The Trajectory of Human History

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Citation | Christian, D. (2023) The Trajectory of Human History.
Journal of Big History, VI(3); 94–108.
DOI | https://doi.org/10.22339/jbh.v6i3.6308

Keywords: World history, big history, human history, future, historiography, species histories.

Abstract: Is it possible to identify a clear shape or trajectory to human history as a whole and what significance or meaning could we attach to such a trajectory? The argument here is that modern historical research within many different disciplines does indeed allow us to identify some striking shapes to the history of our species. It includes that those shapes are full of meaning for understanding the nature and significance of our strange species. Finally, it ends with some speculative ideas about how human history may evolve in the distant future in an attempt to see if we can perhaps glimpse what human history will look like when the human story has ended.

1. Preface

The late Johan Goudsblom thought about sociology on a grand scale and over vast periods of time. This paper is written in a similar spirit by a historian who admired and learned much from Goudsblom's scholarship over many years. As a professional historian, one of the big questions that always nagged at me was this: in what ways is my discipline significant? Is there meaning in history? Does it tell us something about existence? Or about what it means to be human?

Of course, there is meaning in history: meaning of many different kinds. Why else would most universities and schools in today's world have history departments? History contains so many exemplars of behaviours, social trends, and divergent historical outcomes. And so much food for thought about the rich and complex story of our strange species.

But here I have in mind a different type of meaning that historians explore much less often. That sort of meaning resides not in the details but in the overall shape or trajectory of human history when it is seen as the history of a species. What can human history as a whole tell us about our own species, Homo sapiens? In asking these questions, I have in mind the sort of meaning we find when we view a landscape, not from ground level, but from a plane flying at 40,000 feet. From that height you can see shapes that are invisible from close up. A similar sort of meaning can be found in the biographies of people, including ourselves. I have spent much of the last year with a grand-daughter in the first year of her life. Sophia's life already has a shape, but her life as a whole will have a shape that cannot yet be discerned. It is just starting. I, on the other hand, am nearer to the end than to the beginning of my life, so when I look back over my life, I can see a shape and a trajectory. They give a sort of meaning to my life by tracing the journey it has taken me on, with its many twists and turns. Can we identify analogous shapes in the history of humanity? And what can they tell us about the strange species of which we are all members? Such questions are becoming increasingly salient in an era in which the 8 billion members of our species are becoming so intermeshed so fast that we are turning into a single, globally interdependent community.

Similar questions also interested Johan Goudsblom, though he might have phrased them differently. He spent a lot of time thinking about long-term change in human history. Like me, Goudsblom was convinced that there is a lot to be learned by studying very large-scale processes. Indeed, that is why he introduced a big history course at Amsterdam, similar to the courses I taught for many years at Macquarie University in Sydney.[1] Both courses explored long-term historical processes from the largest possible scales, those of the Universe as a whole.

Today, curiously, few historians are interested in questions of meaning at these very large scales, so the questions I am asking are not part of the conceptual repertoire of most historians. The dominant role of disciplines and sub-disciplines in modern scholarship, each with its own well-policed borders, means that most historians stick to slices of human history and avoid discussing, learning about,

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or thinking about human history as a whole, let alone the histories of other species (they leave that to biologists) or of planet Earth (the domain of geologists) or the Universe (the domain of astronomers and cosmologists). Even most world historians focus on recent centuries, as a brief survey of the contents pages of most world history journals will show. Careers and reputations are made within the institutional structures of disciplines and sub-disciplines, and it is risky to stray far beyond those borders. Resistance to large-scale, multi-disciplinary accounts of the past also reflects the fact that, in retrospect, so many earlier attempts to see the shape of human history look contrived, self-interested, and self-serving. As Stephen Mennell (1996, 3) writes,

Sociologists and historians have long been haunted by the ghosts of Herbert Spencer and other Victorian social evolutionists who, in attempting to put their own society and its recent transformation in the perspective of the history of humanity as a whole, actually succeeded only in putting the whole history of humanity in the perspective of their own society.

Today, though, we should be able to describe the overall trajectory of human history with more evidence and more scientific objectivity than in the past because since 1900, our understanding of the past has expanded hugely "both in space and in time," as Goudsblom (1996, 15-7) writes. There has been a vast amount of new research in many different historical disciplines, from cosmology and astronomy to geology and genetics, from palaeontology to anthropology and history. We also live in a more interconnected world in which the idea that world history is European history – an idea that once dominated large scale approaches to the past – now looks bizarre. And, though the ghost of Eurocentrism still hovers over much historical writing today, fields such as world history now make it possible, in principle, to write histories that try to make sense of human societies from all parts of the world. Finally, since the 1950s, new ways of dating past events give modern historical writing for the first time a stable chronometric framework reaching over vast spans of time (Christian 2009).

This multi-disciplinary boom in historical research now allows us to see the history of humanity as one part of a much larger historical story – as that of a distinct, and very strange biological species. That is the approach I will adopt here.

I will ask two main questions about the trajectory of human history. First, can we identify a clear trajectory or shape to human history? That question explains why all the illustrations in this paper have shapes. They take the form of graphs of real or imagined changes at large scales. My second question is this: what meanings do these shapes hint at for the history of our strange species? I will end with some highly speculative ideas about how human history may evolve in the future, and how it may end, because at present we can see just the early parts of the trajectory of human history.

2. The Shape of Human History So Far

Can we identify a clear shape or trajectory to human history so far, a pattern that might hint at the larger significance and perhaps even the deeper meaning of human history?

The idea of a shape to human history is not new. Many ancient traditions have imagined such shapes. Different historiographical traditions have conceived of those shapes in different ways. Some have portrayed stable, largely unchanging pasts. Some have seen history as a story of cyclical rises and falls, or a story of slow decline from a primordial Golden Age. Since the Enlightenment, it has become increasingly common to see history as a long ascent, a story of progress leading to a better future. Finally, many traditions have seen history as a story, either tragic or triumphant, written by the gods but with a limited role for human volition. What trajectories are suggested by the best historical knowledge available today?

To answer that question, we must begin by asking when human history begins and identifying some of the most important changes since then. We need a notional starting point and some clear ideas about the most important changes up to the present day.

Despite vast increases in the available evidence about human evolution, there is as yet no consensus about precisely when human history really begins. That is partly because it is difficult to pin down exactly what we mean when we talk of "human beings" or even "Homo sapiens." Goudsblom (1992) argued for an early starting point to human history, more than half a million years ago, even before human-like creatures first learnt how to control fire. Most scholars would argue for a more recent starting point within the last few hundred thousand years, and some argue that "fully modern" humans, creatures essentially the same as you and me, evolved within the last 70,000 years.[2]

Like all biological species, we evolved within a particular

niche, probably in the savanna lands of southern and eastern Africa. But, unlike all other species, we now exploit environments across the entire planet and have even begun to create entirely artificial environments, from ploughed fields to modern cities. The result is that we have transformed much of the surface of planet Earth and altered the historical trajectories of millions of other species of plants and animals. In fact, in an era that many now describe as the "Anthropocene Epoch," we have become the first species in the Earth's history to dominate change on planetary scales.[3] Quite suddenly, it has become apparent that we are a planet-changing species. Though we remain learner-drivers, with uncertain skills, we are beginning to manage the fate of an entire planet. That is extraordinary enough to mark a new phase not just of human history, but of planetary history. Something quite exceptional happened in the course of human history.

Drawing a line between the earliest human societies and those of today suggests a clear large shape or pattern to many aspects of human history. That shape takes the form not of a straight line, but of a long accelerating growth curve. At local scales and short time scales there are, of course, plenty of fluctuations and reversals, rises and falls, but here it is the larger, rising trends that interest us. Though details vary, we find the same long, slowly accelerating curves if we study growth in human populations, changes in human consumption of planetary resources and energy, the increasing ecological and technological knowledge and power of our species, and human impacts on landscapes, the oceans, and the atmosphere and on other species. In

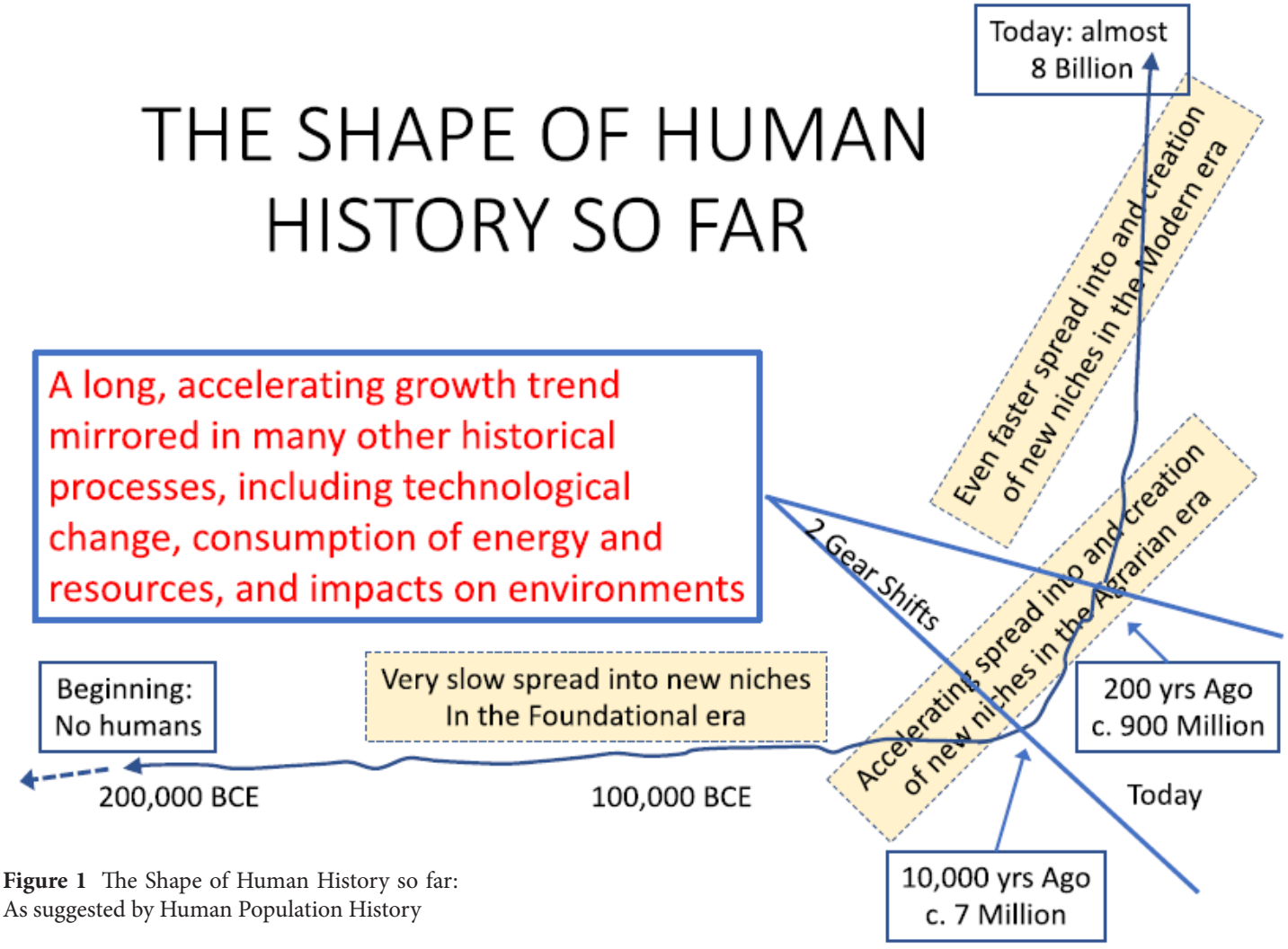


Figure 1 The Shape of Human History so far: As suggested by Human Population History

many domains of human history, the curve has two main inflection points at which the pace of change accelerated sharply. One, dating from about ten thousand years ago, is linked to the emergence of agricultural technologies. The second, dating to just the last few centuries, is associated with the emergence of today's modern, globally connected world, powered by fossil fuel energy. I will use graphs of human population growth and energy consumption to illustrate this shape, but I could also illustrate it from many other long trends. The two graphs that follow both indicate our species' increasing and accelerating control over planetary resources.

The long-term demographic history of our species illustrates this trajectory more clearly than any other long trend.

Whenever we date the beginnings of human history, we can be sure human populations were small when our species first evolved. And, despite a slow expansion in the human range, they remained small for most of human

history during what I like to call the "Foundational Era," the time period before the advent of agriculture. There is some evidence that, as late as 70,000 years ago, the number of humans on Earth may have fallen to perhaps just a few tens of thousands, perhaps as a result of the massive volcanic eruption of Mount Toba in Indonesia. But then, as group after group learned new ways of exploiting surrounding environments, humans began to spread around the world into an increasing variety of niches, and we can be sure that that meant a slow increase in the number of humans on Earth. From 60,000 years ago, and perhaps earlier, humans, a species that had evolved in Africa and Eurasia, entered for the first time the southern continent of Sahul (modern Papua New Guinea and Australia), and perhaps 20,000 years ago, they entered the Americas. Ten thousand years ago, at the end of the Foundational Era, there were perhaps six or seven million humans on Earth (Livi-Bacci 1992, 28-32). They could be found all the way from southern Africa to Siberia, throughout the Americas from Alaska to Tierra del Fuego, and also in what is today Australia. In the new lands they entered, our ancestors soon began to transform the local flora and fauna. This is particularly clear in regions such as Sahul, Siberia, Australia, and North America where their immigration into new regions of the planet coincided with a wave of extinctions of other large species from giant kangaroos to mastodon. By 20,000 years ago, the strangeness of our species' historical trajectory was already manifest.

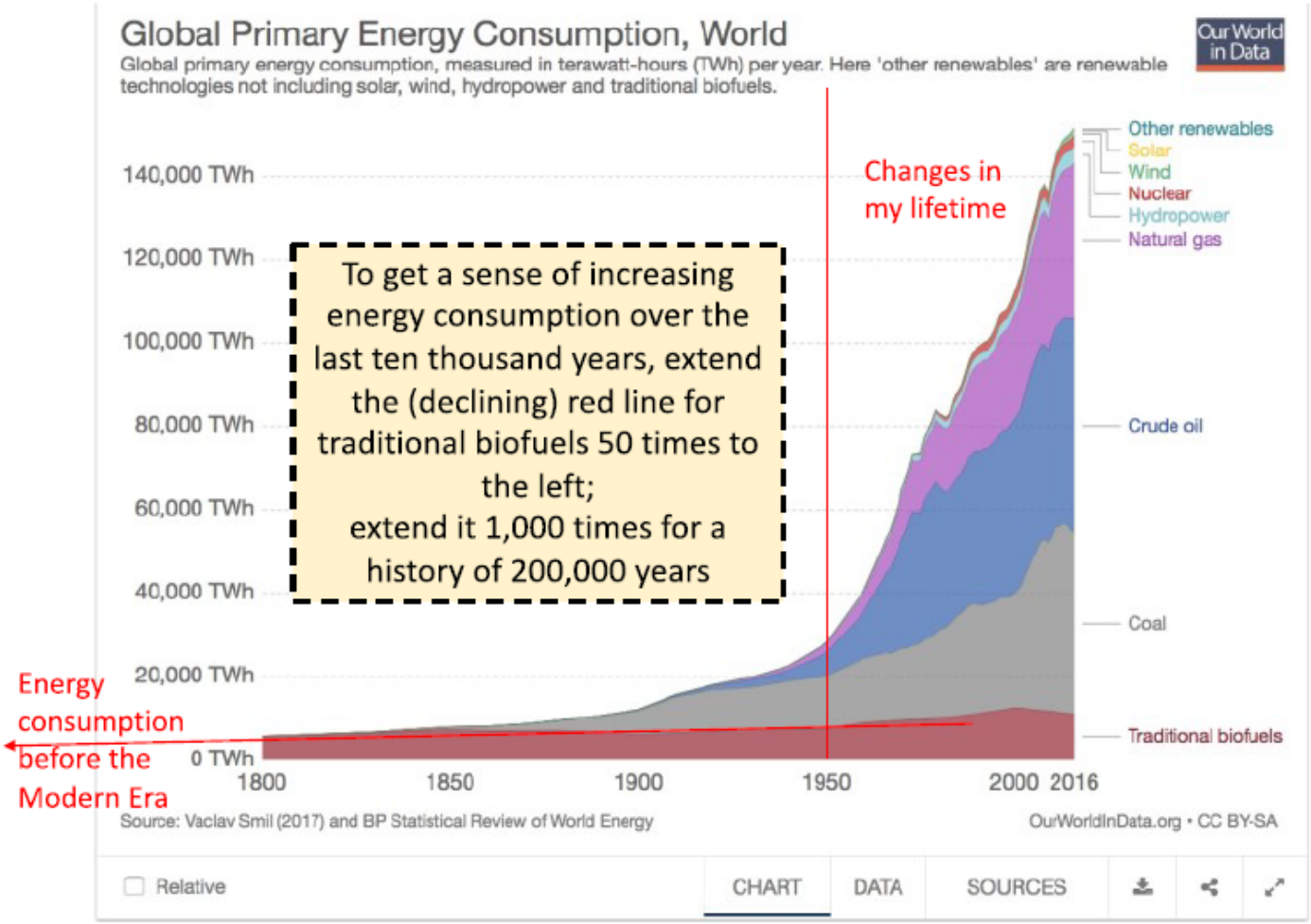
For most of the Foundational Era – by far the longest era of human history – growth of all kinds was very slow by today's standards, so slow as to be imperceptible at the scale of a human lifetime. That is why it is so easy to think, falsely, that the Foundational Era was an era of stasis. No. At scales of thousands of years – the time scales that interest paleontologists and evolutionary biologists – the spread of humans into more and more different environments was a remarkable change, even if those migrations seem glacially slow when compared to the hectic pace of modern history.

The Agrarian Era begins after the end of the last ice age, from about 11,000 years ago, with the introduction of a cluster of powerful new technologies that we commonly describe as "agriculture." These new technologies required increasing manipulation of surrounding environments, but greatly enhanced human control over landscapes (through deforestation and activities such as hoeing, ploughing, or irrigation) and species (through domestication). Increased control over surrounding resources made it possible to produce more of the food and other products humans want and need, and that drove population growth, which allowed more humans to farm more land. Feedback cycles such as this explain why the long curves of human history tend to accelerate at large scales.

If we take 200,000 BCE as the start of human history, the Agrarian Era counts for less than one-twentieth of human history. But agriculture marks a gear-shift in the pace of change because farmers could produce so much more food from a given area than foragers. That is why human populations grew faster than ever before, from perhaps seven million at the end of the last ice age to about nine hundred million by 1800 CE, at an average growth rate of almost 1.5 percent per annum. As transport and communications technologies improved, human societies also became more interconnected so that by 1500, most communities were networked on continental scales. That meant that both goods and ideas were being exchanged over larger and larger areas by more and more people. By 1800, those links were global.

As human numbers increased, so did human consumption of the planet's energy and resources. But what is striking is that production of food, energy, and resources grew even faster than populations, though until recent times only a small minority of humans benefited from growing surpluses. Graphs of energy consumption show the same, slowly accelerating growth trajectory that we have seen in graphs of human populations. In the ten thousand or so

Figure 2 Increasing Energy Consumption



years before 1800 CE, total human consumption of energy increased from approximately fifteen million gigajoules per year to more than twenty thousand million gigajoules per year, while energy consumption per person rose by more than seven times, from about three gigajoules per year to about twenty-three.[4]

In the two centuries or so of the Modern Era – about one-thousandth of the time since 200,000 BCE – increases in populations and energy consumption and in many other measures of human history have been even more spectacular. The most remarkable transformations have occurred since 1800. Technological and scientific innovation soared as cheap energy from fossil fuels drove cascades of experimentation; new transport and communication technologies from steamships to trains and airliners, from the telegraph to the telephone and internet, brought more and more people within a single global network of intellectual and economic exchanges; and change occurred faster than ever before. In just 220 years, between 1800 and 2020, the number of humans on Earth multiplied by almost nine times, rising from about nine hundred million to almost eight thousand million.[5] That is an average growth rate of about 3.6 percent per annum, or more than twice the rate during the Agrarian Era. Remarkably, most people are well-fed, thanks to an increase in the amount of land being irrigated and farmed, and to technological innovations such as genetic engineering and the manufacture of artificial fertilizers that have increased food production fast enough to keep up with soaring populations. Rising productivity in other areas made it possible (in principle) to house, clothe,

and equip increasing numbers of people to higher standards than ever before. Total human consumption of energy increased by about twenty-five times, from just over twenty thousand million gigajoules per year to roughly five hundred thousand million gigajoules. Energy use per person tripled, rising from almost twenty-five gigajoules per year to about seventy-five. There is one more remarkable statistic: the span of human lives increased. For most of human history, average life expectancy was below thirty years, though by 1800 more food and better healthcare had raised it to about thirty-five years. Between 1800 and 2020 the expected life span of each baby born on Earth doubled to seventy years.

3. Making Sense of the Shape of Human History

How we assess these sustained and accelerating "growth" trajectories? We should resist the temptation to call this "progress." It is important to try to describe this shape without letting normative judgements warp our thinking. As the wars being fought today in different parts of the planet remind us, our growing powers as a species can destroy as well as create. And, as Goudsblom (1996, 24-6) pointed out, they can also create new forms of dependency, above all growing dependency on the technologies and social institutions that have given us such astonishing power over planetary resources and other species. We may have escaped the dependency on particular niches that constrain the possibilities for all other species, but a world of 8 billion people cannot possibly survive without the technological and social structures of modernity. As a recent (and controversial) survey of human history by Graeber and Wengrow (2021) concludes, the trajectory of human history can easily be seen as a story of human self-enslavement as humans have created new forms of dependence:

> Jean-Jacques Rousseau left us a story about the origins of social inequality that continues to be told and retold, in endless variations, to this day. It is the story of humanity's original innocence, and unwitting departure from a state of pristine simplicity on a voyage of technological discovery that would ultimately guarantee both our "complexity" and our enslavement. (Graeber and Wengrow 2021, 27)

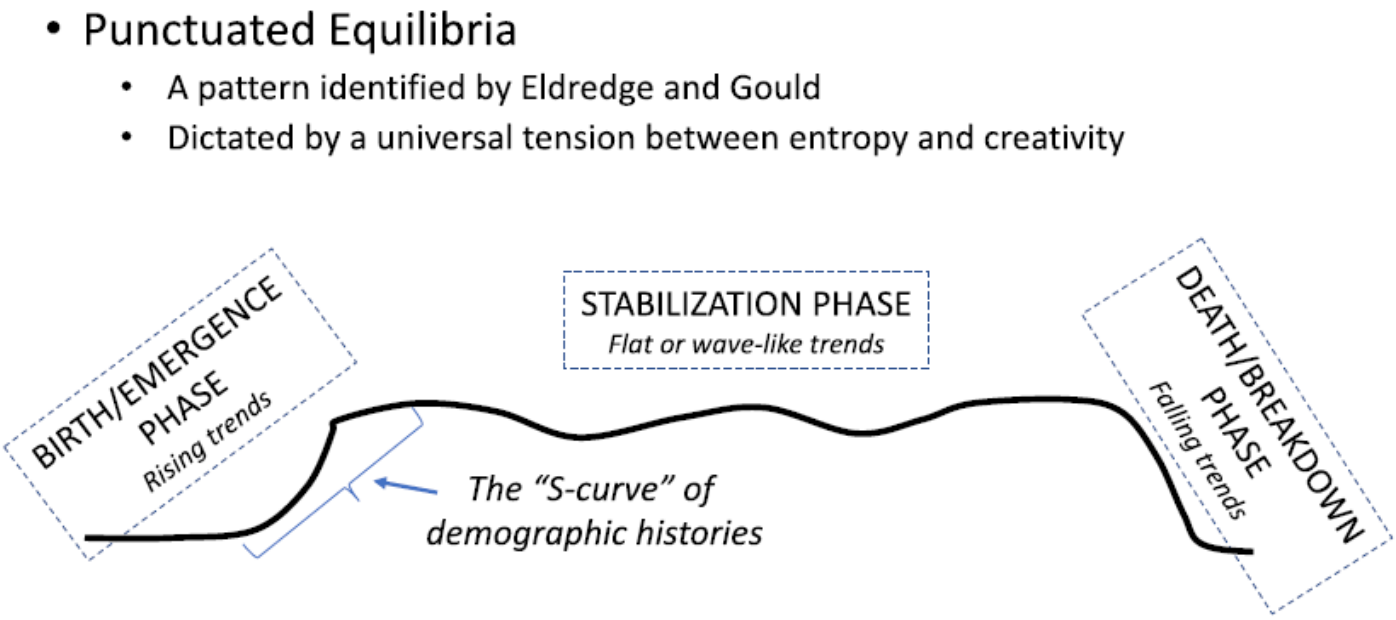
We can see the distinctiveness of our species' historical trajectory most clearly if we compare it to the historical trajectories of other species. New species can flourish when small changes give them some slight advantage within a particular environment or "niche." Koalas, for example, are specialist eaters of the leaves of particular species of trees. That is their niche. The niche both empowers and limits the new species. It creates opportunities but also new forms of dependency on a particular niche. When a new species appears, its numbers and range can increase until members of the new species, now divided into multiple local populations, have spread to wherever they can find the niche they are best at exploiting. Once a niche is fully exploited, populations stop growing and stabilize, and the new species reaches a sort of demographic plateau that may be interrupted by minor, sometimes by major fluctuations, caused by climatic or ecological change, diseases, or other natural disasters. These processes give rise to the familiar S-shaped curve at the start of the population histories of new species. Eventually, though, towards the end of the species' history, the curves will reverse and the species will go extinct because its niche vanishes, or new and more successful competitors evolve and squeeze it out, or the species itself evolves. Those processes create a chronological shape a bit like a table-mountain, with a rise, a phase of stabilization, and an eventual fall.

This trajectory, it turns out, can be found well beyond the realm of biology.

We find it in the histories of many (perhaps all) complex entities. This became apparent to me through my work on big history, which explores the past at multiple scales from those of human history to those of geology and even cosmology. At all these scales you see a similar shape, as complex entities emerge, then stabilize for a period, then vanish. All their histories conform to a standard template or shape that is universal, though the details and scales vary over many orders of magnitude. Stars may last billions of year; species for millennia or even millions of years; while individual organisms can survive for as little as a few hours and as long as a few centuries. And each stage of the template can vary, often in unexpected ways. It is in these variations that we can find a sort of meaning and significance that differs for each type of complex entity.

This template trajectory for the histories of complex entities is similar in its shape to the pattern that Niles Eldredge and Stephen Jay Gould (1972, 84) called "punctuated equilibria." "The history of evolution," they wrote, "is not one of stately unfolding, but a story of homeostatic equilibria, disturbed only 'rarely' (i.e. rather often in the fullness of time) by rapid and episodic events of speciation." All complex entities seem

Figure 3 A Standard Template for the Historical Trajectories of Complex Things



to live through the three stages we have seen in the histories of biological species: birth, stabilization, and death. In the emergence stage you see growth in population numbers and range, in energy consumption, and in impacts on surroundings. There follows a stage of relative stabilization and equilibrium, as the new entity matures and takes its place within its local eco-system. This stage is never completely stable, and a lot may change during this phase. There may even be eras of rapid change, near collapse, and sudden new growth as well as long phases of slow evolutionary change. But the middle phase is generally less abrupt than the first and third stages. Finally, there is one more punctuation, or period of rapid change during a third era of breakdown, collapse, and death. Our Sun emerged over hundreds of millions of years; its stable period will last for about 9 billion years; and it will collapse and die over several hundred million years. The history of biological species has a similar shape though a different scale, because very few species remain unchanged for more than a few million years.

4. Explaining the Distinctive Shape of Human History

How does the historical trajectory of our own species, Homo sapiens, compare to this universal template?

It actually looks very different, because so many of the trends in populations, technological power, use of resources, and so on in the human historical arc lie on exceptionally long rising trends. Of course, that is probably because we are seeing just part of a larger trajectory. Indeed, it makes sense to say that human history so far consists of a prolonged emergence phase.

Still, the trajectory is odd because for most other biological species the emergence phase does not last that long or take so many twists and turns. All organisms display some ecological creativity as they try to survive in their niches, but human history displays an entirely new level of sustained creativity. Instead of exploring a new niche and settling comfortably into it, our species has explored a steadily increasing number of different niches before eventually beginning to transform its environments, thus creating new niches that had never existed before.

Such a prolonged emergence phase is off the charts. We know of no other species in the four-billion-year history of life on Earth that has shown such sustained creativity or transformed environments so profoundly.[6] Groups of organisms, such as the first oxygen-using bacteria, show immense creativity because each species explores its own specialist niche, and together they can explore many niches and sometimes transform them. And they have left plenty of evidence of their collective creativity for modern palaeontologists to study. But a single species exploring millions of niches is something new in biological history.

Human history offers a paradigm example of Hegel's "quantity turning into quality." We have become "dragon-kings" in the lovely metaphor of Didier Sornette (2009): known creatures that have suddenly started behaving in fabulous new ways. What we see is not just one emergence or birth phase, but a series of new starts, so the whole of human history looks like an extended, step-like phase of multiple "emergences."

How can we explain this remarkable historical trajectory? If we can explain it, we can perhaps get closer to defining what makes humans different, so this is a fundamental question about human history and the species to which we belong.

Here is the explanation I find most plausible, and it is one that overlaps with many other attempts to explain the strange historical path of our species. All species nibble experimentally at the edges of their niches, but with limited success. In contrast, our species has moved well beyond each niche it has occupied, until eventually it has started reshaping its surroundings to create entirely new niches. So, what we need to explain is our species' remarkable technological and scientific creativity, our ability to learn more and more about our environments so that we can manage and manipulate our surroundings with increasing power. Behind the sustained growth trends that give shape to human history, and driving them all, is the most fundamental of all trends in human history: a steady increase in our knowledge of our surroundings, which allowed our ancestors to control more resources, more energy, more niches and, by doing so, to support increasing populations. Our "ecological power" or control over our surroundings has increased, following the same accelerating pathway as so many other trends in human history. And that has eventually given us control over much of planet Earth.

What explains this extraordinary scientific and technological creativity? I have argued for many years that the driver of this species-defining creativity is what I call "collective learning": our unique ability to share information with such precision and in such volume that information and ideas accumulate faster than they are lost, so that the total amount of information available to human communities tends to increase across generations. The idea of collective learning overlaps with ideas such as "cultural evolution" that other scholars have used to explain our exceptional technological creativity, and it may be that these differences in terminology are not that significant. For example, Alex Mesoudi (2011, 203), a specialist in cultural evolution, describes the accumulation of knowledge over many generations as "the defining characteristic of human culture." Note that our creativity is collective rather than individual – more an aspect of human groups than of human individuals – because new insights, even if they are contributed by individuals, acquire significance only when shared and stored within the collective memory of many humans linked through exchanges of information.

If this argument is on track, it means that collective learning is a defining

feature – perhaps the defining feature – of our species. It is what makes us so different. It explains our odd historical trajectory and why we have become a force for change on planetary scales.

It is important to discriminate between what I call "collective learning" and other types of learning, because many different species are capable of learning from others. Learning is a cultural attribute, so we are talking about collective rather than individual learning. Culture depends on the sharing of learned knowledge between many individuals. Such sharing, and some level of "culture," can be found in many intelligent species that have languages and can share information and ideas. Populations of chimps, for example, have different ways of hunting or cracking nuts.[7] But humans are unique in sharing information so precisely and on such a scale that collective stores of knowledge grow and evolve across generations. We know of no other species that can exchange information so precisely and in such volume that, in the long run, collective gains in knowledge begin to outweigh losses. Only in our own species do we have clear evidence for the long-term accumulation of information across many generations. That is the phenomenon I describe as "collective learning," not the more tenuous and evanescent forms of learnt knowledge that we find in some other cultural species. Something like a threshold was crossed by the first humans, a small change that made a colossal difference. The difference is, in the Hegelian language, quantitative, but it is also large enough to create an entirely new phenomenon, as "quantity turns into quality." The crossing of this threshold in our ability to share information explains why our species has become increasingly powerful, and at an accelerating rate, as more and more ideas have accumulated and been exchanged by millions of individuals and communities within expanding networks of collective learning over many millennia, giving humans increasing power over the

landscapes and organisms all around us.[8]

Collective learning and cultural evolution were made possible by the evolution of human language, an exceptionally powerful medium of communication. Human language connects humans within what linguist Steven Pinker (2007, 115) calls "an information-sharing network with formidable collective powers." We do not fully understand how human language evolved, though there are many promising hypotheses. It is surely no accident that it emerged within a highly social species whose members had powerful reasons for wanting to communicate with other members of their communities.[9] No wonder all social species, including birds, whales, and primates, have some form of language. But human language is exceptionally powerful. With more space in their frontal cortex, humans had the neurological room for exceptionally large stores of names, words, and concepts, and also for the grammatical workbenches and lathes on which words and concepts can be turned into elaborate stories about real and hypothetical worlds (Roth 2013, 260).

Whatever its origins, human language led our species across a fundamental threshold opening up possibilities that had existed for no earlier species on Earth. Human language allowed each human individual to dip into and contribute to the vast and growing pool of knowledge accumulated from generation to generation in all human communities. Shared stores of well-tested knowledge gave humans exceptional and increasing power over their surroundings and over other species of animals and plants. That is why, whereas Goudsblom argued that learning how to master fire was the critical turning point in early human history, I will argue that control of fire was enabled by an early, and perhaps rudimentary, form of collective learning. It was merely one of the earliest products of that trans-generational intellectual creativity made possible by collective learning.

Collective learning also helps explain the slow acceleration we see in so many of the larger trends in human history. For most of human history, knowledge accumulated very slowly within tens of thousands of small communities. Though some information was exchanged between neighboring groups, sometimes over large distances, it was local knowledge that mattered most, which is why the societies of the Foundational Era were extremely diverse and technological knowledge diffused slowly by modern standards. Knowledge accumulated at local scales. And that helps explain why the larger process of accumulation was largely invisible to contemporaries. What stood out in the lives of individuals were cyclical patterns – the rise and fall of individual families or communities or empires.

But looking back from today, armed with much more knowledge of the past, it is easier to see the long trends of accumulation and the way they have accelerated, particularly in recent human history. Trends of collective learning accelerated because collective learning generated positive feedback loops as innovations encouraged other innovations. Thus, improved communications, whether through the domestication of horses or improvements in sailing ships or in modern innovations such as the telegraph and internet all increased the scale and speed at which humans could share and store information within networks of exchange that now span the entire planet. These feedback loops accelerated many forms of historical change until they became increasingly hard to ignore within recent centuries. "In the past," wrote the philosopher Alfred North Whitehead (1933, 93, in a chapter on "foresight"), "the time-span of important change was considerably longer than that of a single human life. Thus, mankind was trained to adapt itself to fixed conditions. Today this time-span is considerably shorter than that of human life, and accordingly our training must prepare individuals to face a novelty of conditions."

5. Where Is It All Going? Speculations about the Final Shape of Human History

So far, we have seen just part of the larger arc of human history. This is like seeing the biography of a child, which is why the trajectories we have seen so far look like an unusually extended "emergence" phase. Can we take the next step and speculate about what it is that is emerging and what shape human history will have assumed when, eventually, the whole story can be told? I have just completed a book on the future, so such questions are very much on my mind and I will not resist the temptation to speculate (Christian 2022).

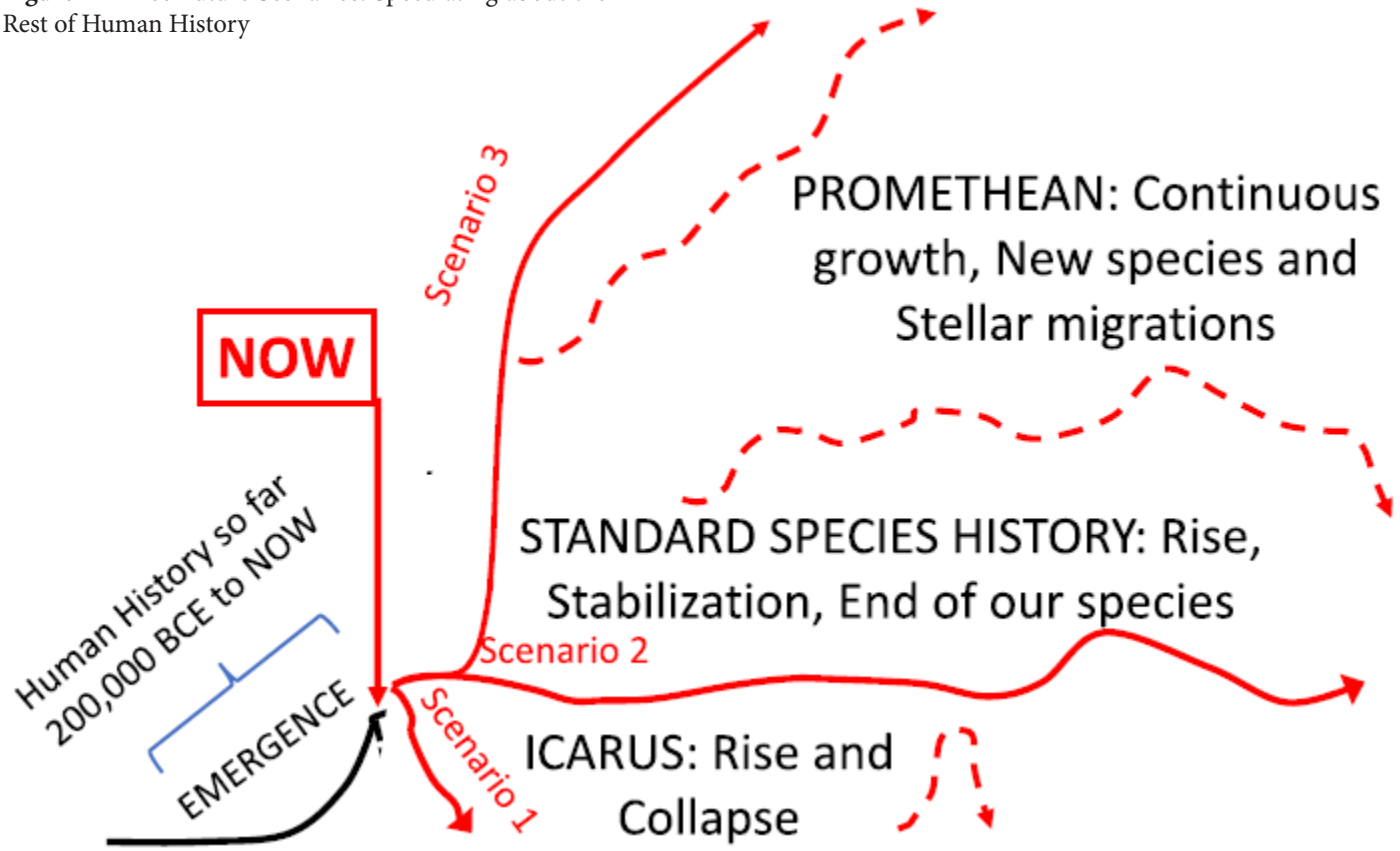
Historians generally avoid questions about the future. Indeed, the historiographer, R.G. Collingwood once thundered (1994, 54) that "The historian's business is to know the past not to know the future; and whenever historians claim to be able to determine the future in advance of its happening, we may know with certainty that something has gone wrong with their fundamental

conception of history." I disagree. I will argue that careful speculation about possible futures is an important form of heuristic for historians because it can suggest new ways of thinking about and assessing the past, those parts of human history that we can see from the present moment. Speculating about possible futures is particularly helpful as we try to identify a shape or trajectory to human history and to tease out possible meanings from that trajectory. Above all, it is worth asking what the trajectory of human history may look like when that history has ended, so that we (or some imaginary future historian of another species) can imagine the whole trajectory as, today, we can describe the evolutionary history of extinct species such as the Dodo or Tyrannosaurus rex.

Such speculations are, of course, not evidence-based in the way that our

discussions of the past are evidence-based. We have no documents from the future, as Collingwood pointed out (1994, 120). So, the discussion that follows is much more speculative than the preceding sections of this paper. That is in the very nature of all types of future thinking. Nevertheless, we can never avoid trying to think seriously about likely futures, and past trends do give us some hints about the type of stories that may be told about our species when our collective story is over. Indeed, studying the more regular trends in the past is the foundation of all serious efforts at forecasting, whether in meteorology, the study of long-term change, or economics. And that means that thinking speculatively about the future has great historiographic significance because it may hint at the long-term significance of trends and tendencies of which we can only see the early phases. For these reasons, the final part of this paper will consider a number of possible future scenarios for human history and ask what sort of meanings might lurk within these different stories. I will explore three broad types of future scenarios for human history. They are based loosely on four scenarios familiar within the world of Futures Studies, and pioneered by the futurist, Jim Dator

Figure 4 Three Future Scenarios: Speculating about the Rest of Human History



(2019, "The Four Generic Futures," chap. 5, pt. 4). Though described here as distinct scenarios for the sake of clarity, the real future will surely blend elements from each of these scenarios to create futures as complex and contradictory as the past that is visible to us today.

All three scenarios make two fundamental assumptions. First, they assume the importance of collective learning as a defining feature of our species, one of the oldest and most persistent of trends in human history. They assume, in other words, that humans will keep finding out more about their environments and finding new ways of managing and making use of those environments. That implies that humans will always have a dynamic and changeable relationship with their surroundings. Second, all these scenarios assume that human history so far consists of a prolonged and unusually extended "emergence" phase. And that raises the profound question: what is emerging? What has human history so far been leading to?

5.1 Scenario 1: Collapse: The Icarus Scenario

The first scenario assumes that we humans are near to the end of the emergence phase of our history and may be entering a phase of rapid reversal and collapse driven by collective learning, by a creativity that generates dangerous technologies that we fail to control. Nuclear weapons are an example of the sort of forces I have in mind. But engineered or uncontrollable pandemics or a failure to come to grips with climate change could also lead to the destruction of much of our species and much of our environment. Under this scenario, if something new was emerging in human history, it will be still- born. We will crash, like Icarus, whose wax wings melted as he flew too close to the Sun.

What stands out in this scenario is the instability and dynamism of human history that could deny our species a prolonged stabilization phase. We may be entering a period of extreme vulnerability, a dangerous bottleneck in human history. In a careful recent study of existential dangers to our species, Toby Ord (2020, 167) puts the likelihood of a profound collapse over the next century at about 1 in 6. Of course, we should not take such estimates too seriously, but they do offer food for thought. Under most of Ord's scenarios, collapse is self-inflicted, the product of our over-reaching technological creativity. That makes collective learning both the most distinctive feature of our species and its fatal flaw. Some scholars in the SETI community have speculated that any species as creative as ours, wherever it may appear in the Universe, is likely eventually to build technologies so dangerous and uncontrollable that they will lead to destruction and collapse. That idea might help explain why we have failed so far to make contact with any other technologically creative species; none survived long enough to make contact.

A collapse scenario would mean that we are now close to the end of human history. It would mean that the trajectory of human history consists of a long emergence phase, followed almost immediately by a sudden collapse, with no significant phase of stabilization in the middle. However, it is also possible to envisage a collapse that is not total. That would be similar in shape, though much larger in scale, to the local or regional collapses that have already been seen many times in human history, such as the collapse of the Roman and Han empires early in the 1st millennium CE. Scenarios like that could eventually morph into our second or third future scenarios.

5.2 Scenario 2: Stabilization and Sustainability

Our second scenario also assumes that we may be near the end of an unusually prolonged emergence phase. But under this scenario, humans will enter a stabilization phase in which many (but not all) of the growth trends of the past will slow or be checked. This scenario looks like the standard trajectory for complex entities as they reach maturity. Many trends today already hint at the start of a slow-down in some of the most important growth trends of the past. This is most evident in the slowing of global population growth since the 1960s. In addition, there is a growing realization that some recent growth curves, such as in the emission of greenhouse gases must be slowed and perhaps even halted.

Under this second scenario, many of the growth trends of the past will slow because we have reached "planetary limits." But the scenario also presumes that humans will have learnt how to live within planetary limits, and how to collaborate on global scales. Innovation and even growth of many kinds will continue under such scenarios, and there will be no slowing of our technological creativity as we search for more sustainable technologies and ways of coping with or even repairing the damage we have already done to the biosphere and more effective ways of collaborating at global scales. But we will learn to avoid those forms of growth that pose intolerable burdens on the global ecosystem and endanger the future of humanity.

Under this scenario, we will eventually identify what it is that has been emerging in the course of human history, because the stabilization phase will mark the arrival of something new: a conscious planet. It will become apparent that human history so far has been building up to the emergence of an entirely new type of complex entity: an entire planet whose future will be shaped by the conscious collective decisions of a single species. That will mark a new phase in the 4.5-billion-year history of planet Earth. Our planet will have become conscious in the same way that our bodies are conscious; while most decisions about the day-to-day operations of the planet will continue to be taken as in the past by local processes – geological, biological, climatological, and even astronomical – the very large executive decisions about planetary futures will now be taken after conscious collective decisions by groups of humans. What we do not know is whether our planet will be the first conscious planet in the history of the Universe, or whether, perhaps, many other conscious planets exist that we have not yet detected. Either way, the emergence of a conscious planet will make human history significant on galactic scales.

Though this scenario envisages a sort of "stabilization" phase to human history, there are good reasons for thinking that the stabilization phase will not last long, no longer than a few centuries or perhaps a millennium or two. That is because, even under this scenario, we may be near the end of our history as a single species. Collective learning is already generating technologies that allow us to modify humans genetically and mechanically, and because these changes will be largely under human control, our species will begin to diversify much faster than it might have under the ancient rules of natural selection. We already know how to change our DNA and we already deploy diverse prosthetics and implants (Kaku 2018, Ch. 11). So, this scenario may be pointing towards the end of "human history" in the strict sense, as our species evolves and diversifies through conscious decisions rather than natural selection, into a range of artificially engineered "post humans." Human history conceived as the history of a single species will end as we start to engineer our own "trans-human" replacements, which will have their own history and their own, distinctive historical trajectories. They may be organisms quite like ourselves, or even very clever machines, or a complex intertwining of humans and machines. Human history will end through a sort of transcendence as we transform ourselves, deliberately and consciously, into new species.

5.3 Scenario 3: Sustained Growth and Migration Beyond Earth: Promethean Scenarios

Our third, Promethean scenario, builds on the second scenario and looks like an extension of it. Under Promethean scenarios, there will be a short stabilization phase lasting a few centuries or at most a few millennia. This will be followed by a new phase of innovation and growth that takes our human and post-human ancestors beyond planet Earth and beyond today's understandings of what it means to be human.

The first reason for taking such a scenario seriously is that we have no reason to think that the restless process of collective learning will stop. Though planetary limits will surely check many forms of growth for centuries, human science and technology will push against those limits, looking for new ways of generating energy (fusion, perhaps) and for ways of migrating beyond planet Earth. Humans have already travelled to the moon and human-made robots have already explored much of our solar system. So, the idea of humans slowly colonizing other parts of the solar system is no fantasy. Eventually, but many centuries in the future, such processes may lead to the colonization of other star systems or the building of artificial worlds. Such migrations will end the bottleneck phase of human history in which we occupy only one planetary habitat whose destruction would entail the end of human history. Instead, humans and post-humans will overflow planet Earth and begin spreading through nearby parts of our galaxy. Such a scenario would continue the sustained migrations into new environments, powered by collective learning, that have shaped much of human history (Finney 1992). This scenario also envisages the emergent "conscious planet" of the previous scenario undergoing a sort of replication, as humans and post-humans travel to and begin to manage other worlds. Indeed, this, it seems, is how conscious planets will reproduce and spread through many different niches on galactic scales.

This third scenario looks like science fiction, of course, but there are good reasons for taking it seriously. If we interpret the word "human" loosely, to include many post-human lineages whose activities are powered by increasingly dynamic forms of collective learning, then human history could be just beginning. The history of our lineage could last at least as long as its past and possibly for millions of years. Could humans still be around in 200,000 years, presumably scattered over several star systems as in the space operas of

science fiction such as Isaac Asimov's Foundation series? If so, human history will turn out to be of interest and significance not just on a single planet, but on galactic scales. The "human" future will take the form of slow migrations to nearby parts of the galaxy, combined with a diversification of lifeways and even of biologies on different planets and around different star systems. If this is indeed the shape of our future histories, then we will eventually have to see human history so far as just the emergence phase of brand new entities and processes that will prove significant at cosmological scales. This is perhaps the strangest scenario we can imagine for the history of our species.

The real future will surely be messier than these neat scenarios suggest; it will be a mashup of many different scenarios. There will be regional collapses, but they may not prove fatal and may be followed by periods of stabilization and further growth and, eventually, by a slow and stuttering colonization of other worlds, accompanied by mechanical and biological diversification of our species over thousands, perhaps millions of years.

6. Meanings: What do these Speculations Suggest about the Meaning of Human History?

In the concluding part of this paper, I try to tease out four types of meaning implicit in the preceding discussion.

6.1 What Makes Us Distinctive?

Even without speculating about possible futures, the human history that we can see today shows that our species has a unique creative dynamism, based on collective learning. And that dynamism has lent planetary significance to human history as we observe it now. We are different from other species, and the trajectory of human history is different from theirs. Tiny differences in our species have turned us into something entirely new, into "dragon-kings." And that means that we live at a turning point in planetary history and perhaps in the history of our part of the galaxy. Our speculative future scenarios remind us that the creativity of our species could prove a curse, or it could drive a very long history that will take our descendants far beyond planet Earth, a history of which today's historians have seen merely the earliest, emergent stages.

6.2 The Dangers We Face

These scenarios also highlight the dangers that could arise from our astonishing creativity, dangers that are particularly threatening at the present bottle-neck moment in human history. There is a real possibility of collapse in coming centuries. But our creativity is such that we should be optimistic about the chances of collectively finding pathways through the dangers we are facing.

6.4 What Human History Has Been Building Towards

In the more optimistic of these scenarios, human history is leading to the emergence of phenomena that are entirely new on planetary scales and perhaps significant on galactic scales. Human history so far has been pregnant with a new type of complex entity: a conscious planet. And if we add to this story the likelihood of human migrations beyond planet Earth, then we can envisage futures in which the human trajectory on Earth may be repeated on nearby planets and even nearby star-systems. Under this scenario, the trajectory of human history will have galactic significance.

6.5 The End of Human History: When and How?

But there are also reasonable grounds for speculating that, except in extreme collapse scenarios, the end of human history will arise as a result of collective learning applied to our own genomes and bodies, as new technologies start generating new sub-species of humans, many of them genetically, biologically, or even mechanically enhanced. In that sense, the trajectory of human history will end with the evolution of new species whose histories will follow trajectories similar to but perhaps even more dynamic and spectacular than those of Homo sapiens.

I hope the ideas explored in this essay can justify my claim that thinking carefully about the overall shape of human history is worth doing despite the speculative nature of much of the exercise. Asking the sort of questions I have asked can suggest new ways of thinking about meanings and forms of significance that lurk within human history and within our strange species. They should surely be of interest to all scholars in the humanities.

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Endnotes

1. On big history, introductions include Christian (2018), and Benjamin, Quaedackers, and Baker (2020); see also the website of the "International Big History Association" at https://bighis- tory.org/ (Accessed March 14, 2023).

2. For recent discussions of our species' origins, see Ehret (2015); Hiscock (2015); and Gamble (2019). Gamble and Ehret argue for sustained demographic and technological change beginning about 60,000 years ago; but there are scholars who see good evidence for important technological innovation and accumulation as early as 200,000 BCE, including McBrearty and Brooks (2000).

3. Zalasiewicz and Waters (2015); for an overview of the Anthropocene as a phase of world history, see Christian (2019).

4. Based on Smil (2015), as summarized in Christian (2018, 312).

5. Data in this paragraph from Our World in Data website (https://ourworldindata.org/ [Accessed March 14, 2023]) and from Christian (2018, 312), which draws largely on Smil (2015).

6. What the evidence for such a species might look like is explored well in Zalasiewicz (2009).

7. See Safina (2020) for insight into the richness of the cultures of brainy mammals and birds.

8. For a very fine history of human technology which sees it not as a series of great inventions, but rather as the slow accumulation of tiny changes and insights made by millions of individuals, see Arthur (2009).

9. The role of cooperation is stressed in work by Tomasello (such as 2009).