1. The Riddle of Humanity

The human species—our species—is extraordinary.

There are perhaps an endless variety of ways to justify that statement. Consider for instance the immense catalog of human construction: skyscrapers, bridges, highways, electrical grids, millions and millions of houses—an enumeration that barely begins to scratch the surface. Or contemplate the effective manner in which the members of our species can migrate and connect, far-ranging travel by car, ship and plane, opening a personal vista onto essentially the entire planet. Or ponder the efficient means by which we now communicate on a daily basis, including hundreds of thousands of messages—written, verbal and visual—speeding around the globe each and every second, the life blood of business and so many vibrant institutions, from schools to governments to social networks. Or think of the unfathomably rich scientific knowledge we have come to possess regarding our surrounding world: relativity, quantum theory, evolution, genetics, the periodic table, to name only the most basic components of our understanding. Or reflect upon the entire tableau of the creative arts—so many dazzling instances of literature, music, painting and more, artifacts that entertain us, uplift us, and hold a mirror to ourselves.

Of course there are problems and challenges too—poverty, war, environmental destruction—and it remains unclear whether the glory of man might eventually (and all too suddenly) become the tragedy of man. But those challenges cannot negate the enormity of the transformation this species has already wrought. It is a transformation that began not that long ago—not that long ago, that is, on any biological or geological timescale. It is a transformation that arose from a narrowly confined set of climates and habitats in which the members of this species lived out their lives as nothing more than simple beasts, no different in nature and behavior from the wild animals we observe today. The history of the transformation—from the first use of fire and clothing, through the domestication of livestock and grain, through the pyramids and the Parthenon, through the Copernican and Industrial Revolutions, to the many-faceted and far-reaching discoveries of the twentieth century—that history alone would be jaw-dropping enough. But perhaps more stunning still is the recognition that this transformation continues unabated through the present day, and indeed, as appears to have always been the case, it continues at a steadily accelerating pace.

Everywhere one looks, one sees a human environment overflowing with the most amazing complexities, an environment brimming with intricacies that would have been unimaginable in any previous era. And everywhere one looks, one sees humans nimbly navigating those complexities and intricacies, displaying skills that would have been inconceivable to any prior age. Watch the child poking her fingers into her electronic learning toy. Marvel at the teenager virtually high-fiving his friend in virtual space. Stand over the shoulder of the animator constructing landscapes more detailed and more dynamic than any actual landscape could manage to sustain. And listen to the men and women clacking at their keyboards, programming machines to perform a great assortment of tasks, from the purest forms of drudgery to the most delicate medical procedures. We find ourselves literally awash in an environmental and behavioral transformation, one that bathes us ever more thoroughly with each passing day, and one that has removed us far far away from our former purely animal selves.

The odd thing is, we humans are mostly immune to any sense of awe and wonderment regarding our own species. Having been born into these circumstances, having learned from a young age to speak, to read, to write, to calculate; having driven a car, having taken airplane flights, having traversed hundreds of shops, offices and boulevards; having rocked the town in the latest fashion, having anesthetized and healed our broken bones, having watched rockets shooting into space; having been exposed to all this and much much more, we are not so apt to be astounded by such happenings and artifacts—they are, after all, simply the everyday material of our everyday lives. Even the novelties, even those rich changes that still rain down

upon us on a nearly continuous basis, even the nascent fuel of our ongoing human transformation, even this manages to escape our amazement. Electronic infant toys, virtual reality, clamorous animations, robotics, artificial intelligence—these may be relatively new to us, but let's face it, they are already becoming routine.

If we want to capture a sense of amazement regarding our own species and to experience an awareness of just how outrageously atypical humanity has become, we need to gain some context and perspective. We need to take a step back from ourselves as it were, disengage from our everyday lives, and view the human transformation through a lens of time and space, through a lens of detachment, like an audience watching a movie. As a hint of what I mean here, there is an Italian animated film from 1976, *Allegro Non Troppo*, that contains a sequence providing an impressionistic version of the type of portrayal we seek. The sequence begins with a soft drink bottle tossed onto a barren planet, with the planet's first cells of life germinating and multiplying within the bottle's residue liquid, the cells eventually slopping past the bottle's opening and onto the planet's surface. What follows is a whimsical march of evolution and progress, from simple and strange organisms, to ever more complex and ever more numerous organisms, including a mammal-like creature that transforms into a primate-like creature that transforms into a hominin-like creature. Thus from the quietude of its beginning, the planet grows increasingly more crowded, more dynamic, more frightful, more sublime, culminating at last in an immense eruption of human-built structures, dominating the once barren landscape—and all this set to the strains of Ravel's *Bolero*, from its hauntingly simple opening melody to its overwhelmingly crashing crescendo.

Allegro Non Troppo is of course more fanciful than accurate, but today we do have access to a similar portrayal, one that is not fanciful but is instead entirely scientific, comprehensive, and germane to the purpose at hand. I am speaking of David Christian's notion of Big History, especially as set forth in his approachable book *Origin Story: A Big History of Everything*. Big History describes events that have taken place from the Big Bang (the beginning of time) through the present day, and highlights the major transformations—thresholds, they are termed—that have shaped our world across that expanse, such as the formation of the chemical elements, the emergence of galaxies and solar systems, the genesis of single-cell life and the not-so-easy transition to multi-cellular big life, and then the advent of humans and all the stages of that species' relentless transformation. Big History analyzes these events through the lenses of complexity, energy and entropy, and through a search for the presence of goldilocks conditions, the just-right circumstances that allow for a spawning of the next big transition. Big History is a fifty-thousand-foot view overlooking a 13.8-billion-year process. For humans, Big History provides a large dose of context and perspective.

To that end, *Origin Story* is noteworthy in three important respects, each of which warrants some further discussion:

1. **Timeline and timescale**. *Origin Story* outlines the latest scientific knowledge and evidence regarding the timeline of the cosmic and planetary events covered in its pages, and furthermore the book offers a sense of scale for that timeline. A sense of scale is critical here, both for an understanding of the immense temporal expanse that took place before the arrival of humans, as well as for a proper feel of the comparative sliver of time during which the human species has achieved the entirety of its transformational turn.
2. **Human thresholds**. There are eight major thresholds enumerated by Big History, the last three of which are human-generated. It would be tempting to chalk up this high percentage of human discussion to an anthropocentric bias, but *Origin Story* provides ample argument and evidence that the human transitions are indeed seismic, unprecedented, and on a level with the other cosmic and evolutionary milestones on the list.
3. **Impetus to human reassessment**. Nearly all the factual evidence presented within *Origin Story* represents scientific knowledge crystallized only since around the

middle of the twentieth century, with much of that knowledge directly challenging the traditional ways in which humans have perceived themselves. The old models, still entrenched in the collective consciousness, no longer pertain.

Origin Story's first noteworthy aspect is its handling of cosmological, geological and biological timelines and in its acknowledgement that human thinking is still trying to adjust to the enormous scale that underlies these timelines. When Charles Darwin's *On the Origin of Species* was first published, it disquieted the public not only for its evolutionary theories and their implication for human origins, it created unease also for its suggestion that the age of the earth and universe was immense, perhaps hundreds of millions of years. In the mid-nineteenth century, it was still hardly conceivable that the interval of prehistory could utterly dwarf that of the known human era. But as scientific evidence continued to mount over the next century and a half, and as that evidence became more and more precise, Darwin's suggestion proved to be inaccurate only to the extent of its underestimation. Easy to conceive or not, the age of the known human era turns out to be as nothing compared to the age of the universe.

By the late twentieth century, radiometric and cosmological dating techniques had progressed to the point that firm and accepted timelines had begun to take shape—for the cosmos, for the solar system, for life, and for humans. Agreement crystallized around the notion that the universe had started with a singularity event, the Big Bang, approximately 13.8 billion years ago, followed by a series of cosmological and biological milestones that bridged the gap to the present day. *Origin Story* charts these milestones and their approximate dates, most of which are reproduced in the following table:

Event	**Approximate Date**
Big Bang	13.8 billion years ago
First Forging of Chemical Elements	13.2 billion years ago
Formation of the Solar System	4.5 billion years ago
Earliest Life on Earth	3.8 billion years ago
First Large Life on Earth	600 million years ago
Dinosaurs Extincted by Asteroid Event	65 million years ago
Hominin Branch Splits from Other Great Apes	7 million years ago
Appearance of *Homo sapiens*	200,000 years ago
Farming and Civilizations Begin	10,000 years ago
Scientific and Industrial Revolutions Begin	400 years ago
Humans Land on the Moon	50 years ago

13.8 billion years is an extremely long period of time, longer than we humans can easily grasp and internalize, given the length of an average lifetime. For that matter, two hundred thousand years is also an extremely long period of time, perhaps a tad more fathomable than 13.8 billion years, but still outside the ken of normal human experience. So it is perhaps difficult for us to truly appreciate that there is a significant difference between the two.

To help its readers absorb the timescales involved, *Origin Story* offers an adjusted timeline in which all the approximate dates for events are divided by one billion years, meaning that on the adjusted scale, the Big Bang is assumed to have occurred only about 13 years and 9 months ago. This certainly makes it easier for us to assimilate the interval, although it might give the mistaken impression that the event is not that far removed, an impression that can be dispelled by the realization that on the adjusted timescale, the average human lifetime plays out over a mere two seconds. Accordingly, the following table repeats the one from above, but now with the approximate dates adjusted by a division of one billion years:

Event	**Approximate Date / 1 Billion Years**
Big Bang	13 years and 9 months ago
First Forging of Chemical Elements	13 years and 2 months ago
Formation of the Solar System	4 years and 6 months ago
Earliest Life on Earth	3 years and 9 months ago
First Large Life on Earth	7 months ago
Dinosaurs Extincted by Asteroid Event	24 days ago
Hominin Branch Splits from Other Great Apes	2 and 1/2 days ago
Appearance of *Homo sapiens*	1 hour and 40 minutes ago
Farming and Civilizations Begin	5 minutes ago
Scientific and Industrial Revolutions Begin	12 seconds ago
Humans Land on the Moon	1 and 1/2 seconds ago

These comparisons help make it clear that cosmological, biological, and human events play out on very different timescales. Cosmological forces are enormous not just in their spatial scope but also in their temporal reach, with significant events typically measured and compared in billions of years. Of the 13.8 billion years that have passed from the Big Bang to the present moment, around 67% of that time had already been spent when the sun and planets of our solar system first came into being, and another 5% would be consumed waiting for the first simple forms of life to appear on the planet Earth.

By comparison, the biological/evolutionary timescale is a bit more compact and dynamic, although still lengthy in absolute terms, with significant events more typically measured in millions or perhaps hundreds of millions of years. Even here, leaps of complexity apparently do not come quickly or easily, for on Earth microbial single-celled life remained without partner for around 3 billion years, consuming another 22% of the overall timeline, leaving only around 6% for the era of multi-celled organisms and big life (that is, the size and type of flora and fauna we experience on Earth today).

By comparison again, human events have played out in a time frame that appears essentially negligible to those of its predecessors. The hominin line has been around for only about 0.05% of the time of the universe, and *Homo sapiens*, our species, has been in existence for only about 0.0015% of the overall timeline. And although the beginning marker of the human transformation remains somewhat fuzzy, the first unmistakeable and abundant evidence for the human revolution, the turn that would put this species on a path clearly

different from that of all the other species, this dates to around fifty to one hundred thousand years ago, meaning that nearly every significant event of the human transformation has taken place over a period covering only about 0.0005% of the universe's timeline, a chronological splinter that would be thought hardly significant in almost any other context.

Origin Story's second noteworthy aspect is its straightforward demonstration that the human-generated transitions of the last one hundred thousand years are of a similar nature and carry similar impact as the cosmological and biological transitions that went before.

Big History enumerates eight different thresholds—fundamental changes that have reshaped a critical aspect of our world: 1. Big Bang Origins, 2. Stars and Galaxies, 3. Chemical Elements and Molecules, 4. Solar System and Earth, 5. Life, 6. Human Difference, 7. Agriculture, 8. Modern Revolution. A threshold is signified by several telltale characteristics. The first and perhaps most obvious of these is a pronounced leap in complexity, often going hand-in-hand with a more focused and more enriched use of energy. An increase in complexity runs counter to the effects of entropy, the tendency for energy and systems to become more ineffective, more diffuse, more random over time. Entropy is the default condition of the universe, and so relentless is its impact that it will ultimately, in a distant future, become the final fate of the universe. But against this incessant pull towards entropy, eddies of great complexity can still occur, localized and chaos-defying leaps of increased pattern, increased structure, increased form. Another characteristic of thresholds are their so-called goldilocks effects, the just-right conditions that make it possible for the next leap in complexity to occur—conditions that are not too hot and not too cold, not too dense and not too sparse, not too oxygen-rich and not too oxygen-poor, etc.

The first five thresholds—the non-human thresholds—demonstrate these concepts. The Big Bang and its aftermath, chaotic though it was, was more complex and more energy-infused than the nothingness that apparently gave birth to it. Then as temperatures cooled to just the right degree and gravity tugged by just the right amount, clusters of stars and galaxies began to form, more organized than the tumultuous foam from which they came. Then in certain dying stars, of just the right magnitude and of just the right composition, the heavier chemical elements were fused and exploded into space, giving us carbon, oxygen, the other elements of the periodic table, as well as all their molecular potential—an enormous increase in chemical complexity that undergirds our world today. Finally, in certain star systems, such as our own, and on certain planets, such as planet Earth, conditions came together in just the right way to support yet another leap in chemical and dynamic complexity—the leap to biological life. And on Earth at least, life itself seems to have contained an impetus towards an ever greater complexity, an ever greater use of energy, with protoplasmic life leading to single-celled life, then leading in turn to multi-cellular life and eventually big life—the ultimate factory for evolutionary forces.

These first five thresholds had produced the state of affairs that could be found on Earth around two hundred thousand years ago, and it was into this state of affairs that *Homo sapiens* emerged. According to Big History, what then followed (and during what has already been described as a mere speck of time) were three more thresholds in rapid succession, all human-related. The question is, is this a legitimate depiction of what took place, or is this just simply some anthropocentric bias? Humans have a natural inclination to be enamored of their own species—scientists and academicians are as susceptible to this inclination as anyone else—and so does this account for the self-assignment of three entire thresholds? Is this perhaps just David Christian running amok, unable to suppress his admiration for his own kind?

In answer to this question, note that biological life, despite its abundant variety, has a certain predicability to it. In the animal kingdom, for instance, due to the constant evolutionary pressure to survive and to procreate, each organism channels its efforts into just a few select activities: eating, drinking, avoiding danger, sexual rivalry, mating, fostering young. You may have noticed that every documentary that chronicles an animal species follows essentially the

same plot line: the search for food and water, the warding off of predators, sexual rituals, the fragile course from birth to adulthood—and then the cycle starts all over again. Thus animal behavior remains remarkably stable and consistent, across time and across species: the lions, catfish, crows, beavers, etc. of today behave essentially the same as did the lions, catfish, crows, beavers, etc. from hundreds of thousands of years ago. And on the African savanna, around two hundred thousand years ago, the earliest instances of *Homo sapiens* could have been anticipated to be no different.

And yet by fifty to one hundred thousand years ago, evidence was quickly accumulating that this species was in fact unlike all the rest: control of fire, specialized tools, cave art, larger social structures (pointing to an almost certain use of abstract language). By ten thousand years ago, the human difference was unmistakable. The population was increasing at an unprecedented rate, the use of environmental resources was taking a quantum leap. The species had by now spread out around the globe, covering nearly all of Africa and Eurasia, and having forayed for the first time into Australia and the Americas. *Homo sapiens* had extincted—other than some small DNA assimilation—all the other hominin lines; *Homo sapiens* had extincted many of the larger mammals as well. Tools, weapons, art, cooking, clothing, abstract communication, a more concentrated use of energy—these were undeniable escalations in behavioral complexity, escalations for which no other species, at no other time, had even given a hint. A new threshold had indeed been crossed.

And humans were not finished. Around ten thousand years ago, in the vicinity and ideal conditions of the Fertile Crescent, the species began to develop agricultural techniques, domesticating certain grains and unleashing their enriched energy, and harnessing certain animals and employing their augmented power. Farming paved the way to larger social structures, to what would eventually become civilizations. Farming spawned an outpouring of construction, from colossal examples such as the pyramids and the Acropolis, to more humble yet indispensable instances, such as thousands and thousands of abodes. Ships began to sail the seas, carts began to cross the land, speech began to be written down. By the year 1600, the human difference had turned into a human domination.

And yet humans were still not finished. Around 400 years ago, another revolution began to take hold, another massive jump in world complexity. Spurred by scientific and mathematical methods, such as those epitomized by Newtonian mechanics, and powered by industrial invention, such as the burning of fossil fuels, humans began to cram their surroundings with an unprecedented depth and breadth of structure: railroads, automobiles, airplanes; factories, terminals, stadiums; radios, televisions, computers; and now so many massive and skyscrapered cities, all stuffed with plumbing, traffic and electricity, intricate dances of infrastructure reaching to the clouds. By the twentieth century, the extent of human knowledge was bumping against what must surely be the universe's limits: sub-particles, genetics, artificial intelligence. And perhaps a bit on the darker side, if there were to remain any doubt about the energies now employable by this species, note that at one irritable push of a button, we can annihilate every organism on the planet Earth, turning out the lights on what has been more than a three and a half billion year process.

Homo sapiens is not a normal life form. Even with all anthropocentric bias duly noted, the fact remains that the human species has utterly transcended the evolutionary boundaries that have confined every other instance of biological life. Humanity deserves all the attention it gets.

Origin Story's third noteworthy aspect is that it establishes an entirely new narrative regarding humanity—a new narrative about humanity's surroundings, a new narrative about humanity's origins, and a new narrative about humanity's current conditions. The first glimpses into this narrative were becoming apparent in the nineteenth century, but it was not until the last half of the twentieth century that the full extent of the story emerged clearly into view. So we find ourselves early in the twenty-first century still in a period of adjustment, but it should

also be obvious by now that the new narrative does not align to the traditional ways that humans have had of regarding themselves, and thus a self-reassessment is becoming quickly overdue.

There have been two well-established traditions for explaining humanity and describing humanity's place within the world. For convenience I will label the first of these approaches as the *religious tradition*, and I will label the second approach as the *philosophical tradition*.

There are probably as many religious origin stories as there are religions, but they do tend to share a common theme. A divine force, often called God, creates the world and its contents—the earth and the heavens, the rocks and the streams, the plants and the animals. Then furthermore God *specially* creates humans, the specialness intended to account for all the uniquely human traits—intelligence, language, inventiveness, and all the rest. And because humans are special and because the world serves as their domain, it is usually stated or implied that the world was created shortly before, or along with, the very first humans. In some religious traditions, creation is seen as God's one and final act, but in most, God continues to play a role in ongoing events, such as when he sends his only begotten son.

It is not my intention to disparage religious thought. I have met too many who will blithely decry religion as irrational and backwards, entirely misapprehending the subject. No other animal species has ever had a religious notion, and neither did humans for a very long time. Religious thinking is evidence of a striving for greater understanding; it is a signpost on the road towards human progress. And furthermore, a study of religious history reveals that religions have tended to become more sophisticated, more complex with time, fitting into the overall theme of human transformation and human advancement. Any honest effort towards religious striving is to be treated with utmost respect (just as any selfish push towards fundamentalism is to be confronted with utmost reproach).

Nonetheless, the religious tradition does not hold. The world was not created alongside humans—in fact, the universe had been in existence for nearly an eternity before humans came along. The world has not served solely as a human domain—in the spatial-temporal continuum, humans barely mark a trace. And as for specialness, humans began as animals, they were beasts like so many others—intelligence, language, inventiveness, and all the rest, in the beginning these were nowhere to be found. But if all this seems a bit too humbling, humans can take some comfort in the one apparent compensation, that they in fact owe divinity nothing in the way of a debt for all that humanity has now become. Intelligence, language, inventiveness, and all the rest—these have been entirely human-forged.

Turning to the philosophical tradition, it seems to have arisen to some extent out of a dissatisfaction with the religious tradition, as well as out of a dissatisfaction with the turmoil of human change. In the philosophical tradition, a creator is not the primary focus. Instead the world and its events are measured against the principle of a natural or ideal state, a state that is essentially timeless, a state in which human rationality preferably shapes the view. Thus humans are special in this tradition too, for they alone are endowed with an innate faculty of reason, and the challenge of human experience is to overcome the strife, the confusion, the disruption of ordinary life, to attain or to regain a rational equilibrium, a well-ordered stasis. Such ideas were fundamental to both Plato and Aristotle, and their influence reached forward into the Age of Enlightenment, where Descartes, Leibniz, Voltaire, Rousseau and others could refine and foster the tradition. So powerful has been this approach in the shaping of how humans have perceived themselves, it should be noted that even a philosopher such as Kant, so willing to fathom and to question almost every other human concept, was nonetheless willing to accept an innate rational faculty as simply a given.

And yet as with the religious tradition, the philosophical tradition does not hold. The natural state of a human is to be purely an animal, its equilibrium condition is to be evolution-bound on the African plains. Not a stasis, but instead a dynamic artificial construction has been the driver for vaulting this species to its more ideal place, and thus it is the turmoil of human change, of human transformation—the strife, the confusion, the disruption—it is to these we owe the blossoming of our not-so-innate reason.

The facts as we currently understand them are these, this is the new narrative:

Around 13.8 billion years ago, our world began in a tumultuous burst of energy. As that world expanded and cooled, stars and galaxies were formed, followed by the chemical elements. On the planets of some of these star systems, conditions would allow for life, and this is what happened on the planet Earth, over three and one half billion years ago. Biological life on Earth remained simple for quite some time, but eventually evolved to something more complex, to the types of plants and animals we are more familiar with today. Sometimes conditions were chaotic for life—asteroid strikes, temperature swings, volcanic eruptions—producing mass extinctions followed by evolutionary explosions. But at other times conditions were more stable, allowing evolution to take a more gradual course, and it was during the most recent stable period that hominins first emerged, leading eventually to *Homo sapiens*.

If those earliest *Homo sapiens* possessed any of the behaviors of human modernity, those behaviors must have been inchoate at best; life for those earliest *Homo sapiens* was focused almost entirely on survival and procreation, just as to be expected. But it was not too long thereafter that the signs emerged that this species was in fact extraordinary. From life as simple hunter-gatherers humans quickly turned to becoming world conquerers, reconstructing their environment almost constantly along the way. Populations increased by orders of magnitude, geographical expansion extended around the globe. Farming, writing, civilization, seafaring, science, industry—in a steady acceleration, humans kept building on what they had built before. By the twenty-first century humans had practically obliterated nature from their view, substituting in its wake a multitude of sprawling, towering monuments to artificial pattern, structure and form. Behaviors that were once evolution-bound had now reached an almost unlimited expression: language, computation, constant innovation. And so deeply had this species now plumbed the depths of its surrounding world that it was on the verge of conquering the fundamental building blocks of the universe, and the fundamental building blocks of life itself.

The facts as we currently understand them are these, we must see ourselves in the light of this new narrative.

There is, however, an irony at the heart of this new narrative. As deeply as humans have now seen into so many different aspects of their world—biology, physics, chemistry, mathematics, logic—there is one subject, perhaps the most critical subject of them all, for which the species has yet to achieve even the most basic understanding. Humans do not as yet understand themselves, and they do not as yet understand what has engendered their remarkable history.

Note how during the last several hundred years—the era of Big History's final threshold, the modern revolution—humanity has forged a complete revision of its understanding regarding almost every feature and every process underlying the observable world. For instance, humans have long gazed at the moon, the stars, the planets, the other contents of the cosmos, have observed the patterns and observed the aberrations, and have asked questions about what is going on. Why the regularity? Why the aberrations? What are the relationships between all these heavenly bodies? What drives the celestial dance? Over the years there have been suggestions, declarations, arguments, discussion, and occasionally a bit of insight, but it was not until the modern era that our knowledge turned deep, sophisticated and effective, and now we have Newton's laws of motion and gravity, and Einstein's relativity, to help us navigate our way around. Humans have long pondered the material objects of their surrounding world—the rocks, the water, the air—have observed each substance's unique properties, have noticed the combinatory changes these substances often undergo, and have asked questions about what is taking place. What are these things made of? Why are some of them liquid and some of them solid? Why do they combine in such transformative and fiery ways? What drives the material dance? Over the years there have been suggestions, declarations, arguments, discussion, and occasionally a bit of insight, but it was not until the

modern era that our knowledge turned deep, sophisticated and effective, and now we have atomic and quantum theory to help us comprehend the scene. Humans have long contemplated the immense variety of life—trees, flowers, fish, insects, birds—have watched each organism's natural behaviors, have witnessed the births and witnessed the deaths, and have asked questions about how to explain these events. Why are there so many different kinds? What is the purpose behind each organism's behavior? From where do these organisms come? What drives the organic dance? Over the years there have been suggestions, declarations, arguments, discussion, and occasionally a bit of insight, but it was not until the modern era that our knowledge turned deep, sophisticated and effective, and now we have evolutionary theory and genetics to help us clarify the living drama.

But note this too, that humans have also long observed themselves. Humans are aware that they are in many respects just like all the other living creatures—humans must eat and drink, avoid danger, have sex and procreate, and rear their young. Humans are also aware that they are utterly unique—language, intelligence, innovation. And humans have asked questions about how did this situation come to be. Why are we both the same and different from all the other animals? From what do we derive our unique abilities? Is there a purpose to what we have constructed all around us, and what do we do now? What drives the human dance? Over the years there have been suggestions, declarations, arguments, discussion, and occasionally a bit of insight, but…alas, even in the modern era, there has been only minimal progress.

We do know now more about human history, that temporally speaking this history is minuscule compared to everything that went before, and that consequentially speaking this history has been nothing short of epic. We know now that we began purely as animals, and that once the transition was set in motion, the pace of change turned into a constructive acceleration, leading to the outrageously altered circumstances we find ourselves in today. But these are only descriptions, they are not insights into what has shaped the human dance; these are inventories of what has taken place, not elucidations that can help us understand. When it comes to explaining the processes driving human events, when it comes to seeing deeply, sophisticatedly and effectively into the features that have epitomized the human transformation, we realize that there are no equivalents to the laws of motion and gravity, to relativity; no equivalents to the periodic table, to quantum theory; no equivalents to evolution, to genetics. Humans do not as yet understand themselves.

This overarching question regarding the human transition—how did humans change from pure animal to what humans have become today, what processes underlie this unprecedented and powerful transformation—this is what I call the riddle of humanity. As a scientific question it is indeed important, perhaps the most important scientific question yet to have received much of an answer. But the importance of the question goes beyond just the demands of scientific inquiry, for it is also a question that has implications for the future course of humankind.

If we could put ourselves beside those earliest farmers in the Fertile Crescent, and ask them to predict what the future would be like in another ten thousand years, we recognize that we would be setting them an impossible task. Airplanes, electricity, calculus, the internet—hardly a single concept that defines the current age would have yet to reach those farmers' ken. And are we in a similar position today ourselves, trying to anticipate our own future? True, if we could assume another ten thousand years of transformation similar to the ten thousand years that have gone before, then indeed we might expect a world full of artifacts and events that we could not possibly conceive today. But in a certain sense, this exercise seems strange and futile. The accelerating pace of human change, although bringing it with a host of technological marvels and environmental understandings, has also brought with it the looming consequences of a runaway recklessness—widespread extinction of many species, proliferation of weapons of mass destruction, rapid deterioration of the global climate. At times it seems unlikely that humanity will make it through the next ten years, let alone the next ten thousand.

These are not the kinds of problems that will be solved with guesses and half-efforts; they will instead require the deepest understanding of who we are and how we have arrived at these circumstances. What part of us is still driven by the pure animal we once used to be? What part of us is driven by the new constructions we have been building all around us? What was the original source of humanity's innovative turn, and does that source still continue to work among us? Is there a purpose to what humanity has accomplished over the last one hundred thousand years, and does humanity understand the consequences of what it does now? The value of accurate insights such as Newton's laws and Darwin's evolutionary theory is that they help us navigate an effective path forward, they allow our further actions to be more constructive than destructive, they protect us from floundering about. If we could uncover similar insights regarding human history and human endeavors, then in this area too we might find the means to begin forging a less reckless path, a path that still builds upon the wonders that have become the hallmark features of humanity, while leaving the door open to a more hopeful and sustainable future. Thus there is great value to be gained by attempting to answer these questions; there is great potential to be had by shedding light on the riddle of humanity.