

21st-Century Narratives of World History: World Historians in Global Dialogue

ed. Charles Weller

The Human System—An Introduction

Patrick Manning

The Human System and its Troubles

Humanity today functions as a gigantic, world-encompassing system, built of seven billion individuals who participate in activities and organizations that combine to perform myriad interacting functions. In its systemic behavior, human society reproduces itself, it ingests great amounts of natural resources, transforms them and produces a full range of social, economic, cultural, communication, and governmental activities. It also yields, as exhaust, waste materials of many types.

Humanity is an open system, as defined by the fact that it ingests materials from its environment and expels exhaust materials back into the environment. It is a historical and adaptive system, in that it functions not only according to an initial plan but also undergoes change in response to external and internal influences. These adaptive mechanisms may serve both to strengthen and weaken the operation of the system. Having begun as a small community, humanity has now grown to become one of the principal influences on the larger system of the earth itself—interacting with what geologists like to call earth's geosphere, hydrosphere, atmosphere, and biosphere. Humanity emerged within the biosphere and has grown rapidly to become an influential portion of that sphere. More rapidly than any other terrestrial influence, the human system is bringing change (and perhaps destabilizing change) to the earth as a whole.

This chapter provides an argument for inclusion of systems-thinking in the understanding of human history. It is *not* an argument that “systems” provide the answer to history – that systems will clarify all the big patterns of change in the past. But it *is* an argument that the logic of systems and systemic change adds some important specific insights to the understanding of history, especially at the level of world history. The peculiar nature of the human system is that it sustains itself both through biological evolution and social evolution.

The story of the human system, as told here, begins some 70,000 years ago as certain East African populations of *Homo sapiens* developed patterns of fully articulated speech – more or less like ours today. These populations relied upon their improved system of communication and the ideas they developed with it. They spread, step by step, throughout the African continent and across the world as a whole, incorporating other hominid populations as they spread. Early in this process, humans created multiple forms of representation—that is, representing their interpretation of their world notably in speech but also in visual art, dress, music, and in interpretation of their society and environment. In this view, the replication and transformation of the human system provides a framework for summarizing human history. As will be seen, speech, categorization, innovation, and migration play central roles in social evolution.

The human system, however, is now in trouble. Its troubles lie both in its external relations with the environment and in its internal functioning. In large part, today's troubles result from the very

success of the human system: its growth in population, productivity, and in its ability to mobilize resources for issues of high priority.¹ In its external difficulties, humanity faces a likely destabilization of climate, especially because of the burning of fossil fuels and the expansion in greenhouse gases. In addition, we are losing many types of plants and animals, as human activities are encouraging habitat shifts and extinction of animal and plant biota from the tiniest to the huge, on land and in the waters. By analogous processes, the waters of the oceans, streams, and lakes are being polluted by human activity; the very flows of the ocean are threatened with being redirected. Thus, the atmosphere, the biosphere, and the hydrosphere are under severe pressure because of the expanding human system. Even the geosphere is groaning with expanding seismic activity in response to drilling and fracking for extraction of natural gas.

Within the human system, the trouble may be just as severe. Great flaws have shown up in the management of human resources. The crisis in human inequality, measured most easily by differences in income and wealth, is deepening as the benefits of production go disproportionately to the wealthy. One result of this inequity is that great numbers of people are held in subjection and deprivation. The poor, as understood by modern science, have the same intellectual potential as all others, but today's deprivation wastes their potential; social oppression and antagonism may be expected to grow. In addition, the great investments in mutual hostility and warfare are in many ways wasteful.

Study of the human system involves identifying its elements, tracing their interplay, and analyzing its transformations over time—especially with attention to the roles of individual and collective consciousness. Is the system ready with adaptive responses that will respond automatically to current crises? Is the system capable of changing its direction in time to limit the damage and threat from within and without? To anticipate the question posed at the end of this essay: can human nature change?

Formation and Expansion of the Human System, 70,000 – 30,000 BP

I begin with a narrative of the formation and early stages of the human system, in which speech communities of foragers spread throughout the Eastern Hemisphere. This early history, I argue, is more central to later developments than usually thought. Then I interrupt the narrative to present the theory and define the terminology used in the rest of the chapter. The remaining narrative traces a period of dilemmas and subsystems (30,000 to 6,000 years ago), explores the diverging scales of social order (from 4000 BCE to 1700 CE), and questions human nature (from 1700 CE to the present). The narrative sketches out how recurring episodes of social evolution guided by human agency led to a succession of dramatic changes, each characterized by a combination of success and malfunction, leading to the dilemmas of today.

Research in genetics and paleontology indicates that a new hominid species, *Homo sapiens sapiens*, emerged in Northeast Africa some 200,000 years ago. The communities of this species, similar to other hominids in that they were good at running and had the use of tools and fire, developed slowly for a long time before their dramatic expansion. The climate in which the new species developed included major swings in temperature and humidity over the long term and significant fluctuation in the short term. As *Homo sapiens* entered the scene, climate was warm and humid and sea level was nearly as high as it is now. But by 70,000 years ago, temperature and humidity had declined to a relatively low point. It was at about this moment (though presumably not because of climate), that innovative communities, again from East Africa, developed articulated speech.²

That expanded capability for communication precipitated the formation of the human system. Inherent patterns of speech change took hold, and language divergence led to the emergence of separate language groups. Did language arise because of the biological evolution of a larynx placed to modulate air from the lungs more precisely? Did it arise because of social need for more detailed communication? In any case, speech unleashed discourse, social reorganization, and innovation.

Language groups might commonly have included 200 – 300 persons, residing across a territory but assembling occasionally. When groups lost contact with each other, their languages diverged with time. Through definition of their world and through innovation to modify it, these communities became local systems that changed by social evolution. Over the course of 10,000 to 20,000 years, these communities and their diversifying subsystems expanded across the Old World tropics. By retaining their inherent capacities and remaining in contact through migration, they had become a single great human system, stretched in a thin but growing community across land and littoral from the African Atlantic to the South Pacific.

This growing community spread initially throughout Africa, as seen through the archaeological record.³ The expanding community of talking humans became a system at this time because of the degree of human intercommunication; other species have *herd* behavior but not really *system* behavior. Were the migrants able to teach speech to other human groups? The various language communities differentiated in language and, with time, in customs—yet they remained connected by migration and did not become entirely self-sufficient. As populations expanded across Africa, they had to learn about each new ecology in order to survive and thrive, getting access to firewood and water and perhaps finding materials for jewelry. Customs developed, perhaps including periodic reunions, to maintain social relations within communities. Some major technical developments took place, including the development of clothing and the construction of watercraft.⁴ With the watercraft, presumably made of reeds bound by cord, migrants navigated lakes and rivers and, most outstandingly, crossed the Bab el-Mendeb from Africa to Arabia at the opening of the Red Sea. Some moved east along the Indian Ocean littoral as others moved west across the African mainland. Moving to the east in tropical latitudes, human settlers moved across coastal and inland areas of Arabia, Persia, South Asia, and Southeast Asia until they reached Australia and New Guinea by about 50,000 years ago.

The ups and downs of climate affected human expansion. As temperatures declined from 60,000 years ago, the lands of northern Africa and southwest Asia became dry and desert, obstructing all but the hardiest migrants toward the Mediterranean; humans remained restricted to tropical and subtropical regions. From about 45,000 years ago, humans found their way to the temperate lands of Eurasia (perhaps through the passage just west of the Himalayas) and then moved rapidly across the grasslands, west to Europe and east to the Pacific. In the northern temperate zones, someplace between what are now Russia and China, humans and dogs encountered each other. The two species formed a bond: dogs apparently joined human communities readily. This association gave humans their first experience with breeding. With time, dogs spread through human communities on all the continents, thus revealing the networks of continuous contact among human populations. (Bows and arrows, once they were invented, spread almost as far.)

The consolidation of human populations throughout the Old World was well advanced by 30,000 years ago. Steady adjustment to local ecologies brought differentiation in communities. In addition, from the earliest expansion, talking humans encountered other humanoids—other communities of *Homo sapiens* in Africa, Neanderthals in Europe and West Asia, and *Homo erectus* or Denisovans in eastern Asia. Geneticists have shown that there was interbreeding of these communities in Eurasia, but we do not know under what social conditions.

This narrative of human expansion is becoming familiar to students of world history. But what were the subsystems and sectors of the early, constructed social systems that stretched in a thin layer over such a huge terrain? What functions did these subsystems serve? Did they benefit the whole system or just specific social groups? The human system had no central brain, though many conscious individuals and communities were able to share information and develop consensus behavior. The biological subsystems of human groups continued, but were supplemented by social subsystems, expanding and subdividing functions. For the period before 30,000 years ago, while expanding human communities implemented many practical decisions, it seems that conceptual and social changes were the most numerous and most important. For instance, the social practice of migration enabled both the gene pool and the social archive to be widely exchanged among all human communities. Human reconfiguration of the material world would come later.

Biological and Social Systems: Theories of their Evolution

A systems-based approach to world history provides a framework encompassing all of humanity yet focusing as well on its subsystems at every level and on its local elements. This approach has the advantage of encouraging analytical linkage of the earliest times with the most recent times; it also requires attention to human interaction with the many aspects of our environment.

The term “system” has long been in the lexicon of many languages.⁵ Not until the aftermath of World War II, however, did it become a formal topic of analysis. Norbert Wiener and John von Neumann led in developing formal theories of systemic relationships. Since then, systems-thinking has developed many important applications. I have chosen to draw on four major elements of systemic and evolutionary analysis, with some further extensions: the “general systems analysis” of the biologist Ludwig Von Bertalanffy, who published general statements from 1945 to 1976; James G. Miller’s 1978 analysis of “living systems”; the investigation of “complex adaptive systems” from the 1980s; and study of human social evolution, especially by Peter J. Richerson and Robert Boyd.⁶ I have combined these and other systemic approaches with my own thoughts to propose a framework for the human system that balances six principal elements:⁷

- (1) Humanity is a **biological system**, evolving through *natural selection* within its genome.
- (2) Humanity is an **open social system**, consisting of **communities** at all levels, evolving through *social selection*.
- (3) **Social evolution** works through **social selection** via conscious choices.
- (4) **Subsystems** of humanity and its **communities** perform key **functions**: reproduction, maintaining borders, processing matter and energy, and processing information.
- (5) **Sectors**, each with characteristic *dynamics*, are constructed to expand the performance of functions within *subsystems*. These sectors are institutional structures that generate social behavior serving within a subsystem.
- (6) The **constructed human system**, in its growth and transformation, is the central object of study. The system exhibits a teleological drive to survive and to thrive.

Humanity as a biological system with its subsystems. Humanity is a biological system at least in that it is made up of many individual human organisms. In addition, humanity is a biological species with a shared gene pool. Following earlier hominid evolution, today’s humanity has undergone biological evolution in the rise of phenotypical variations that we sometimes identify as “race,” and in the emergence of genetic adaptations such as the sickle-cell adaptation to malaria and the growth of lactase persistence among milk-drinking populations.

Biological systems function at multiple levels, from the cellular to the organism and on to the level of herds. Miller, in showing the analogies among all these levels of living systems, has proposed a list of nineteen subsystems for any living system. Each subsystem performs a function necessary for the survival and reproduction of the system. For the case of an individual human organism, these are listed as follows, showing the *name* assigned to each subsystem, its *purpose* (or function), and *agents* (or *organs*) fulfilling the purpose:

For the organism as a whole. 1) *Reproducer*, to produce the next generation [reproductive organs]. 2) *Boundary* – to separate the system from its environment [the skin].

For treatment of matter and energy. 3) *Ingest* – to bring materials from the environment [mouth, lung]. 4) *Distributor* – to circulate ingested materials [heart, blood and lymph vascular systems]. 5) *Convertor* – to convert ingested to usable materials [stomach, small intestine]. 6) *Producer* – to synthesize materials for growth, damage repair, replacement, or moving output. 7) *Storage* – to store energy [fatty tissues, muscles, bones, lower bowel]. 8) *Extruder* – to remove products and waste from system [lungs, kidneys, ureters, rectum, anus, lungs, sweat glands, birth canal, breasts, mouth]. 9) *Motor* – to enable the system to move [muscles, bones, joints]. 10) *Supporter* – to support the system and to separate subsystems [skeleton, tendons, ligaments, muscles].

For treatment of knowledge. 11) *Input transducer* – to bring information from the environment [eyes, ears, nose, tongue, nerve endings]. 12) *Internal transducer* – to accept information within the system [polysynaptic regions of neurons, receptor cells]. 13) *Channel and net* – to carry information within the system [blood and lymph vascular systems conveying hormones, central and peripheral neurons]. 14) *Decoder* – to prepare information for decisions [cells in sense organs]. 15) *Associator* – to form associations (categorize) to start learning [brain]. 16) *Memory* – to store information for learning [brain]. 17) *Decider* – to receive information inputs and transform them to information outputs (to make decisions based on available information) [pituitary, spinal cord, brain]. 18) *Encoder* – to implement decisions within the system [brain, endocrine glands, elements for alpha, beta & gamma coding]. 19) *Output transducer* – to implement decisions in the environment [endocrine glands, lips, tongue, palate, larynx, lungs, hands, feet].

Figure 1. Biological subsystems of a human organism: names, purposes, agent organs.

Figure 1 shows that biological subsystems are neither neatly packaged nor discrete. The *output transducer*, to express the individual's choices and decisions to the environment, uses numerous agents—including voice, hands, feet, emotions, and more. That is, as Miller points out, the functions of certain subsystems are dispersed downward to the next level in the biological hierarchy, yet still serve as an overall subsystem. In addition, a single agent can contribute to several subsystems—as the mouth contributes to *ingest*, *extruder*, and *output transducer*. Subsystems, therefore, consist of all the elements combining to form each specific function: it is important not to oversimplify them.

The human social system: levels (communities at various scales) and subsystems. Systems created by social evolution function at multiple levels, as do biological systems. The most basic unit in social evolution is the human family or local community. Intermediate levels of social systems have arisen (language groups, voluntary associations, ethnicities, regional or civilizational cultures, plus states and international organizations). Figure 2 displays the case of the most basic social system, a *small community* (for instance, a language community or a residential community), showing the *name* of each Miller-type subsystem (the same 19 at every level of living systems), its *purpose* (or function), and the *agents* (individuals or social groups) fulfilling the purpose. In this case the environment of the system is the natural environment but also other human communities.

Human communities, starting with local communities, are *open* systems: they interact with their environment and they also depend closely on neighboring communities. This open-community structure has been essential for the multiple levels of communities: local, language-based communities; towns as they developed; ethnicities and monarchies; regional and civilizational groupings; and states (including monarchies, empires and nations). Because of the openness of community systems, the subsystems that perform functions for sustaining them are often *distributed* among communities or sectors. For instance, collection of food can be distributed across communities of foragers, herders, fishers, and farmers.

For the community as a whole. 1) *Reproducer* – to reproduce the community [adult members]. 2) *Boundary* – to separate community from its environment [selected community members and “walls,” both physical and metaphorical].

For treatment of matter and energy. 3) *Ingest* – to bring materials from environment [those who acquire food and resources]. 4) *Distributor* – to circulate ingested materials [those who distribute food and resources]. 5) *Converter* – convert ingested to usable materials [those who transform food, fuel]. 6) *Producer* – to synthesize materials for growth or damage repair [artisans]. 7) *Storage* – to store matter-energy [those who store food or energy]. 8) *Extruder* – to remove products and waste from system [those who clean up]. 9) *Motor* – to enable the system to move [legs, boats]. 10) *Supporter* – to maintain spatial relationships among system sectors [persons, walls].

Information. 11) *Input transducer* – to bring information from the environment [scouts]. 12) *Internal transducer* – to accept information within the system [speech]. 13) *Channel and net* – to carry information within the system [messengers]. 14) *Decoder* – to prepare information for decisions [guides and interpreters]. 15) *Associator* – to form associations (categorize) to start learning [analysts]. 16) *Memory* – to store information for learning [senior group members.] 17) *Decider* – to receive information inputs and make decisions [decision-making persons or groups]. 18) *Encoder* – to represent decisions within the system [linguists, artists]. 19) *Output transducer* – to implement decisions in the environment [convey message of the group].

Figure 2. Social subsystems of an early human community: names, purposes, agent groups.

Comparing Figure 2 with Figure 1, we see that in some cases the agents performing various functions are very similar at both individual and community levels, while in other cases the agents are very different. The motor system for a community is much the same as for a human organism—legs of the individual. But the agents of social reproduction (adults) are very different from the agents of biological reproduction (individual reproductive organs). Further, the boundary of a human community at any level is much less precise than the skin surrounding an individual human organism. For the processing of information, we see that the internal transducer for human communities is speech, which is very different from the neural system of a human individual.

Social evolution and social reproduction.

Up to now, this discussion has focused on cross-sectional description of living systems. We turn next to systemic evolution and transformation over time. For biological evolution in humans as in other species, nuclear DNA serves as the *archive* of genetic constituents and the *template* for replicating the organism and its elements. The *mechanism for change* in biological evolution is natural selection: mutations in DNA, caused by a range of mostly random factors, survive and spread if they are adaptive or at least neutral in genetic reproduction of the species.

Social evolution, while analogous to biological evolution in general, is quite different in its particulars: the social system changes through human agency rather than through biological

mutation.⁸ The four main steps of social evolution center on conscious choices, though each choice brings additional implications.

Innovation accelerated among humans especially because of the rise of fully articulated speech.⁹ The interaction of people through speech brought interpersonal *discourse*, the exchange of information and sentiments. Discourse gave specific names to the elements of the world (nouns), to actions that can be taken (verbs), and qualifications of these (adverbs and adjectives). In this discourse, speakers engaged in specific *categorization* and general *representation* of their world. Through *categorization*, people selected terms and assigned meaning to them, thereby constructing knowledge about the social order, the natural world, and any subject imaginable. In *representation*, once people represented their world by coining thousands of words in language, they pictured aspects of their world in other media—dress, music, dance, visual art, and philosophy. In these discourses of categorization and representation, people communicated meanings with a mix of clarity and error, agreement and disagreement, information and misinformation. The result, however, was that individuals and groups repeatedly proposed innovations in conceptualization, social structures, and material life.

Archiving began as the process of selecting and preserving elements of the social order. The selection of innovations to preserve required a consensus articulated for the community. Discourse in communities could lead to consensus but also to extended debate between viewpoints: for instance, categorization could lead to creation of spurious categories, yielding innovations of value to special interests but not to the human system as a whole. Out of these discourses developed *ideologies*, sets of ideas that served either to sustain or undermine a social consensus, often representing specific interests within a community. Overall, however, a process of *social selection* commonly led to a consensus in favor of adopting and preserving innovations.

The actual preservation of the archive began as the conscious, collective memory of community members, reinforced by the structure of social institutions. The inherited structures of society and the innovations of the current generation had to be preserved in some sort of archive and made accessible for the next generation. This human social archive—the social equivalent to the biological human genome—ultimately became more complex and more reliable, especially with the invention of writing.

Reproduction of the social order included all the ways in which the practices of one generation were passed on to the next, through the intermediary of the archive. The human system must reproduce itself roughly every thirty years, the average difference in age between an individual parent and child. Intergenerational learning is central to implementing the *template* that replicates existing society and its recent changes. In addition to the inherent patterns of child-rearing, such constructed social practices as initiation, apprenticeship, and education became essential to replicating the social order. The social archive and the template for reproducing the social order are less precise and reliable than are the workings of DNA. On the other hand, the mutations that launch biological evolution are largely random, while the innovations that launch social evolution are commonly conscious choices.

Deselection of undesirable practices is one more element of social evolution. For those innovations that have been archived and reproduced in later generations, some will turn out to be harmful. Once a consensus forms that they are unfortunate, an effort will be made to purge them from the archive. This is, in effect, an additional innovation intended to counter the earlier one.

Communities, subsystems, and their sectors. The human system is composed of overlapping and interacting communities, initially at levels of family, language group, and ethnicity. With time,

communities expanded to towns, states, and empires. These communities, to survive and reproduce themselves, required *subsystems* functioning to perform the tasks of reproduction, maintaining boundaries, processing of matter and energy, processing of information. The human system, since it began, has maintained the same 19 subsystems—functions to be performed in each living system. Each subsystem, while necessary to the community and to humanity overall, became more complex as human society expanded. Rather than adding new subsystems, the process of social evolution worked by constructing *sectors* (with innovative functions) and adding them to the appropriate subsystems. This relationship among communities, subsystems, and sectors enabled technical and conceptual changes to be fit into the underlying biological system of humanity.

Sectors of human subsystems and their dynamics. Each subsystem performs its function through institutions that are here called *sectors*. But as social evolution brought change, learning, and complexity, inherent subsystems developed additional *sectors*. Language emerged as a *sector* constructed for use in the *internal transducer* and *decoder* subsystems of human communities. With early language communities as the principal social organizations, a given language was sustained by those who communicated and maintained a discourse within it.

Such sectors, while constructed by human agency, commonly function through dynamics that are inherent to the logic of the sector. Thus language inherently includes vocabulary, parts of speech, grammar, phonology, plus patterns of gradual change over time. In another example, the function of the *producer* subsystem is to synthesize materials for growth and repair. When agriculture arose it became a distinct sector, governed by the seasons and the characteristics of the various crops. A parallel sector within the *producer* system developed for animal husbandry, with its patterns governed by the breeding, pasturing, and exploitation of the animals. Much later, libraries arose as a sector within the *memory* subsystem: library dynamics rely on the logic of classification and access to resources. The novelty of each sector generated an appropriate sort of human behavior that fit the institution, as with weeding in agriculture and re-shelving in libraries. In the case of each sector, whether it addressed information or matter and energy, the relevant *subsystemic logics* could be encountered only by entering each of these new practices. The growing system of human knowledge developed many discrete disciplines of knowledge about the inherent character of many types of activity.

The constructed human system. How have these numerous elements and sub-elements of the human system sustained the system as a whole? One big question inherent in Miller's scheme is about the functioning of the *decider*, the subsystem that is to make decisions based on available information. The answer, consistent with Miller's observations, is that the mission of higher levels is often performed by distributing tasks to lower levels. So it is with decisions in political, economic, cultural, and social arenas—the decisions are taken in a distributed fashion among overlapping communities, where contending views are expressed through ideologies, in a continuing debate on the degree to which they should be de-centralized or centralized.¹⁰ Humans everywhere preserve the initial endowment of common genetic archive and common social archive. Its persistence is reinforced by migration, enabling both the gene pool and the social archive to be widely exchanged among all human communities.¹¹ Together, these archives provide a platform for further social evolution. Even today, with superpowers and international organizations, we are far from having a unique “decider” to answer all the big questions.

Dilemmas and Subsystems, 30,000 BP – 6,000 BP

I return now to the narrative, describing the unfolding of human history in terms of the emergence of new sectors performing key functions in certain subsystems. Beginning 30,000 years ago, the nascent human system had to deal with wild fluctuations in temperature, humidity, and sea level: these climatic jolts continued for a full 20,000 years. Environments shifted everywhere. Massive fluctuations, both year-to-year and over the centuries, brought insecurity to every living thing. Glaciers advanced from the Arctic, covering most of Europe, much of North America, and expanding in mountains everywhere. Humid areas became dry and dry areas became desert; huge storms criss-crossed land and sea. Every species moved toward the equatorial zone and lower altitudes, with chaotic struggles for new habitat and needed resources.

Then, from the low point of the glacial maximum, the fluctuations turned in an upward direction. From 20,000 years ago the temperature and humidity rose slowly and then careened their way upward (but with a major reversal from 13,000 to 12,000 years ago). Plant and animal species moved from their concentration in equatorial zones, colonizing lands at higher altitudes and higher latitudes, though with reverses. Humans too expanded. Most likely, because of their improving technology and knowledge of the land, they expanded at the expense of other species, as by diverting watercourses or as with Australian burning of terrains to concentrate the animals to be hunted. Meanwhile, megafauna became extinct in several parts of the world at the time of the temperature reversal.

Rather remarkably, the period of climatic crisis from 30,000 to 10,000 years ago was also a period of extraordinary innovation in human society. More than a shift from foraging to agriculture or from Paleolithic to Neolithic tools, this era may be called “the era of production” because it was in this time that societies supplemented their ancestral reliance on foraging, hunting and fishing with production of many sorts. Accompanying the technical innovations were surely crises in leadership, attention to the heavens in an effort to predict the weather, and efforts to understand the activities of spirits governing the unknown.

In systemic terms, the expansion of all these new productive activities added new *sectors* to the *production* subsystem. For instance, early pottery industries arose in the Jomon pottery of Japan and pottery of the Nile Valley. Construction of housing arose as a sector: the era of the glacial maximum is when many human communities moved from living in light shelters to construction of homes, constructed out of wood, stone, bamboo, mud, and skins. The development of agriculture based on wheat and rice has been recounted many times – each of these became another sector of production, with its own dynamics. Domestication of animals brought new sectors for chickens and for ruminants.

The *ingest* subsystem had to expand to incorporate all of the raw materials brought into agricultural and artisanal production: the capture of water for their crops through cisterns and aqueducts, obtaining fibers for weaving. The *distribution* subsystem had to expand to accommodate growing exchange of commodities among communities. In the same processes, permanent communities consolidated: villages and towns brought new problems in leadership and in disposal of waste. Semitic-speaking migrants, from the upper Nile Valley, settled in the Levant and the Arabian peninsula; Indo-European-speakers, with eastern Eurasian ancestry, expanded west from Anatolia: these were *boundary* and *supporter* subsystems expanding with early Holocene migrations.

Then—suddenly and seemingly for good—temperature and humidity stabilized about 8,000 years ago. Temperature, humidity, and sea level stabilized to a degree that had not taken place for millions of years, remaining roughly stable from this point of the Holocene era until the present. Humans had to adjust to this change like all the others, but their adjustments provided the basis

for millennia of expansion in human population and society. This stabilization occurred at the most fortuitous time for humans – in early stages of the agricultural age. Communities could now plan, within tolerable limits, for the changes in seasons, the rains, the availability of grazing lands, the availability of fish, and all the elements of their increasingly complex style of life. Under these circumstances, agricultural society was able to spread and innovate to a degree that might not otherwise have been possible, so that agriculture, herding, and fishing had become the dominant bases of human food production by the middle of the Holocene era. This shift to stability in climate could have been considered as a gift from the gods.

During the early millennia of climate stability (from 8,000 to 6000 years ago), changes in the human system included the implementation of new productive sectors, such as the system of ox-drawn plows for wheat and barley farming, the development of paddy rice, the expansion of maize production, and expansion in farming yams. Towns arose, most famously Catalhöyük, which thrived in Anatolia from 9400 to 8200 years ago. One recurring question about this era is whether the rise of agriculture resulted in creation of a gendered division of labor that put women in a permanently subordinate position. I suspect that, rather than a one-size-fits-all demotion of women to subordinate status in agricultural societies, there were numerous experiments and negotiated results in designing division of labor for the numerous tasks of agriculture and their interplay with other economic activities.

In the long period from 30,000 to 6000 years ago, human society developed numerous new sectors of production, so that foraging became subordinated to production of human resources. The rise of production brought the creation of numerous artisanal specializations. While social hierarchies had expanded in certain areas of life and in certain communities, to a large degree humans managed to keep differentiation within an overall framework of social equality. Human communities developed in roughly parallel fashion in widely separated parts of the planet—with differences among agricultural, pastoral, fishing, and foraging economies—all of them in contact with neighbors. Can one argue that there was a single human system in times when there was no direct contact between distant regions—for instance, between Mesopotamia and New Guinea? Were the indirect ties, mediated over centuries of migration and exchange, sufficient to sustain the human system of earlier times?

Diverging Scales of Social Order, 4000 BCE – 1700 CE¹²

The late Holocene era maintained the climatic stability of the preceding millennia. Sea levels varied up and down by roughly one meter, as compared to the hundred meters of change from the Glacial Maximum to 8,000 years ago. Still, climate change remained influential in this era. The Sahara was again desert by 4000 BCE. Later climate shifts included a cooling period from 1200 BCE to 1000 BCE; the Medieval Warm Period 900 – 1300 CE; and Little Ice Age in the sixteenth and seventeenth centuries CE. Overall, however, the continuing climatic stability of the Holocene would enable human society to continue on its trajectory of expansion and innovation.

The technical and social innovations in human societies, after accelerating in the late Pleistocene, continued to unfold into the Holocene. With time, however, these increasingly complex societies faced choices between two basic paths: whether to embrace the expansion of hierarchy or to continue in limiting hierarchy. In each case the analyst may ask, when did a top-down social dynamic begin, in which efforts to create inequality became organized? And when did bottom-up social dynamic begin, in which those who were deprived in one way or another began to press for revision of the rules of society? To restate the question: how would societies govern their greater complexity? Would it be possible to maintain the cohesion and egalitarian relations that had

characterized earlier societies? On one side, the priority was to reorganize society in hierarchical terms, with clear identification of leadership and command. On the other side, time and again, societies chose to limit the expansion of hierarchy, governing the rise in social complexity with enhanced structures for shared decision-making.¹³ (A third answer was given by a smaller group of societies that maintained old-style egalitarianism: they fit into broader humanity as specialized hunters and foragers.)

Many of the basic decisions seem to have been set during the second millennium BCE. In what I will call the “Old World core”—the region from the Mediterranean to North India, also including the Yellow River Valley—societies opted principally for hierarchical social systems. The details, of course, are more complex. The Harappan society of the Indus valley and the Minoan society of Crete developed major urban societies with minimal hierarchy, though both of these disappeared by roughly 1300 BCE. The hinterlands of the civilizational centers—and perhaps the subaltern strata within the urban centers—may have preferred an egalitarian model but were caught up in the dominance of the great centers.

The latter Holocene era was highlighted by the rise of hierarchical civilizations in Egypt, Mesopotamia, the Yellow River valley, and in Mesoamerica. In deference to the written calendars created in these communities—with beginning dates ranging from 6000 to 4000 years ago—my narrative switches calendars at this point.¹⁴ The sectors of hierarchical civilization included monarchy, bureaucracy, religion celebrating the monarch, taxation of production, and administrative distribution of food, and monumental construction that commonly celebrated the state more than the community. Bronze metallurgy arose by 2900 BCE: relying on alloys of copper and tin, it sustained many technical advances. Writing systems, if created often, would seem to have survived only if nurtured by an elite literate class. Full writing systems arose in the form of Uruk’s cuneiform by 3300 BCE, in Egypt’s hieroglyphics by 2500 BCE, and in Chinese characters by 1200 BCE. These were the innovations of hierarchical civilization.

In other parts of the world, technical and social accomplishments expanded, though without such growth of social hierarchy. Construction in wood, stone, brick, and adobe expanded as towns grew. Watercraft developed with the addition of sails in the Mediterranean, the Indian Ocean, and the Pacific. Public works of various sorts arose, as communities worked together for water management, mining, building protective walls, and constructing ceremonial sites. The steady mastering of fire brought production of ceramics to almost every region. Iron metallurgy emerged among artisans in Anatolia in roughly 1200 BCE, and shortly thereafter among artisans in India, in Vietnam, in three regions of Africa, and elsewhere. Iron, being more widely available than other metals, enabled metal use to expand not only in urban civilizations but in rural centers all across the Old World.

This same era brought great migrations of agricultural peoples, moving into both densely and lightly populated regions. From 4000 to 3000 BCE, rice-growing Austronesian-speaking migrants, having sailed in their outrigger canoes from the Chinese mainland to Taiwan, moved south to the Philippines and then settled both to the east and the west in the Indonesian archipelago. At much the same time, Bantu-speaking migrants, beginning at the frontier of today’s Nigeria and Cameroon, began pushing their settlements to the south and east. Maize, fully developed by Mesoamerican cultivators by 4000 BCE, had spread to North and South America by 3000 BCE. Meanwhile, in northern Eurasia, speakers of Yukhagir languages moved from the Arctic shores of eastern Siberia, settling all the way west to the zone now known as Finland.

Two interesting cases show that the innovations in hierarchical and non-hierarchical societies could interact in surprising fashion. In both these cases, crucial developments in intermediate-

level technology arose outside the centers of hierarchy, yet enabled hierarchical societies to expand all the more. First was the rise of writing systems among Semitic-speaking peoples. These systems, fully developed by 1400 BCE, may have been inspired by Egyptian hieroglyphic writing, but proto-Canaanite was quite different, relying on an *abjad* of just over 20 letters, each corresponding to the sound of a consonant. This workable system, usable by commoners, spread west with Phoenician language, providing the model for Greek and Latin scripts, and spread east with Aramaic, providing the model for the scripts of South, Central, and Southeast Asia. Second was the development of horse-drawn chariots with spoke wheels. These chariots, developed by the Central Asian peoples who had domesticated horses, sustained a culture of heroic warfare in their homeland for some time; eventually the war chariots ventured south to challenge the large states. In the era from 2000 to 1600 BCE, chariot warfare led to the conquest of Anatolia, Mesopotamia, and Egypt. Indo-European neighbors of the Altaic-speaking inventors used chariots in their contemporaneous conquest of Iran and North India; China adopted chariots in about 1200 BCE. Chariot warfare brought changes on the battlefield and facilitated seizure and enslavement of exposed populations. Slavery, which already existed in West Asia, the Mediterranean, and South Asia, expanded and gained a more permanent place in the society of this great region. Horses, meanwhile, joined lions as symbols of state power.

In the Old World core, states erected numerous physical walls. The Great Wall of China and its preceding smaller walls were famous, however, in not really forming a dependable boundary between those on one side and the other. Still, wall-building continued in an effort to impose new categories on society. In addition, numerous metaphorical walls were created as well. They separated slaves, inferior castes, and certain ethnic groups as inherently different from those with privilege. In terms of human-system logic, the creation of physical and metaphorical walls took the form of extending the *supporter* subsystem, which structured the relations and divisions among sectors, in part to control the resources going to each. More broadly, the proliferation of walls revealed the increasing attention of communities to subdividing humanity into discrete and mutually exclusive categories. Thus, the physical labor that went into building the Great Wall gives a hint as to the social effort devoted to creating the metaphorical wall separating slaves from free people. In effect, this reasoning exaggerated the differences among groups and minimized the variations within groups. These metaphorical walls—defining codes of dress and codes of obeisance—came to play an important role in the elaboration of sectors that were intended to perform specific tasks within the human social system.

With such walls, sectors of *production* or *networking* could be created through rationalization, with a claim that this categorization created a social benefit when in reality it suited only the private need of some interest group. Sectors could be created based on the needs of general social welfare, or on practical self-interest. Self-interest can be rationalized through ideological statements—principled and coherent but not necessarily valid views of society and its categories. Not uncommonly, religious justification was given to social categorization—in effect, making the argument that these divisions, constructed through human agency and sustained by social institutions, had their origin in nature and in the wishes of supernatural powers. At worst, the human creation of such sectors allowed cruel and pointless subjugation. If children, women, or people of a particular ancestry could be categorized in this way, they were open to ruthless treatment. On the other hand, gender relations, while often portrayed as fixed by law and tradition, must surely have varied according to the power of those on both sides of the gender divide, and because of the common interests shared by both male and female.

By the mid-first millennium BCE, the Old World core had reached new heights of achievement, bringing three important new *sectors* to large-scale society: commerce, empire, and large-scale religion. As populations and levels of production rose in the Old World core, the long-standing

systems of exchange came to be supplemented by commerce—that is, by trade relying on money, banking, marketplaces, ports, caravans, and resting spots. Coins were first created in roughly 600 BCE, and their use spread rapidly. The expansion in commerce spread commodities more widely, but it also created fortunes among merchants, reinforcing inequality and jealousy. As commerce spread, so did empires. The Achaemenid empire arose in 550 BCE, incorporating pre-existing states of Persia, Mesopotamia, and the Levant, and setting up larger-scale administrative coordination. In three centuries came Alexander’s conquest of the Achaemenids, and soon thereafter arose the Mauryan empire in India, the Qin empire in China, and the empire of Rome in the Mediterranean. Iron weapons were available to all of these conquerors, and horses led charges as a cavalry rather than with chariots.

The two new sectors of commerce and empire seem to have required a third sector: large-scale religion. The strains of commerce and empire, wealth and hierarchy, brought anxiety and unhappiness to many. In response, the era from the sixth century BCE to the seventh century CE brought the flowering of several important new religious traditions. Indeed, the empires and most of their capital cities were rather ephemeral, while several of the new religious traditions became permanent features of human society. Jainism, Buddhism, Mithraism, Christianity, Manichaeism, Islam, and other religions asked believers to consider all as the human community. These religions began not just as belief systems but also as social movements. An outstanding example of the influence of religion is the case of Asoka, ruler of the Mauryan empire, who experienced a deep change of heart after leading in the bloody conquest of the kingdom of Kalinga in 261 BCE. He became a devout Buddhist and supported the expansion of Buddhism throughout his realm.

Each major religion had its initial key insight in spiritual and ethical understanding. But as religions encountered each other and competed for converts, they tended to adopt each other’s institutional forms and interpretive styles—for instance, mysticism. In addition, as religions became associated with states, they came to adopt hierarchical values, while still not giving up their initial message of salvation. It is remarkable that religion outside of the literate zones of empires did not take the form of crusading visions of universal salvation. It may be that, in the areas beyond the empires, the questions of hierarchy and oppression were not posed in such forceful terms.

In the first millennium CE—after the decline of Rome, Han, and Mauryan states—the contrasts in hierarchy between the Old World core and other parts of the world declined. In part, practices of hierarchical societies spread to new areas; in part, the practices of egalitarian societies developed to more elaborated levels. Hinduism and Buddhism each spread into Southeast Asia as universal religions; Islam spread further into Africa and into northern Eurasia. Maritime activity expanded in the western Indian Ocean; then Sri Vijaya rose in the eighth century to become a Buddhist-oriented nexus of commerce from its base in Sumatra, linking south China and the Bay of Bengal. Austronesian mariners sailed the Pacific and across the Indian Ocean. Viking mariners sailed the North Atlantic, the Mediterranean, and across riverine Europe all the way to the Caspian. Major states developed in Japan, Korea, and Europe, great alliances of Turkish clans arose periodically in the steppes, kingdoms arose in the African savanna, the eastern coast of Africa, and the American highlands; a system of writing arose among the Maya. While the Islamic world and the Song state were the great powers of the world as of 1000 CE, Vikings led a major attack on Ottoman Constantinople and the Song state lost lands to the northern Liao and Jin states.

This expansion of states and commerce is usually interpreted as the diffusion of hierarchical, civilizational ideas from the core to adjoining regions. In contrast, it could be argued that regions outside the core had evolved hierarchies on their own. One way to distinguish the hypotheses is in the relative specificity of institutional forms: if the practices of Vikings, Sri Vijaya and Turks

closely matched those of Mesopotamia, we have a clear case for diffusion; if the practices were substantially different, we have a case for local agency and development.

The years from 1200 to 1700 CE brought a calamitous global unification to human society, resulting from the compounded transformations of late Holocene societies worldwide. Regions were brought into tight connection, magnifying both the similarities and differences among them. This era of global crisis followed the warming trend of 900 to 1300 CE, which had brought good crop yields and growing population to regions all over the world. But the same trend enabled the rise of the Mongol Empire, which dominated over half of Eurasia from soon after 1200 to roughly the 1380s. The Mongols crushed Song China, eliminated the Abbasid Caliphate, reordered Eurasian politics and war for centuries to come—and expanded Eurasian trade ties on land and sea. Yet the Mongol regime was weakened by a disaster in health that spread beyond Mongol frontiers, as the Black Plague raged across Eurasia and into Africa in the mid-fourteenth century, causing devastating loss in population, best documented in Europe. Plague recurred thereafter, and temperatures fell steadily until the Little Ice Age of the seventeenth century.

On land, successor states sought to replicate the Mongol regime: the Romanovs and Ottomans came closest to success. By sea, maritime connections expanded throughout the Old World in the fifteenth century—and in the sixteenth century, European mariners came to dominate the Atlantic and span the Pacific. The “Columbian Exchange” brought the transfer of many sorts of biota between the Americas and the Old World, and brought a disastrous decline in American populations from 1550 to 1650. Systems of colonial slavery expanded in the Americas and in Asia; African populations met limits and eventually declined because of the destructiveness of slave trade. Great fortunes were won and lost in developing an expanded commercial system that linked all areas of the world. Silver, from the highlands of the Andes and Mexico, facilitated the expansion of commerce and war on all continents. The total human population may well have declined in the period from 1350 to 1650: European regions declined and may have rebounded in that time period; other regions of the world are less likely to have rebounded by 1650.

The great religious controversies of the sixteenth and seventeenth centuries can be seen as responses to this restructuring of the world. The wars and evangelization campaigns of Protestants and Catholics focused on empire and commerce, but also on accommodating to the larger size and more complex past of the world as now understood. The contemporaneous great battles of Shia and Sunni, especially in Iran, and the struggles within Buddhism responded to the same tensions and global shifts. By roughly 1700, the reverberations of global interaction had become less severe for most regions, though Africa and the Americas still suffered. Systems of commerce, politics, and belief had accommodated to the new linkages. Even the Little Ice Age came to an end. The stage was set for the human system to begin an unprecedented era of expansion.

Human Nature: Can it Change? 1700 to the present

During the past three centuries – “the modern era,” as one says—the human system has grown in many ways, contrasting sharply with the crisis and stagnation of the preceding centuries. Modern growth accelerated along many axes: in trade, population, communication, knowledge of the world, and more. Such growth, however, brought with it three great challenges. First was the concomitant growth in human inequality, for instance in the expansion of enslavement to a peak in the late nineteenth century or the divergence in wealth continuing to the present. Second was the developing ideological contest between the defenders of hierarchy, on one side, and the proponents of an egalitarian social order, on the other. Third was the confrontation, reaching

crisis levels in the late twentieth century, with the ecological limits on the expansion of human society.

Growth and crisis in human society have elicited a concern about “human nature,” the apparently inherent patterns of human behavior. There is fear that a biologically-frozen human nature might render futile any effort to reform society, thus frustrating any efforts to limit war, inequality, and environmental destruction. In contrast, I see “human nature” as a summation of the behaviors generated in all of the social sectors constructed over the millennia. While behavior within each sector is generated by the specifics of its processes—on the assembly line, on the farm, or in a hospital—all of them, having been constructed, might therefore be regulated or reorganized. By this logic, human nature is in recurring and accelerating change. The question, then, is: what governs the overall balance of human behavior? Might a conscious social consensus seek to reform that balance?

I conclude by exploring the potential for successful human policy through some examples of recent social change. Modern-era growth has gone well beyond what economic indicators can show: the number enslaved grew to the seemingly impossible figure of some 50 million in the late nineteenth century, despite the course of slave emancipation during the whole century. The number of industrial wage workers grew to an even larger peak in the mid-twentieth century and then ceased growing. Human population more than doubled from 1700 to 1900, and then grew by a factor of four before 2000, in response to improved health care and nutrition. Even more rapidly, populations shifted from rural to urban areas, passing 50% urban shortly after 2000.

Ideological debate—the public discussion of social priorities—grew along with the era’s expansion in commerce, empires, wars, and migration. While ideological discourse had long been influential at local levels and among the powerful, the expansion of literacy and communication media drew more people on every continent into public debate. The revolutions of the United States, France, Haiti, and Spanish America sharpened the class, national, and racial dimensions of ideology. Concurrently an economic “Great Divergence” propelled Western Europe and North America ahead of other regions in wealth and levels of production. New types of physical power—steam, electric, and petrochemical—generated industrial output; wastes of all sorts flowed into the earth’s environment. European notions of “race” and “civilization,” as expressed in popular writings, suggested that differences of these factors could be distinguished in a clear hierarchy with Europeans at the top and Africans at the bottom.

World War I was a clash over global leadership among recently constituted national polities. The victors were the United States, Britain, and France; the Soviet Union and Japan also gained in power. After the war, a constellation of ideologies and social groups struggled for global leadership: contending liberals and conservatives; the proletarian ideology of communist parties, the negotiating stance of socialists; and a dictatorial ideology. The notion of dictatorship, in which small elites governed through an industrial economy, gained dominance in a few industrial countries but was also imposed through colonialism on nearly half of the world’s population.

The ancient choice between social hierarchy and equality thus reappeared—now on a fully global stage but with some new dimensions. Popular culture arose to articulate innovative support for egalitarian outlooks. What had been local folklore, subordinated to elite culture, grew to become an immense cultural industry, lionizing “celebrities” and connecting cultural expression by millions around the world, in which many consumers can decide what media and what artist to enjoy. Further, the natural sciences accelerated the scale of their knowledge, broadening professional training and skill in science, engineering, and medicine; even the social sciences, though confused by ideological debate, developed important new knowledge.

To rephrase these changes in systemic terms, the human system added sectors in which these developments took place: new sectors of the productive subsystem for each new source of power; new sectors of the distribution sector with the rise of the gold standard; new sectors in the *decoder* and *associator* with the rise of scientific research and universities; new sectors in the *encoder* for global popular culture; new sectors of the social division of labor with the hardening of racial and civilizational boundaries. Some of these new sectors brought genuine advances in productivity; others rationalized the seizure of lands and the biasing of prices. In strategic systems terms, the competing ideologies can be seen as attempts to revise the *decider* function for humanity—rather than leave decisions to be distributed among communities, the ideologies proposed various ideas for centralizing humanity’s decisions: in nations, political parties, or empires. World War II can be seen as a fight to the death among major ideologies, followed by a postwar recognition of the fragility of human society.

The key benefit of human-system analysis is that it distinguishes *subsystems* (the inherent elements of a living system) from the constructed *sectors* within those subsystems—which generate specific and appropriate behavior for each sector. Thus the overall problem of human nature and behavior must be broken down into sector-specific behavior. Just as the sectors are constructed historically and can be deconstructed, the behaviors are constructed and can be deconstructed. Human-system analysis argues that we have the power to change ourselves and to meet the challenges we face.

To return to the narrative: the generation after World War II provided three decades of life with a greater degree of economic equality, worldwide, than in the previous two centuries. This was also a time of substantial social welfare programs, the dismantling of empires, and rapid economic growth to rebuild after wartime destruction. The United Nations and its organisms took form, along with other international organizations: such international organizations had the potential to broaden decision-making by including more national units, but could also narrow decision-making by establishing elite-based bureaucracies. Yet in the postwar era as in other times, growth remained the one objective on which virtually all ideologies agreed. The experience of growth, accelerated in recent experience, brought an appetite for more—growth in the social order came to be seen as “human nature.” Nevertheless, the expanding human order ran headlong into its disruption of the global environment, especially in rapid warming and in destruction of many species. This great systemic dilemma could not be easily resolved, because the ideology of growth had become deeply engrained.

From the 1970s, inequalities grew rapidly. An energetic ideological movement arose—a restated campaign for unregulated economic growth that came to be known as Neoliberalism. It eclectically linked interests of the wealthy, corporate opposition to regulation, innovations in financial systems, banking interests, and electronic networks. Its influence was felt in Structural Adjustment programs restricting public expenditures in ex-colonies, privatization in Chile, deregulation in wealthy countries, then in new and risky financial instruments. Neoliberals claimed their financial sector to be the center of economic growth and social advance, arguing that the incentives to amass profit in financial instruments reflected fundamental human behavior. Their approach precipitated the worldwide 2008-9 financial panic and demanded that financial institutions avoid paying the costs of the panic. Neoliberalism appeared able to veto the emerging consensus for human equality and remained unconcerned about the environmental crisis.

What future should humanity seek in responding to the crises of environmental destruction and human inequality? For the environment, is it feasible to renounce the addiction to growth? In this essay I have sought to demonstrate that humans have the agency to develop a policy—whether

such a policy could succeed is a separate and difficult question. To offer a brief response, I call for an effort to achieve a *near-steady state*. In such a policy, humanity would draw a relatively constant amount of resources from the earth, thus permitting other spheres to renew themselves. If human innovation were engaged effectively enough, it might be possible to use those limited earthly resources more efficiently, so that individual humans and the human system could experience more broadly the quality of life. The objective of this sort of steady state, combined with active application of innovations to improve social efficiencies, might show humanity a way to maintain and advance its level of living without destroying the planet on which we live. The objective would be to identify and deselect, from the human archive, the preference for growth and the preference for inequality.

If we admit that humanity is in trouble, do we agree on why it is in trouble? No—at least not yet. Understanding recent global growth entails a classic debate in agency vs. structure. It could be the task of large-scale social science to investigate this issue. If it could be shown that advancing health and expanded production were the achievements of elite imperial leaders, we would have our answer: human agency has caused our problems. On the other hand, if the growth of trade, population, and nationhood could be shown to result from the long-term and structural results of gradual linkage among global regions, we would have a different answer: structure of the human system has caused our problems. If it is the case that long-term structure rather than short-term agency has done the most to bring humanity to this dilemma, we are in even more trouble. Is it perhaps some of each? Since agency and policy are weak tools with which to correct the momentum of accelerating system growth, policy would need to be used in the most expert of fashions to slow or re-channel the momentum.

If it is the case that devotion to growth, greed, and inequality are localized and recently learned patterns rather than basic and inescapable human instincts, there is the possibility of rethinking and redirecting those energies. That is why it is important to distinguish biological evolution and social evolution as sources of human behavior. Thus, the voracious behavior that now dominates financial markets may not be the inherent behavior of all humans but, rather, the result of local incentives within the specific systemic sector of high finance. As for whether “human nature” can change, it can be shown that it is already changing. The creation of systemic sectors of human life, each with its specific dynamics, has generated behavior patterns specific to each sector. Social patterns have been reinforced over centuries and millennia, but much of the structure of society is new. This reasoning does not tell us what to do to change human society and “human nature.” But it does tell us that they are changeable, and tells us to look for changes that appear to fit human needs.

NOTES

¹ For an insightful overview of this issue, see James Burke and Robert Ornstein, *The Axemaker's Gift: A Double-Edged History of Human Culture* (New York: G. P. Putnam's Sons, 1995).

² Temperature and sea level rose from the trough at 70,000 years ago until 60,000 years ago, then underwent a long, slow temperature decline until 30,000 years ago, when temperatures began declining rapidly.

³ Ehret, *Cambridge World History*, Vol. 1.

⁴ Study of the genome of body lice, associated with clothing, showed that the lice species originated at least 83,000 years ago, in Africa. The African origin suggests that clothing was initially worn for display rather

than for warmth. Melissa A. Toups, Andrew Kitchen, Jessica E. Light, and David L. Reed, “Origin of Clothing Lice Indicates Early Clothing Use by Anatomically Modern Humans in Africa,” *Molecular Biology and Evolution* 28 (2011):29-32.

⁵ For instance, “The System of the World” (Isaac Newton, vol. 2 of *Principia Mathematica*) and *Systema Naturae* (Linnaeus, 1732).

⁶ Ludwig Von Bertalanffy, *General System Theory: Foundations, development, applications* (New York: G. Braziller, 1969); James G. Miller, *Living Systems* (New York: McGraw-Hill, 1978); Stanley Wasserman, *Social Network Analysis: Methods and Applications*. (Cambridge University Press, 1994); Linton Freeman, *The Development of Social Network Analysis: A Study in the Sociology of Science*. (Empirical Press, 2004); John H. Miller and Scott E. Page, *Complex Adaptive Systems: An Introduction to Computational Models of Social Life* (Princeton: Princeton University Press, 2007); Peter J. Richerson and Robert Boyd, *Not by Genes Alone: How Culture Transformed Human Evolution* (Chicago: University of Chicago Press, 2005); Richerson and Boyd, eds., *Cultural Evolution: Society, Technology, Language, and Religion* (Cambridge, MA: MIT Press, 2013).

⁷ Further works in history and historical sociology have advanced the systemic conceptualization of history: Immanuel Wallerstein, *The Modern World-System*, vol. 1 (New York: Academic Press, 1974); J. R. McNeill and William H. McNeill, *The Human Web: A bird’s-eye view of human history* (New York: Norton, 2003); and David Christian, *Maps of Time: An Introduction to Big History* (Berkeley: University of California Press, 2003).

⁸ Miller correctly emphasizes the parallels among all living systems, especially in their short-term functioning. But in a choice that I find surprising, he did not distinguish between the long-term mechanism of change—that is, DNA-based biological evolution for cells, organs, organisms and animal groups, in contrast to the social evolution of human communities, societies, and humanity overall. In another surprising omission, his functional approach gives virtually no attention to conflict or disease in biological species or to war in humanity. If these deficiencies could be corrected, Miller’s work would have wider relevance.

⁹ Innovation can also be seen as creativity in big or small new ideas, whether they are ultimately positive or negative in their effects.

¹⁰ Subsystems are too often misunderstood as coherent and neatly bounded—a common error in categorization: common errors in discourse exaggerating uniformity within groups and difference between groups.

¹¹ Patrick Manning, Cross-Community Migration: A Distinctive Human Pattern,” *Social Evolution in History* 5 (2006), 24-54.

¹² The late Holocene era was highlighted by the rise of hierarchical civilizations in Egypt, Mesopotamia, the Yellow River valley, and in Mesoamerica. In deference to the written calendars created in these communities—with beginning dates ranging from 6000 to 4000 years ago—my narrative switches calendars at this point.

¹³ Flannery and Marcus, *The Creation of Inequality*, 183.

¹⁴ The Gregorian calendar—not the most accurate but the most widely used—is the current representation of precise calendars developed by careful observers of heavenly bodies, and it denotes the last 6000 years as a time in which human communities had gained a new level of ability to observe the natural world and to preserve and pass on those observations. (The period from 4000 BCE to 1700 CE in the revised Gregorian calendar corresponds roughly to the period from 6000 years ago to 300 years ago in the “before present” calendar used informally in scientific discourse.)