Chapter 3: Notes toward a Science 2.0 theory of human history

One of the most surprising ideas our work for this book leads to is the power of a society’s world story to shape its own history. How could a story such as Homer’s Iliad help lead a society into events as important as the poleis’ victory over the Persian Empire or the Peloponnesian War? If Science 2.0 can help us understand cultural evolution, a good place to begin is the way this emerging way of thinking about the world can explain the power of world stories. So we begin this chapter with one last, curiously specific example of how a society’s world story can shape its history:

In The Religion of Technology, David Noble observes that four major 20th century technologies seem to fulfill what we’ve called Modernity’s foundational stories, integrating the grail quest and the Apocalypse. In those technologies, the modern quest knights – scientists – provide the means to realize the millenarian vision of Joachim of Fiore:

- Atomic energy can deliver Armageddon;
- Space travel makes it possible for the elect to ascend to the heavens;
- Artificial intelligence can create eternal life, and;
- Genetic engineering allows for the perfection of the human race.

From the viewpoint we’ve developed in this book, Noble’s observation is no mere coincidence. Modernity’s world story evolved from the 12th century millenarianism and the grail quest mythology, through the world story shaped by thinkers such as Bacon, Galileo, and Descartes, to the story that created a world where technology is essential. Certainly, the history of the last 500 years is much more than the inevitable fulfillment of 12th century stories. Yet, these stories seem to have had a powerful shaping influence.

Is it possible that stories written at the end of the 12th century evolved to guide the actions and discoveries of the most well educated people of the 20th century, most of whom have never even read those stories? In answering the question, this chapter explores a way of thinking about cultural evolution in the light of Science 2.0, with an eye toward what that means for the transformational period we are living through today.

The world story of Science 2.0 is still emerging. So there’s no way to know exactly how it will develop. Still five of its most important elements already seem clear:

- First, our universe is very, very old. Every phenomenon happening today is assumed to stem from the Big Bang, more than 13.5 billion years ago, and is linked in a single process.
- Second, Einstein’s E=mc² suggests that every “thing” around us is a form of energy, structured in a network of networks – from sub-atomic particles in atoms to galaxies in the Universe as a whole. As a result, almost every phenomenon is networked, on a variety of scales, to many, many others. (See description of networks below.)
- Third, everything around us is constantly changing. That change began with the Big Bang and continues today, from sub-atomic particles blinking in and out of existence, to molecules mutating in DNA, and global warming. Moreover, agents in networks at many scales can create cascades of change. So, a few genes mutating in Chinese fowl around 1916 resulted in a flu epidemic that killed millions during and after World War I.
- Fourth, our brains give the impression that we are directly experiencing the world as it actually is. That is an illusion. Our eyes, for example, do not provide photographic images. They send hundreds of thousands of tiny points of perception that our brains combine with memories. In this way, the brain constructs images so that we can interpret a world we can only see indirectly. We only perceive what the brains tells us is there, and that is sometimes inaccurate.
- Finally, the scientist is not a searcher for the truth, as Descartes assumed. Rather, because people can only interpret the world, the scientist looks for the best possible model/story to explain any phenomenon. Some of those models become what Thomas Kuhn (1962) calls a “paradigm,” and other scientists in the field use it to structure their work. The movement from Science 1.0 to Science 2.0 is just such a paradigm/model/story shift.
Because networks are essential for understanding Science 2.0, it’s worth taking a quick look at their nature before going on. Science 1.0 demands that we think in terms of independent “things,” including people, each of which has its individual identity. Science 2.0 invites us to think in terms of networks and the agents that make them up. (Much has been written about networks. For the curious reader, we recommend Bruno Latour’s ideas about Actor-Network Theory.)

An agent is any “actant” whose behavior can cause a response in other agents. In the struggle to thrive in the world of Science 2.0, agents will try to enlist other agents into networks. In biological networks, living things can enlist: members of their species, as in a herd of zebras; other species, as with the bacteria that live in the human stomach and help people digest their food; and “technological” assistance, as in the dams that beavers build.

In cultural networks, humans enlist: other people; other species, as with domesticated animals; stories, in the expanded sense we’ve been using: technology; and social institutions. What makes stories, technology, and institutions “actants” is their ability to change the behavior of other agents in the network. After all, people started to live very differently when cars became affordable, and the Internet has made a thoroughly globalized world a reality.

Such networks are continually changing, as agents join, leave, or remain members. Not only that. As agents change individually, they can create cascades of change among other network members, who depend on them. World War I, for instance, was fought by two competing networks, the Allies and the Central Powers. The war’s outcome was largely determined by changes in these networks. In 1917, the United States joined the Allies and, then, Russia withdrew. One of the most important events determining the result was the introduction to the Allied network in 1917 of a new technological agent, the tank.

In short, networks provide the flexible structure that living systems need to evolve. These networks enable agents to connect or disconnect, as their environments shift; they also provide the constraint that enables very different agents to work together.

— On networks

In the world of Science 2.0, everything is changing, the unpredictable happens frequently, and living things can perceive such change only indirectly. In such a world, how can anything as fragile as a bacterium, a flower or a human being thrive? The answer, we argue, is evolution.

Evolution 2.0

Like science in general, evolution has been going through a paradigm shift in recent decades. The older paradigm is the neo-Darwinian “modern synthesis,” which emerged in the 1940s. This model of evolution combined Darwin’s natural selection with the study of genetics.

Neo-Darwinian evolution has three key qualities. First, as a process, it is gradual, driven by small changes that result from purely random, undirected mutations of the genes. Second, physical form, as well as much behavior, is the automatic product of genes. In this way, DNA can be compared to a recipe, “a set of instructions which, if obeyed in the right order, will result in a cake”(author’s italics). Third, the living products of their DNA instructions are then tested for fitness through “natural selection,” their interactions with other living things and the forces of nature in their environments. With neo-Darwinian theory, “the history of life at all levels — including and even beyond the level of speciation and species extinction events, embracing all macroevolutionary phenomena — is fully accounted for by the processes that operate with populations and species.”

As a result of these qualities, neo-Darwinism presents living things as relatively passive — more acted upon than acting — in the process of evolution. At the smallest scale, the “micro-scale,” living things must obey their DNA’s instructions; organisms are the “vehicles” that carry their “replicator” genes. On the largest scale, the “macro-scale,” they are subject to the forces of natural selection. Some living things can learn and change their behavior. But evolution and learning are distinct processes.

Not all students of evolution agreed with this gene-centered model. In the 1960s, Dmitry Belyaev noticed that stressful environments could activate normally inactive genes, and provoke significant changes. Similarly, C.H. Waddington discovered that genetic mutations would accumulate during periods when the environment remained relatively stable. However, when the environment changed dramatically, those accumulated mutations would express themselves, sometimes in dramatic changes.

Some neo-Darwinians tried to incorporate such discoveries into their evolutionary theory. But, by the 1990s, it was becoming clear that the modern synthesis did not account for the full richness of evolution.

The most controversial early challenge to neo-Darwinian theory appeared in 1972, with the idea of “punctuated equilibrium,” published by paleontologists Niles Eldredge and Stephen Jay Gould. They argued that macroevolutionary change, like the move from dinosaur- to mammal-dominated ecosystems, occurs in relatively sudden “punctuations” of normally gradual evolution. Ever since, neo-Darwinians have denied this rejection of pure evolutionary gradualism. More recently, work in fields such as molecular biology, biosemiotics, and modeling complex systems have made the neo-Darwinian model increasingly effective.
more difficult to accept. The new model doesn’t have an accepted name yet. So we’ll refer to it as Evolution 2.0. (Because this is a short book, we present only a brief overview. For the curious reader, a much fuller discussion of this emerging paradigm appears in 10.)

This emerging understanding of evolution advances “a far richer and more sophisticated theory of evolution, where the gene is not the sole focus of natural selection”10(2). Rather, Evolution 2.0 models the process by which life has come to explore what Stuart Kauffman12 calls the “adjacent possible.” In a world of constant change, even the most successful survival strategy can eventually lead to a dead end, as most of the dinosaurs discovered. Evolution 2.0 enables living things to explore new possibilities so that they can develop innovative survival strategies when their older, more established ones fail.

The key difference between neo-Darwinism and Evolution 2.0 is that the emerging model occurs in a nested network, where agency is spread throughout the network. As a result, phenomena from genes to cells, organisms to ecosystems, and even volcano eruptions or asteroid strikes, all contribute as agents in the evolutionary process. Moreover, because these agents are all interconnected, Evolution 2.0 seems like a much “thicker” process, a non-linear conversation between phenomena at every scale, rather than neo-Darwinian dictates. In this way, high levels of stress in the environment (macro-scale) can trigger “semi-directed” mutation (micro-scale) in living things (meso-scale), suppressing enzymes that usually limit such mutation10. This is not the blind and random change of neo-Darwinian theory. How a gene mutates is random, but chemical systems in the body encourage certain types of mutation to meet the challenge.

Learned behaviors can even be passed on under some conditions. Such behaviors range from preferences for certain foods, learned in the mother’s womb, to songs that some birds and whales must learn. With these songs, dialects may differ, so that “members of a group are united by a dialect that is clearly different from those of other groups”10(172). This sort of learning may be one of the origins of human culture. In these cases, the animals that inherit non-genetic characteristics may be able to survive better because of them. As a result, they may also experience genetic changes that strengthen those characteristics. Nisbett13 goes so far as to suggest that the holistic and individualistic way of thinking of Chinese and Westerners, respectively, may, over the last 5,000 years have been genetically reinforced. The study of biosemiotics – how living things process information – offers insights into the mechanisms by which cultural habits can become the object of genetic selection6.

With Evolution 2.0, we leave the world of Science 1.0, where most matter is dead and action occurs because of linear cause-and-effect. In the world of Science 2.0, phenomena at many scales behave as active agents. And because of their networked structure, and the communication between scales, evolutionary change can cascade in a non-linear way.

The pattern of evolving phenomena

Yet, even in a world of cascading, non-linear evolutionary change, most phenomena seem to evolve in a similar pattern. As the reader may recognize, that pattern – derived from the principles of complexity theory – resembles punctuated equilibrium, especially in the repetition of longer stable periods and shorter transformational periods.

Take a simple example: Put a chunk of ice in a pot on a hot stove. It will remain solid until it approaches its melting point; the molecular structure breaks down; then, it enters a turbulent “phase transition” and transforms into liquid. It will remain liquid until it approaches its boiling point, with a breakdown in molecular structure, becomes turbulent again, and transforms into gas. Phenomena like this alternate between the “stable states” in which their behavior conforms to established habits, and turbulent phase transitions, in which their agents explore the environment for behaviors that enable them to survive. The resulting dynamics can be represented in the drawing below, created as a “back-of-the-cocktail-napkin” attempt to understand several phenomena studied in complexity theory14:

![Figure 1: Pattern of evolving phenomena](image-url)

This pattern is overly neat and coherent, an approximation of the networks it maps, not a mathematical or literal representation. It is a guide for the interpretive explorer. As an example, consider what this model suggests about the evolution of mammals.

The earliest mammals appeared roughly 225 million years ago, a few million years after the dinosaurs appeared. As the dinosaurs came to dominate ecosystems across the world, mammals had to find niches where they could survive by avoiding...
dinosaur predators. Until the collapse of ecosystems, about 65 million years ago, mammals remained “mainly small, nocturnal, tree-dwelling creatures"\(^{(15)}\). Yet, even though their body types would develop only in minor ways, mammals' genetic makeup continued to change through mutation at a fairly constant rate.

Most of those mutations would not be expressed in body changes until the 10 million-year phase transition, after the ecosystem collapse, during which those systems re-organized themselves. With so much constant mutation left unexpressed, "evolution of the whole [can proceed] without interruption in an obvious but imperceptible way"\(^{(16)}\). This is a far cry from the neo-Darwinian "recipe" metaphor for DNA. Why did nearly 140 million years of genetic change in mammals only express itself fully in a phase transition if DNA is a recipe to be followed? Why are so many mutational "instructions" overlooked for so long, only to be exploited later?

The answer lies in the pattern in Fig. 1: Any complex phenomenon – from a molecule to an organism to an ecosystem – is a coherent network of agents, each of which is also a network of agents – atoms in molecules in cells in organs in organisms, and so forth. In phase transition, the coherent network that makes up the whole has dissolved, and its agents must experiment as they search for the physical structures and behaviors that will enable them to survive in new conditions. Here, long-accumulated genetic mutations can finally create major changes. As Jablonka and Lamb\(^{(272-276)}\) explain, this is precisely the sort of behavior that the emerging model of evolution suggests.

In the phase transition that follows collapse of the network, new forms of life – such as mammals – can flourish. As Stanley Salthe\(^{17}\) notes, this is the most creative period of any phenomena’s evolution, because of the freedom from the coherence imposed by older established habits. As they interact with others, the agents learn which new behaviors work. As a result, new "rules, laws, and structures" emerge within their networks\(^{(160)}\). These become the stable-state habits that will continue as long as they are successful. Over time, the agents build relationships practicing these behaviors. The longer habits succeed, the deeper the relationships become, and the more the agents rely on their relationships. In this way, the networks of flora and fauna, predator and prey become stronger, habitual patterns develop, and agents begin to depend on those patterns for their welfare. These locked-in relationships and habits explain, for example, how mammals were ecologically trapped into such a narrow role for more than 100 million years.

At some point, the environment changes so much that behaviors needed to adapt fall outside what established habits allow. At this point, the phenomenon enters “senescence”\(^{17}\), where agents struggle to meet challenges without going beyond those old patterns. Finally, environmental change becomes so great that agents can no longer survive unless they break out of those habits. The phenomenon’s network collapses – just as the molecular structure of ice breaks down as it approaches its melting point – and, surviving agents, still connected in smaller networks, must either fall apart or reenter phase transition and develop another habitual pattern. Yet, living things have no way to anticipate what shifts may occur in an ecological phase transition. Evolution 2.0 suggests that, as a result, underused mutations continue to emerge as part of the process of exploring the “adjacent possible.” By thus creating possible alternatives, living things are preparing for the inevitable shifts, exploring alternatives they may have.

Given this understanding of evolution, DNA is less like a recipe than a “playbook.” In games like basketball, teams may have certain frequently practiced “set” plays that enable them to make the most of their players’ strengths. However, no one can be sure what plays the other team may be running. The game is too complex, and any specific game can develop in many different ways. As a result, each team has a book of plays from which its members work to adapt to developments that weren’t expected, with tactics that have already been learned. In effect, each team is constantly exploring the game that is evolving, based on the playbook that gives them a limited number of effective tactics they can draw on. The game does not act out instructions; rather, it is a negotiation that players, as agents of their teams, informed by their playbooks, have with each other, and the other team, over the course of the game.

This is largely the way some researchers in molecular biology have come to think of DNA. For Jasper Hoffmeyr\(^9\) DNA is a "template" “used to recursively and adaptively re-create the system.” That template records successful survival strategies that its organism may need. Some are currently in active use; others become available in times of change and stress. For an embryo developing from a single cell, the genetic template’s “instructions” are activated in a complex conversation in which genes, cells, enzymes and the environment create complex feedback loops. All of them communicate so that the developing individual can prepare, from its very beginning, for the specific environment in which it will live. Each individual organism is a unique experiment, individualized from its species’ shared template; each will also be tested by natural selection as it interacts in its ecosystem.

When ecosystems are in a stable state, this instructional conversation limits the experiments organisms make. The “purpose” of Evolution 2.0 is to enable living things to adapt so that they can thrive in the world of Science 2.0. So in the stable state, there is no need to explore the deepest possibilities of change in an organism’s DNA. However, when ecosystems collapse, new survival strategies become necessary. As a result, over the 10 million years following that collapse of the dinosaur-dominated ecosystems, mammals experienced an “adaptive radiation,” as “new teeth and body shapes evolved to allow exploitation of the earth’s suddenly available treasures”\(^{18}\).\(^{(171)}\)

Our retelling of the story of mammals’ emergence to dominance is oversimplified. Yet it makes clear the interconnected “thickness” of Evolution 2.0. Gould\(^{11}\) points to this thickness when he discusses how evolution occurs at six scales – the gene,
In spite of this intentional imprecision, our theory was recently validated by the more mathematically rigorous work of Korotayev. Acceptable. For the most part, cultural stable states do not simply end and phase transitions begin; rather, societies often move back and forth between the two, as anyone studying the halting attempts at lasting change in organizations, such as those in healthcare or education today, will note.

Why do such different phenomena conform to this pattern? Because all phenomena that evolve seem to alternate between relatively long periods of relative stability and the shorter transformational periods, during which they re-organize their structures to meet changed environmental conditions. That pattern remains remarkably similar in both biological and cultural evolution. From this point of view, a panorama of human history over the last 50,000 years might look something like this:

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**Cultural Evolution 2.0**

Although Fig. 1 was created to explain physical phenomena, it also reflects many of the important cultural phenomena identified over the last half century:

- Michel Foucault’s description of the 500 years of Western history as periods alternating cultural “continuity” and “discontinuity”;
- Gerhard Mensch’s analysis of Western cycles of economic boom (stable state) and depression (phase transition) and;
- Giovanni Arrighi’s examination of the evolution of Western capitalism through periods of Italian, Dutch, British and American dominance.

One last note: This understanding of evolution makes it clear why this process generally leads to increasingly complex phenomena. In order to prepare living things to meet challenges they are still unaware of, evolution requires Kauffman’s exploration of the adjacent possible. The process therefore continually produces and tests more and more diversity. And the progressive integration of such diversity is at the heart of increased complexity.

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*Fig. 2: Human history as ‘punctuated equilibria’*

History is too messy and abundant, and what we know with certainty too limited, to assume that events should conform to our abstractions; so we keep this figure imprecise. For example, the movement indicated in the figure is overly linear. Our date for the beginning of the Agrarian Revolution is 11,000 years ago, although 10,000 or 12,000 years ago would be equally acceptable. For the most part, cultural stable states do not simply end and phase transitions begin; rather, societies often move back and forth between the two, as anyone studying the halting attempts at lasting change in organizations, such as those in healthcare or education today, will note.

In spite of this intentional imprecision, our theory was recently validated by the more mathematically rigorous work of Korotayev and Grinin, in their modeling of the growth of urban populations (see Fig. 3).
Here we see that urban population remains essentially flat in both the pre-axial and post-axial stable states, while it increases exponentially in both the Axial Age and Modernity transitions. According to Korotayev and Grinin, the main factor enabling such rapid population growth is an acceleration in technological innovation. As Brian Spooner notes, this dynamic becomes a self-reinforcing cycle, because larger cities mean more people exchanging and testing innovative ideas, creating more technologies that encourage still larger populations.

When you look at the last 50,000 years this way, human history alternates between three stable-state periods and three phase transitions:

- From about 50,000 years ago until the end of the Ice Age around 12,000 years ago, human beings were organized in hunter-gatherer bands of up to about 30 people and mega-bands of up to 200, constantly on the move, following the prey they hunted, very much like earlier hominids.
- In the centuries following the end of the Ice Age, population increased, people discovered agriculture, and experiments with new ways of organizing social life emerged. This phase transition, the Agrarian Revolution, would continue to some time around 3000 BCE, when pre-axial states, such as Sumer and Egypt began to appear.
- These pre-axial states would continue to dominate human societies until perhaps 1200-1000 BCE, when increased population, technology and trade precipitated another cultural phase transition.
- The 600-year Axial Age enabled the cultures where it developed to re-organize themselves into bureaucratic empires, the post-axial model.
- The post-axial state would dominate human history from c. 200 BCE to 1500 CE, at which time further increases in population, technology and trade precipitated a second axial transformation.
- Today, we appear to be approaching the end of this cultural phase transition, Modernity.

As we noted in Chapter 1, there is nothing “inevitable” about this pattern. Societies undergo transformational periods such as the Axial Age or Modernity only when increased social complexity overwhelms their society-wide networks. The resulting breakdown makes it possible for the smaller networks within it to readjust, evolve, and reinvent themselves. Whole continents – Africa, Australia, both Americas – and significant parts of Europe remained untouched by Axial Age transformation. For example, Aztec and Maya societies never experienced such transformation. And those whose ancestors had been Aztec or Maya were swept up in Modernity only when the Spanish conquered them. Cultural evolution, like biological evolution, is a matter of adaptation to specific events and conditions.

Nor is it only the pattern of evolution that is similar in biological and cultural forms; it is also the underlying dynamics. With biological evolution, we looked at the emergence of mammals as an example of these dynamics. Let’s turn now to a social analogue – the dynamics by which writing emerged as a powerful agent of cultural evolution. Sometime around 3000 BCE, the first “complete writing systems,” which captured speech for the purpose of communication, appeared in Mesopotamia and Egypt. These writing systems were essential to govern pre-axial states with populations of hundreds of thousands or millions. Until the Axial Age, writing would remain a tool of the people of power among whom it arose, priests, bureaucrats, and merchants.

During the 2000 years that followed the first writing systems, millions upon millions of social experiments increased the value of writing. It would be used for trade among empires, recording important stories, international politics, and even, in Egypt, as a powerful tool for political propaganda. However, as the pre-axial cultural networks fell away in Greece and Israel, India and China, writing flourished as never before. Like mammals after the collapse of dinosaur-dominated ecosystems, millions upon millions of experiments became available to people in these societies searching for new survival strategies. In the Axial Age, writing became the preferred tool for communicating culture and storing knowledge, making science, philosophy, and the religions of the book possible. In this way, writing moved from being a convenient way for people of power to keep track of growing wealth and make their orders known, in the pre-axial period, to the way for a much wider range of people to understand their world and help those throughout society adapt to an increasingly complex social world.

Note the remarkable similarities in the dynamics of biological and cultural evolution. Yes, the mechanisms are different. Where the template for biological evolution is DNA, any society’s network of stories, especially its world story, serves the same purpose in cultural evolution. In both cases, the template stores historically tested strategies and tactics that have enabled their possessors to thrive. Both also make it possible to adapt by providing avenues for innovation that can be tested and, if successful, incorporated into the template. Note also that, as templates, both DNA and stories are passive. Agents must act on them to create the interactions and eventually the habits of their ecosystems and social networks as wholes. They offer the range of survival strategies, the platform for innovations, and the limits that will one day threaten both ecosystems and societies. With this dynamic, biological entities enact their DNA and learn from the resulting behavior, while people in cultures enact their
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Moreover, events on all these scales are embedded in a history that one can trace back to: they generate; and how they affect the ability of people in them to survive and thrive.

Throughout this book, we have emphasized this thickness, as events unfold on three meta-scales:

- At the micro-scale, individual members of any society act on its stories, talk with others to better understand those stories, use the society’s technology, and innovate on both the stories and technologies;
- At the meso-scale, these individuals become agents connected in social networks, ranging from families to states, and interact to drive the society, within the limits of their ecosystems, and its interactions with other societies;
- At the macro-scale, the interactions of different societies can generate a world system, as people in their social networks interact with their ecosystems, and both geological and climactic conditions, all of which shape and limit what they are able to do.

Cultural evolution occurs in the context of: events on all three meta-scales; the communications, interactions and responses they generate; and how they affect the ability of people in them to survive and thrive.

Moreover, events on all these scales are embedded in a history that one can trace back to:

- The spread of Homo sapiens across the planet, starting perhaps 70,000 years ago;
- The descend of our evolutionary ancestor, Homo ergaster, from the trees of the East African rain forests nearly two million years ago;
- The evolutionary separation of our ancestors from the rest of the great apes perhaps seven million years ago, or;
- The end of dinosaur dominance 65 million years ago.
At each step, our ancestors followed certain paths that limited what we human beings can do today, but also opened new possibilities. What happens at any point in history is the result of a highly complex network of networks, formed by millions of years of events on many scales, in which a change at any scale may have unforeseeable consequences that cascade through networks across the planet. This is what we mean by a thick conception of cultural evolution.

To illustrate, let's take a look at the richness of agents, structures, and other forces that would result in the Thirty Years War (1618-1648) in Central Europe. First of all, that conflict was embedded in hundreds of years of Church history, as well as the Church's interactions with governments across Europe. This history includes the way the Church adopted the foundational texts of grail quest and the end of times, which it used in the Crusades. When the Crusades failed, with the loss of Jerusalem in 1187, and the Church could not save people from the Black Death, it became possible that the job of *viri spirituales* could fall outside the Church, as it would to the priesthood of science.

In addition, as ordinary Europeans became aware of the riches of Islam during the Crusades and, then, the expansion of the Mongols brought Europe into the first trans-Eurasian economic system in the 13th century, a wave of opportunities for trade and growing wealth followed. By the 14th century, world trade centers appeared throughout Europe, and the Church took advantage of the resulting wealth with indulgences, leading to the proto-Reformation responses of clerics such as John Wycliffe (c. 1320-1384) and Jan Hus (c. 1369-1415). The Thirty Years War might even have started about a century earlier, when the Hussite Wars (1419-1436) began with the first Defenestration of Prague in 1419. However, without the printing press, the Hussite Wars remained local. Perfecting earlier Chinese innovations, Guttenberg's printing press, however, made it possible to reach a wider audience with a Bible its members could read, as well as political propaganda. The growing wealth of the Renaissance, as Europe recovered from the devastation of the Black Death of the mid-14th century, again highlighted the abuses of the Church, and Luther's response could now be communicated across Europe. The events that would then lead to the second Defenestration of Prague and the Thirty Years War even more fully demonstrate the thickness of cultural evolution.

Contributing factors ranged from the religious conflict of Protestants with Catholics to the political conflicts of the Austrian Habsburgs with the Holy Roman Empire, the Spanish with the French, English with Dutch; from the economic conflicts arising from the old landed class, which aligned primarily with the Catholic Church, and the new commercial class, which would align mostly with Protestants (eventually bringing us the Protestant Ethic) to technological innovations, especially the firepower of the guns and cannons, again borrowed from the Chinese. In addition, thousands of individuals would contribute significantly – religious figures from Hus to Luther, generals during the war from Mansfield to Wallenstein, a range of politicians including the Kings of Spain, Denmark and Sweden, and an army of merchants and manufacturers who made the war possible. This is thick cultural evolution with a vengeance, causality spread out into every corner of society, all carried on a wave of social transformation.

**Some implications**

In such a short book, it's impossible to look at all the implications of this theory of thick cultural evolution. Still, a couple of them are worth examining briefly.

First, starting after the Ice Age, human history entered a self-reinforcing cycle of growing population, accelerating technological innovation, and growing wealth. As communities grew to thousands and then tens of thousands, wealth and power became more and more centralized in the hands of a few. For a species that had grown up in egalitarian bands, this inequality has continued to pose a difficult challenge – maintaining order in large groups while providing fair treatment. The challenge may even be more fundamental: Frans de Waal suggests that the desire for being treated fairly is part of our primate heritage.

As a result, ideologies evolved to balance the wealth and power of the privileged few with their responsibility to maintain order and ensure justice. In ancient Egypt, this balance was articulated in Ma'at, the belief that the pharaoh was responsible for maintaining "right order," including protecting even the poorest from oppressor. It was similarly at the heart of the Biblical concept of kingship and the Chinese Mandate of Heaven. The desire for justice also seems critical to Goldstone's dynamics of social rebellion in the modern world; only as the gap between wealthy and poor becomes extreme, and inflation makes it harder for the poor to buy their daily bread, do phenomena such as the French or Russian revolutions occur.

This balance is especially interesting in light of the breakdowns preceding both the Axial Age and Modernity. In the Eastern Mediterranean area, between 1200 and 1500 CE, for instance, the first "globalized economy" developed between partners in Egypt and Mesopotamia, the Aegean and the Fertile Crescent. Similarly, between 1200 and 1500 CE, the first pan-European world-system connected China, India, Islam and Europe. In both cases, population and interaction between members of different populations grew; new technology appeared; and the amount of wealth, along with those trying to take advantage of it, increased. In both cases, the majority of states in these areas had more and more difficulty maintaining order. In the pre-axial Eastern Mediterranean, all these changes contributed to the invasions often attributed to the "Sea Peoples" and the cultural collapse that led to a "dark age." In Europe, it led to the Protestant challenge of the Catholic Church, the rise of a new merchant class, and, combining these two with existing political tensions, 150 years of war. It also led to the world story that created a scientific worldview, capitalism, and the nation-state.

A second implication: Any society’s network of stories, especially its world story, acts as a template for its cultural evolution,
much as DNA acts as a template for organic evolution. As a template, these stories serve several functions. For one thing, they act as a storehouse for their society's historical survival strategies. In axial China, that storehouse emphasized the importance of political unity and submission to authority; in Greece, it insisted on the interplay of small, independent political units, where many members of the polity could express their thoughts; in modern Western Europe, it focused both on the role of the individual as quest knight/explorer and on the need for cooperation in the quest for salvation of society as a whole. In all three cases, these stories reflect a shared remembered past and suggest strategies for meeting the challenges of an unknown future.

These stories also form the basis for social experimentation that was so central to both the Axial Age and Modernity. Axial China's world story relies on the ideal of the sage king, who understands the Dao and can therefore respond to the world effortlessly. This ideal offers the basis for the schools of philosophy that sought to tutor China's axial kings, eventually leading to the combination of Confucian and Legalist thought that still dominates Chinese government. In Modernity, the world story was explicitly experimental, leading to quest-like forms in science, capitalist economics, and imperial nationalistic politics.

These stories serve one last function — to limit what is possible/permmissible within their societies. As noted earlier, one of the key elements of all stories is that they have to leave out some details. Yet sometimes those omitted details can be essential for social success. That seems to be part of the reason for the differences that Goldstone points out in different cultures' responses to the mid-17th century CE revolts in China and the Ottoman Empire, on one hand, and in England, on the other. The Chinese world story emphasized submission to ancestral precedent; the Ottoman world story, submission to Allah. The English world story focused on the journey of the quest knight. Largely as a result, China and the Ottoman Empire relied on traditional solutions and were unable to adapt to the greater social complexity that had helped create those revolts. England, however, was able to explore new solutions and moved forward to become a leader in the modern world.

In short, this combination of a basis for experimentation and limits to what we believe we can do that gives any society's world story the power to shape its history, as we point out in the beginning of this chapter.

All of which brings us to the third implication of our study: The world story of Modernity has reached its limits and requires re-examination and retelling for the human community to move ahead successfully. The most important experiments of the modern transformation — science, capitalism, and nationalism — are betraying their promise. And a new way of experiencing and acting in the world is essential. Far from being able to control nature, as Descartes hoped, science and technology have led us to the brink of poisoning our environment. And while capitalism has made it possible for a human population of more than seven billion, today, capitalism has replaced religion as one of the key elements of belief and a source of systemic corruption. In recent years, we have seen the reaction to that corruption in Egypt and Syria, in Ukraine and in many cities in China.

Finally, the cultures of nationalism now dominate most of the states of the world because those nationalistic cultures were so successful in organizing societies of hundreds of millions of people. Yet, with their insistence that "our" cultural stories are right and everyone else's are wrong, they are making it impossible to address the challenges Modernity has created. We live in a world that is globally integrated. Supply chains and financial networks can no longer be divided by state boundaries. Even information from all over the globe is now instantly available everywhere. It is no surprise, then, that the more important challenges people face today are equally global. Yet, as long as we are captive to our cultural stories, it will remain almost impossible to address those challenges. The old national cultures that were essential to building our complex societies now threaten to make us unable to solve the challenges that require international cooperation.

And so we will conclude with some observations on how our globalized world may be able overcome these cultural constraints and avoid the direst possibilities suggested in Huntington's "clash of civilizations."

References

REFERENCE LINK