Soil, weather, and temperature conditions all have to be in the right range. And if a passing bird digs into the soil and eats the seed, no tree will grow. What is needed is not a chain of causes and effects, but the *emergence* of the apple tree, as a result of a wide variety of interactions. And when we get to a phenomenon like the evolution of human life, the relative simplicity of the emergence of an apple tree is transformed to a level of improbability that approaches the mysterious (Theroux 2023).

The concept of emergence is so critical to complexity science that Henrik Jensen titled his textbook *Complexity*

[7] Evolutionary biologist Jack Cohen wrote about complexity science with mathematician Ian Stewart, including their primer of the subject, *The Collapse of Chaos* (1994). He presented frequently, emphasizing this point, at workshops sponsored by the Institute for the Study of Complexity and Emergence, between 1998 and 2006, where I met him. It was at the last of those conferences, on complexity and philosophy, where I met Dmitri Bondarenko.

Science: The Study of Emergence.[8] As opposed to the linear causality of a mechanical model, a symbolic order grounded in complexity science suggests that such events emerge, as the component systems of any CAS interact with each other and all the complex systems around them. In systems as extensive as an ecosystem, a language, or a large city, so many CASs are continually interacting with other systems that it becomes near-impossible to predict what will happen, as with the COVID pandemic of the 2020s. Ironically, the United States had quite literally written the book, a formal plan of government action, on how to minimize the effects of such a pandemic in today's world. But political concerns – and perhaps some human frailties – made it impossible for authorities to implement that plan.

Emergence is an especially good way to understand complex human phenomena, such as history. Think, for instance, about all the political, economic, and religious subsystems that interacted to cause the Thirty Years War. On one hand, the Mongol invasions of the 13th century created a world trading system from Beijing to Brussels, accelerating the growth of the commercial class throughout Europe. Then, the Black Death (1346-1353) killed off enough members of the ruling class – an alliance between the Catholic Church and regional aristocracies – to tantalize the growing commercial chance with the opportunity of political power. So when Protestantism arose, it offered that commercial class a power partner to replace the Catholic Church/aristocracy. Add the printing press in the mid-15th century, and a new method of communication amplified all these other shifts so that the opposition between these two alliances could spread across Europe, leading eventually to the Thirty Years War. Here, agents ranging from the microorganisms and rats that brought the Black Death to the horses of Mongol soldiers, the trade their conquests resulted in, and a flood of new technologies – all contributed to the Thirty Years War.

It was this way of thinking about history in terms of complexity science that led Bondarenko and me to the realization of the importance of myth. So we turn now to the view of myth that emerged as we apply complexity science to history.

What is myth?

The mainstream model of religion defines "myth"[9] as Atran does – as another world, inhabited by "*supernatural agents ... who master people's existential anxieties*" (2002, 4; his italics). In this model, believers accept the world of myth as literally true. As Daniel Dennett tells us, if worshippers don't believe literally in their mythic agents, then, in his opinion, their belief system "is not really a religion" (2006, 10). In many ways, this conception of myth answers a question my wife found on Reddit: "Why do we talk about Christian religion, but Norse mythology?" For Christians, the stories of God, Jesus, and the Devil are true, while those of Odin, Freyja, and Loki are merely fanciful imaginings of people who don't have the truth.

Another way to think about myth is more symbolic, much more like Christian's "shared map." Thinkers who use this model range from Joseph Campbell to Merlin Donald. For Campbell, myth is a society's symbolic "field in which you can locate yourself" (2004, xvi); for Donald, it is "a unified, collectively held system of explanatory and regulatory metaphors," whose "symbols 'define' the world" (1991, 214-19).

I was surprised to realize that I agree with much of both these models. For me, myth is the stories people in any society tell about the gods or spirits of *another* world *and* the symbolic map of *this* world. Note that neither of these popular models of myth explores the issue in this essay – myth as a driver of cultural evolution.[10] The reason that it can serve all three of these functions also surprised me: Myth is a *neurobiological imperative*, grounded in the way our brains transform the chaotic world around us into an ordered cosmos of coherent stories that allow us to make the decisions we must make to survive.

The process by which the brain acts as a subconscious storyteller has been discussed widely.[11] Here's a brief summary of it: The senses take in vast fields of fragmented information. For example, each retina has more than a million rod and cone cells, each of which records a single spot of light.

[8] For my take on emergence, see Baskin 2022.

[9] Throughout this paper, my focus is on myth as an element of religion, rather than the popular use of it to mean an explanation that is untrue, such as the "myth" of a flat earth. One point I will be making is that myth is symbolically true for the cultures that create it.

[10] Only a very few writers on the subject even suggest that myth can function as a driver of cultural evolution. Among those who do are Robert Bellah, in *Religion in Human Evolution* (2011), and Anthony Wallace, in *Religion: An Anthropological View* (1966).

[11] I have explored this issue in more detail in Baskin (2023). My key sources were Gazzaniga (2011), Ramachandran (2011), and, most importantly, Laughlin, et al. (1990).

This fragmented information is delivered to the brain, where it is mixed with memory, decoded into images, and compared to our mental models of what we've learned the world should and should not be like. These mental models filter out any images that our unconscious minds don't believe will enhance our survival and are then connected with what we have perceived before, turning our experience into coherent, story-like perceptual models.

It's important to remember that this process seems to have evolved *not to create accurate perceptions, but to ensure we see those things that are coming to help and, even more so, to threaten our ability to survive.*[12] As a result, our perceptual stories have to answer three questions: 1) What is happening? 2) How should I respond? 3) Why did it happen? To answer these questions, our perceptual stories are almost always both *coherent* and *frequently unreliable*. They are coherent because coherent stories, where everything fits, make it far easier to decide what to do. Besides, if the action such a story leads to produces undesired results, we can always do something else. But, if they are *not* coherent, we can be frozen to the point of not reacting when survival is at stake. Moreover, these stories are frequently unreliable because the need for coherence drives our brains to make up information we don't have and present it as "true," so that we can make needed decisions. Anyone who's been in a long-term relationship is likely to recognize times when they had major arguments only to discover one element of their perceptions, often answering the third question, was, as psychologists put it, "confabulated."[13]

From this perspective, the process by which we perceive the world is a form of subconscious storytelling. And *myth-making is storytelling that is negotiated among groups of people* – "the debated, disputed, filtered product of generations of narrative interchange about reality" (Donald 1990, 258). More specifically, myth is the stories that answer the three perceptual questions *for entire groups* faced with the powerful, invisible forces we live among: *What* are both the existential threats and the awe-inspiring forces we experience? *How should we respond* to them, both as individuals and in cooperation with other? And *why* do they happen?

What makes this definition of myth so interesting is that it includes much of the other models of myth. Among the invisible forces myth addresses are those that produce birth and death, abundant crops or being invaded. These are all forces that myth accounts for in what Christian calls a society's shared map. They can also be the anxieties that Atran and Dennett point to as the reason for myth. For me, the key difference from the mainstream myth of Atran and Dennett is that myth must answer the three perceptual questions. The gods and other spirits of myth, then, emerge as *symbols* that allow people in any society to understand and respond to these forces. However, from this perspective, myth is not fiction; rather, it is an attempt to understand the invisible forces around us using poetic symbols, similar to the way science uses numbers.

As a result, myth is generally so powerful that it is used for a variety of other purposes. From organizing people into groups of like-minded associates to create a feeling of belonging (King 2007) to a way for politicians to mobilize communities for war (Harris 2004). For those of us who study big history, especially when we apply it hand in hand with the principles of complexity, this concept of myth offers a variety of advantages.

Applying these complexity patterns

For me, one of the first of these advantages is the ability to explain today's most disturbing events as part of a process that has occurred before. I grew up in the 1950s and '60s, so I experienced McCarthyism, the Civil Rights movement, and the Vietnam War. But, even with the violence each of them created, I remain astounded at the current worldwide political polarization and disregard for long-practiced norms. And that doesn't even touch on the constructions of widely different realities that has become commonplace.

Yet, complexity science, coupled with this understanding of myth can make sense of all this: Societies across the globe have entered the chaos of a full-blown phase transition. Especially among political leaders, behaviors demanded by old cultural attractors no longer hold. In just about every institution in every society, people seem to recognize, if only unconsciously, that the old attractor's ways don't work, but

[12] For a fascinating examination of this conclusion, see Donald Hoffman's *The Case Against Reality* (2019).

[13] In his discussion, Ramachandran notes that this process of perception uses many of the same processes as hallucination: "One could almost regard perception as the act of choosing one hallucination that best fits the incoming data …." (2011, 229). So it's no wonder that confabulation enters the process so seamlessly.

no one knows what the new ways will be. Most of us are understandably terrified and the result is a sort of global psychosis, reflecting a disturbingly wide range of experiments. As my back-of-the-napkin figure predicts, these experiments both look forward and back, in efforts to find what will work.

What we need, then, is a new symbolic order, embodied in a scientific myth, like Bacon's myth of the scientist extracting nature's secrets to make human life better.

That is, as in the Axial Age, today we face a series of existential challenges that demand a different way of thinking about the world. In that period, the societies that did transform successfully did so by rewriting their myth. Especially important is what I've called a "mythic twist."[14] For example, in Axial Age Greece, the 5th century BCE was a century of chaos. First, the Persians invaded Greece in 490 and 480, when the Persians burned Athens, but were eventually defeated by the alliance of Greek city-states. After their victory, those city-states competed for political dominance, with alliances led by Athens and Sparta, resulting in the Peloponnesian Wars (431-404 BCE). Those wars would also cause a plague, further reducing the power of Athens and undermining confidence in the myths of the gods of Olympus. We can see this shift in the criticism of the gods in Greek tragedy, where basically good people, such as Oedipus and Orestes, suffer intensely because of those gods' whims. Combined with Greece's experimentation with science, a new, more rational symbolic order emerged, taking its mythic form in the philosophies of Plato and Aristotle, whose mythic elements became especially important in Medieval Christian theology.

A similar mythic twist helped drive the emergence of the modern scientific symbolic order of the West, a rewriting of the myth of Late Medieval Christianity.[15] The key to this twist came in the works of Thomas Aquinas in the 13th Century, which explained that God and his creation were rational (Gillespie 2009). This position would be largely absorbed by the Late Medieval Catholic Church. The mythic twist that would shape Western science came from Francis Bacon, in works like his *Novum Organum* (1620), during a chaotic period that culminated in a century and a half of religious wars. To create a society that would be far more safe and comfortable, Bacon explained, the source of human knowledge should come, not from the speculative methods of Medieval churchmen, but from scientific research. The scientist's job would be to "torture" nature into giving up its secrets, thereby enabling life-enhancing innovations, such as the printing press. In this mythic twist, the attention to nature that Aquinas had praised now moved from the act of knowing God to the attempt to improve human life.

As a result, by incorporating complexity science, big history's creation myth can help people understand how those challenges arose and how other societies, facing similar challenges, were able to overcome them. Already, big history can act as a platform on which knowledge of the widest variety of disciplines can become available. With the addition of complexity science, we can show how, as terrifying as the current situation is, it is also what can be expected in our continually changing world. We are living through a typical cultural phase transition, whose experimentation can generate new symbolic order which can generate a new myth, different types of behavior, and, eventually, a new attractor. By focusing on the experience of societies that did reinvent themselves, our origin story can create the map for how we can similarly transform the way we think about the world.

Most important, complexity science offers one possible symbolic order for reinventing our modern myth. The current version of this "evolutionary epic" was created at a time when few people doubted our mechanical symbolic order. So it's worth asking whether a mythic twist, grounded in complexity science, might yield a different way of thinking about our world. For example, as it's currently told, that story often seems linear, with a clear beginning in the big bang, a linear evolution from less to more complex material structures, and an expected ending in heat death. What would happen if we processed the same facts through the lens of complexity thinking? This is not to say that the current version is "wrong." Rather, the big history community would profit from a discussion about these two ways of interpreting the facts of our origin story. After all, there are legitimate scientific problems with the current approach (e.g., Hossenfelder 2018) and fascinating speculation on alternatives (e.g., Sheldrake 2012). And the far more interconnected order suggested in complexity science seems more appropriate to the challenges we face today.

Conclusion

[14] For a deeper dive into this dynamic, see Baskin. 2023.

[15] For a full discussion of how deeply Western science was grounded in Late Medieval Christianity, see especially Gillespie (2009) and Freely (2012).

Of course, one could argue that believing big history should contribute to developing a shared map of the world for our time demonstrates intellectual arrogance. And there may be some truth in that. However, our world today faces very real existential challenges, and, as the saying goes, "Extreme times call for extreme measures."

Still, the explosion of knowledge over the last half century is changing the way we understand the world. Sciences from astrophysics to neurobiology have found that our universe is far more complex and interconnected than we thought. Combining history, neurobiology, and complexity science, it's also clear that any society's symbolic order shapes how its people think about and even perceive their world. Moreover, if my analysis is mostly accurate, myth has historically provided a driving force for the cultural evolution required when old symbolic orders no longer work for people. Even the transformation from Late Medieval Christianity in Europe to Modernity came as a result of a mythic twist, as the Thomistic myth of studying God's creation moved from an act of worship to Bacon's myth of torturing nature to access her secrets.

Today, our species faces the existential challenges of moving from being a pre-computer, mildly industrialized set of empires, a half-millennium ago, to our present status, as societies capable of AI, extremely industrialized, and connected as a global community. What we need seems to be a mythic twist that will help us think of our world as the deeply interconnected nested network that complexity science suggests it is. And where better to do that than in big history, which operates as a platform in which so many other disciplines can interact?

At the very least, we owe ourselves a discussion of what we might learn if we conduct the conversation on whether big history's shared map would profit from such a mythic twist.

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