2. Evolution Turned Inside Out

The word used most frequently to explain the human transformation is *evolution*, the implication being that humans must have *evolved* from pure animals to the rational and innovative creatures they have become today. One approach to this idea would be to suggest that evolutionary modernization has been gradually taking place over the entire course of hominin history, for around seven million years, ever since the human branch broke off from the chimps and the great apes. A caricature portrayal of this proposal would be the commonly seen rendering of a procession of increasingly sophisticated hominins, starting with an apelike knuckle-walker, then progressing through a series of more upright and less naked cavemen—each in turn sporting a more advanced weapon or tool—culminating at last in a suit-and-tie-clad businessman holding a briefcase.

Few scientists actually subscribe to such an extreme form of evolutionary gradualism for humans, because there is really nothing in the fossil record to suggest anything modern about hominins until at least the last one million years, and quite possibly until much more recently than that. Nonetheless, scientists still make frequent application of evolutionary theory to help account for humanity's revolutionary turn. For instance, one popular hypothesis is that humans must have acquired something that could be called a language gene at a recent point in their history, giving them the capacity for abstract speech, and because language would confer a selective advantage, the mutation and its resulting behaviors have become thoroughly entrenched within the species. A related suggestion focuses not on language but instead on intelligence, hypothesizing that there must have been genetic mutations targeting human neural capacity, giving rise to brains that can think algorithmically and logically, accounting for the rationality that distinguishes humans from all the other animals. Then there is the field of evolutionary psychology, which takes an even more wide-scale approach to applying evolution to neurology, proposing the existence of many modules within the human brain, each the result of selective adaptations that must have arisen from the survival-and-procreative circumstances of human ancestry.

One other application of evolutionary theory to human history targets not biological change within the species but instead cultural change. The notion of cultural evolution dates back to Darwin's time and has undergone many revisions and comes in a wide variety of flavors, each attempting to explain modern human society within the framework of evolutionary concepts. The popularity of cultural evolution gained a boost in the 1970s with the publication of Richard Dawkin's book *The Selfish Gene*, which introduced the concept of a *meme*, a proposed gene-analogous entity that can carry cultural ideas and practices, be replicated and hosted, and compete with other memes for selective advantage.

The desire to apply evolutionary theory to the human transformation is certainly understandable. Evolutionary theory, in combination with genetics, has been extremely successful in describing and explaining the types of changes that species can undergo, and so what could be more natural than applying these concepts to the human transformation, in essence the motherlode of species change. Nonetheless, there are difficulties.

First, the time frame for evolutionary change in modern humans is extremely narrow, since nearly all the impact of the human transformation has occurred within just the last fifty to one hundred thousand years. Significant evolutionary change tends to be much slower and more gradual, more on the order of hundreds of thousands or even millions of years, especially in geological environments that are relatively stable, the condition that exists on Earth in the present age. Lions, gorillas, ants, etc.—most wild species remain much the same today as they were many hundreds of thousands of years ago, and in such circumstances it would be surprising to come across a species undergoing significant evolutionary alteration in an extremely short period of time. This concern about time also applies to cultural evolution, which faces the conundrum of explaining why many modern cultural changes appear to

happen almost instantaneously, a characteristic that runs counter to typical evolutionary dynamics.

Second, there is the problem of a lack of specificity. Assume, for instance, a mutation were introduced into the gazelle population that increased leg muscle size and sinew strength. This is a biological change that would create a direct behavioral consequence, namely an increase in running speed, and in turn, this behavioral consequence would directly confer a selective advantage, namely the ability to better survive predator attacks. The chain of events from mutation to evolutionary impact is unbroken—the evolutionary explanation is direct and complete—and this is not uncommon for descriptions of evolutionary change as applied to the plant and animal worlds. In contrast, hypotheses regarding human language genes or human neural mutations fail to provide any element of such a direct connection. The presumption is that the proposed human genetic mutation produces a physical alteration—maybe a change in vocal cords or in synaptic connections—but at the present time these presumed physical alterations remain entirely unspecified. Furthermore, assuming such alterations could be identified, there would then need to be a connection from the physical alteration to the resulting language or intelligence behavior, and given the current state of neuroscience and the like, such direct connection from vocal cords and neurons to specified language and intelligence behaviors seems unlikely to be forthcoming anytime soon. True, such connections might eventually be discovered—science should be allowed some time to work—but until these linkages are revealed, such hypotheses must be considered murky and uncertain as to their veracity.

Finally, there is the problem of applicability. Evolutionary theory and genetics describe *biological* consequences—that is, *physical* changes in organisms as well as the resulting impact on organisms' observable behavior: a brighter plumage to attract the sexual mate, a louder squawk to ward off the predator, a sharper tooth to subdue the prey. But the distinctive features of the human transformation are not in fact physical or biological, they are instead environmental. There is actually very little in the way of evidence to suggest that *Homo sapiens* has transformed biologically or physically over the last one hundred thousand years, and this is exactly as might be expected for almost any species over such a short period of time. In contrast, there is an overwhelming amount of evidence indicating that the human environment has been transformed dramatically over the exact same period. Compare the African savanna with the streets of Manhattan, if you feel the need to be convinced.

Of course observable human behavior has also changed dramatically over the last one hundred thousand years, and this changed behavior needs to be accounted for too. But the presumption that there must be something physical or biological underlying these new behaviors seems to be overlooking an explanation that is more readily at hand. Just as changes in biological characteristics can produce altered organism behaviors, changes in environmental circumstances can *also* produce altered organism behaviors. And in humans, where behaviors have been changing immensely in recent years, it seems odd to ascribe such changes to the physical and biological realm, where there is little evidence of any change at all; it seems more straightforward to attribute such changes to the human environment, which has been transforming just as radically as the behaviors themselves. Think, for instance, of driving behavior. On the African savanna one hundred thousand years ago, *Homo sapiens* would have displayed absolutely no driving behavior at all, and was this because humans were organically incapable of the activity? Today, driving behavior among humans is nearly ubiquitous, and is this because in the intervening years humans have somehow acquired the physical capacity? Why not instead state the more obvious, that humans did not display driving behavior one hundred thousand years ago because there was nothing in the environment to drive, and that humans display driving behavior in abundance today because automobiles have become a foremost feature in the human scene.

If evolutionary theory explains the impact of *biological* characteristics and the behaviors resulting from those characteristics, and if the human transformation is marked by a radical change in *environmental* circumstances and the altered behaviors resulting from those

circumstances, then does evolutionary theory even apply to the case of human transformation? Is this perhaps just a misuse of the tool? Are we stubbornly pounding a square peg into a round hole?

If we are concerned that the application of evolutionary theory to the human transformation is indeed a case of pounding a square peg into a round hole, then a corrective course of action would be to modify the shape of the peg. Note that the evolutionary process is defined by a collection of concepts—such as organism, environment, fitness, mutation and selection—and these concepts are described as interacting with one another in the regulative way that defines the process. But is evolution the *only* process that can be defined by these concepts? In other words, can these concepts be rearranged somehow, can they be described as interacting in an alternative way? Is there room here to be a bit more creative, to effectively alter the shape of the peg?

To analyze the evolutionary process and its underlying components in a bit more detail, let's consider a scenario in which the geological environment is essentially stable and mostly isolated—not much unlike the circumstances existing on the Galapagos Islands when the young Darwin visited during the voyage of the *Beagle*. Biological change in such an environment would be essentially driven by two different forms of organism mutation. First, some species, with survival-and-procreative characteristics that fit well to the given environment, will tend to flourish, while other species, with characteristics not so well suited, will tend to disappear. Of course in a stable and isolated environment, this form of change will eventually trend towards an equilibrium, leaving biological change to then happen more frequently by way of the second form of mutation, by way of random genetic variation. And here too, fitness to the environment will determine the likely course of events, with gene mutations that increase an organism's survival-and-procreative chances more likely to gain hold than gene mutations that do not.

From this description—filled with words such as *trend*, *likely*, *random*, and *chances*—we begin to see the reason why the evolutionary process tends to be more slow and gradual, especially in environments that are relatively stable. The prospect of success for mutations in this scenario, the strength of their fitness, depends not on a targeted certainty but instead on probability. No one mutation, though it indeed be advantaged, is guaranteed particular success—the gazelle with the larger muscle mass and greater sinew strength will indeed be faster, and yet might nonetheless be felled. What is *natural* about natural selection is in large degree this reliance upon random processes and probability; survival of the fittest is primarily a function of the law of large numbers. Thus the evolutionary process has much in common with the workings of a house-advantaged casino: with only a few customers playing over just a few nights, the casino might not turn a profit, but given a multitude of customers playing over an abundance of time, the casino is eventually going to thrive.

There are of course other scenarios. For instance, environments are not always stable and isolated, and evolutionary change tends to be more dramatic at times of major environmental shifts—such as after asteroid hits or volcanic eruptions. But in general, the same principles still apply: whatever environment is given, the organisms within that environment will mutate through survival-and-procreative trials and through genetic variation, with the probabilities underlying natural selection gradually nudging the organisms towards a better environmental fit.

Such descriptions highlighting the evolutionary process and its underlying components are well known and have been highly successful in explicating various cases of biological and species change. So the question to ask now is, does anything about these descriptions correspond to the case of the human transformation? Do the components of the evolutionary process have correlations in the observable features of the human turn? Do we recognize any elements of randomness and chance, is there a heavy reliance upon the law of large numbers? What features of the human transformation might be described as being stable, and what

features do we recognize as undergoing sustained mutation? Or to put the entire matter a bit cheekily, if evolutionary theory were the gene, and the human transformation were the surrounding environment, what can we say about the degree of fitness?

Here is what I would propose: the process underlying the human transformation can indeed be described with the exact same components used to describe biological evolution—that is, organism, environment, fitness, mutation and selection—but in the description of the human transformation these components take on exchanged roles and operate with one another in entirely different ways, producing an underlying process that in many respects runs *counter* to the evolutionary process, that *opposes* evolution's effects. Thus the human transformation can be described as not being evolutionary at all, but in fact much more like its opposite. The human transformation is really evolution turned inside out.

First, note that the focus in the case of the human transformation is on just one type of organism—here when we say *organism*, we mean specifically *human* organism and all its differential effects. In evolutionary descriptions, the environment might be taken specifically, but the organisms within that environment are usually considered collectively and much the same. Thus we can speak of fitness to the environment as a *general* rule and not make exceptions for any kind. We can speak of environments reaching equilibrium without worrying about how one particular species might continuously destroy the balance. The characteristics of biological evolution are therefore operative for every type of organism, whereas the characteristics of the human transformation are privileged to just one species. In the human transformation, no other kind of organism directly takes a role in the ongoing action, no other species has a similar impact as humans do. The human transformation is essentially a one-species show.

Second—and perhaps this is the most important point—take notice of what is stable and what is mutating in the human transformation. In the scenario outlined above depicting biological evolution, it was assumed that it was the environment that was stable, and that the organisms within that environment underwent sustained mutation, through both survival-and-procreative trials and through genetic variation. In the human transformation, however, these roles are reversed. As we have suggested already, there is no clearcut evidence and no clearcut reason to assume that humans have changed physically or genetically over say the last one hundred thousand years; any genetic drift could be taken as slight and insignificant. And thus *Homo sapiens* today is essentially the same as *Homo sapiens* from many years ago—biologically speaking, the organism has remained almost entirely stable. The surrounding environment, on the other hand, well, that is a much different story—the surrounding environment has been anything *but* stable. From fire pits and animal skins and makeshift shelters to electricity and automobiles and towering skyscrapers, humans have been mutating their surroundings in the most massive of ways. There is almost no place left on this entire planet not retouched by human hands, and in the locations where humans typically live, such as in numerous modern cities, nature has been practically expunged from view, replaced everywhere by a relentless reconstruction, a reconstruction targeted always towards human benefit. This fundamental difference between biological evolution and the human transformation cannot be emphasized strongly enough: in biological evolution, the organisms mutate towards the best environment fit; in the human transformation, the environment is being mutated to achieve the best organism fit.

Furthermore, the concepts of fitness and selection—as operative in the human transformation as they are in biological evolution—are nonetheless of an altered nature and produce a much faster paced result. Humans mutate their environment primarily for the purpose of increasing their survival-and-procreative prospects—that is to say, for the purpose of increasing human fitness. Controlled fire, clothing, structured weapons, and all that then follows—nearly every environmental change has been targeted towards improving human robustness. The effectiveness of these endeavors is attested to by the fact that there are now

eight billion people living on the planet, and that nearly every square inch of the earth's surface has been made hospitable for humankind. But also take note of this: these environmental mutations, so spectacularly successful for the human species, have been in no way random. The success of these mutations has not been dependent upon probability; the human transformation is not a consequence of the law of large numbers.

When humans attempt to make an environmental change, they do not put forth a multitude of random variations and then wait to see which one works out the best. What a bizarre approach this would be of making shelters, for instance, trying out hundreds of haphazard architectures and arbitrary materials and then observing which experiments tend to stand up and which experiments tend to fall down; or worse yet, observing which of these shelters' inhabitants better survive and procreate, and which of these shelters' inhabitants tend to disappear. It is not that shelter creation could not be accomplished in this manner, at least in theory—it is after all the tried-and-true method of biological evolution—but arriving at an effective house in this way would take a great deal more time and do considerably less to advance the immediate fitness of this one particular species. Thus instead of engaging in random trials, humans *target* their environmental mutations and they *anticipate* the results. Humans do not make their selection after the fact, they prejudge their selection at the time of the change. Therefore selection in the human transformation is not *natural* selection, it is not a child of randomness and not a function of probability. The word we are searching for is *artificial*—artificial selection, artificial construction. *Artificial* is the word that captures the two critical aspects of selection in the human transformation, namely that selection in the human transformation involves both a restructuring of the given environment as well an eschewal of any randomness. This is not to say that every human environmental change is successful—indeed a good many are not—but an unsuccessful environmental change is a consequence of an error in judgement, a mistake, it is not an unfortunate spin of a random wheel.

Another characteristic of artificial selection that distinguishes it from its biological counterpart is that artificial selection can be accretive. In the human transformation, most environmental mutations have expanded upon previous mutations, enhancing the original in both breadth and depth. Consider, for instance, the first manmade articles of clothing, and then take a good look at what we wear today. Picture the first tools invented for harvesting crops, and then visit the machines in a modern farmer's shed. Plus environmental mutations can be immediately copied, copied to almost any degree—the effectiveness of one can become the sudden impetus to the effectiveness of thousands, or even millions, of others. And today almost no environmental mutation is complete in and of itself, but instead serves as a link in a hierarchal chain. Look at a house, an airplane, an entire highway system, and then consider all the connective parts of which these artifacts are composed. These accumulative and dependent characteristics stand in sharp contrast with those of natural selection, where nearly every survival-and-procreative trial and nearly every random genetic mutation is essentially an independent event.

Of the observable consequences of this non-evolutionary process underlying the human transformation, perhaps none is more striking than its awe-inspiring speed. Not constrained by the lumbering characteristics of biology, not held back by the usually glacial movements of geology, and not delayed by the vicissitudes of random chance, the human transformative process works many orders of magnitude faster than its evolutionary counterpart. This is why there is such a manifest difference in the timescales underlying, on the one hand, biological/evolutionary events, where significant change typically plays out over the course of millions of years, and on the other hand, human events, where significant change has been happening in a mere fraction of that time, and at an accelerating pace.

In summary, the process underlying the human transformation is composed of the very same elements as the process underlying biological evolution, but in the human transformation these elements come together in an entirely different way, producing a new kind of process with a very different impact. It is a process that favors just one type of organism to the exclusion of all the rest. It is a process that exchanges the mutative roles of organism and

environment. It is a process in which the selective drive towards fitness disengages from the vagaries of chance, and it is a process that generates accumulative and accelerating change. It is a process that in many respects runs so counter to biological evolution that it can be considered evolution's opposite, even to the degree that it effectively nullifies many of evolution's constraints.

It is perhaps not entirely surprising to think that the process underlying the human transformation would be in some way different than the process underlying biological evolution. Humans are after all clearly unique within the animal kingdom, and to chalk up that uniqueness to no more than some standard evolutionary processes might seem a bit underwhelming, given the immensity of the consequences. We expect that unusual outcomes will be engendered by unusual causes, and so we anticipate that there will be *something* different behind the human story. But to say that the human transformation runs *counter* to biological evolution, to say that it *opposes* evolution's effects, that claim might take us aback at first, might feel entirely unexpected. And yet it is this opposition that is key to understanding much about humanity's unique and current situation, and particularly key to understanding the concept of human freedom.

To see why this is so, let's take a moment to consider the powerful constraints that biological evolution imposes upon the organisms that fall under its domain. The most obvious constraint is that organisms are almost entirely dependent upon their environmental circumstances, with extremely limited ability to override the given conditions. Having evolved to fit to a particular environment, a species and its organisms will struggle mightily when that environment changes or disappears. Biological history is chock-full of extinctions driven by such environmental transitions—for instance, the dinosaurs, long abundant and long dominant upon this planet, disappeared practically overnight in the dramatically changed circumstances following a massive asteroid hit. Environmental dependency also limits a species' geographical range—sea creatures must live in the sea, forest dwellers must live where there are trees, etc. This is why *Homo sapiens* was limited to certain parts of Africa until around fifty thousand years ago; the species was fit for that particular kind of environment, but not fit for almost any other.

One might wonder at this point why organisms in general do not attempt to alter their surroundings to make their circumstances more suitable to themselves, instead of acquiescing to becoming the given environment's slave. There are examples of tentative movements in this direction: birds reconstruct environmental materials into nests, beavers do the same to construct dams, etc. But these behaviors appear to be the result of evolutionary pressures, and thus once successfully in place, these behaviors do not get generalized, but instead become rigid and attached to the given environment. The problem here is that evolution is the most demanding of taskmasters. The need to survive and procreate becomes so overwhelming for each organism that it effectively hijacks every aspect of the organism's being, leaving essentially no latitude for discovering any alternative approaches. Remember that evolutionary fitness is a function of the law of large numbers, where even the slightest change in probability can lead to a dramatically different long-term outcome, and it would seem that any behavioral effort not acutely focused upon survival and procreation is bound to become a loser in the long-term game. We have noted previously how animal behavior is remarkably similar across species and across time, and this is mostly because all animal behavior shares this laser-like focus upon the need to survive and procreate. This extends so far as to cementing an animal's perceptual characteristics, where environmental features such as food, water, predators, rivals and conspecifics invariably achieve the utmost in foregrounded attention, whereas almost every other aspect of the environment—that is, every aspect not directly concerned with survival and procreation—dissolves into background noise. The background environment does have a great deal of helpful information to offer—as humans have been discovering over the last several thousand years—but for every other species the background environment goes

almost entirely unnoticed. An organism striving to survive will keep its eye open for predators, but not for the phases of the moon. An organism feeling the urge to procreate will be keenly attuned to a conspecific partner, but not to the symmetries in the surrounding landscape. Thus the evolutionary mechanism has the self-fulfilling effect of compelling its participants into a rigid adherence to evolution's rules; evolution severely limits an organism's perceptual and behavioral freedom.

It is important to recognize at this point that humans too—and not that long ago—were limited in this exact same way; as pure animals, humans were entirely bound by evolution's constraints. Therefore the most important aspect of the human transformation has been a loosening of these binds, a loosening that could be achieved not by just any random characteristic, but instead by a process directly countering evolution's effects. The primary mechanism of this loosening has been to turn the mutative formula around, with humans altering their surroundings instead of waiting to be altered themselves. Originally fit just for the African plains, humans have conquered colder climates with the mutative benefits of fire, clothing, and shelters; have conquered the expansive seas with the transformative advantages of ships and submarines; have conquered, most outrageously, even the darkness of space and the distant reach of the moon, with the modifying aid of space ships, helmets and suits. In fact, so successful have humans become at bending their surroundings to their own personal needs, that few today would find themselves at all comfortable left to their own devices on the original African plains.

Furthermore, at the core of these environmental alterations stands a perceptual awareness that has clearly expanded from what humans experienced before, when every ounce of their attention was given strictly to the immediate needs of survival and procreation. Humans do still retain much of this survival-and-procreative awareness—food, drink, sex, rivalries, etc. still garner a great deal of human attention—but humans, unlike every other kind of organism, are no longer *restricted* to these perceptions. Today humans perceive a great deal more about their surrounding environment, they have slowly but surely had their blinders removed. Humans can keep an eye open for predators, and still observe the phases of the moon; humans can remain keenly attuned to a conspecific partner, and yet be aware of the symmetries in the surrounding landscape. In consequence of this greater perceptual freedom, humans have built up a broader awareness of the pattern, structure and form contained within the spaces around them, thereby unleashing the power and understanding to reconstruct so many different aspects of their surrounding world.

None of this yet explains how and why humans first began the process of altering their environment, or how humans first became perceptually aware of the environment's expanded potential—this is a topic that will be taken up in great detail later on. But for now it is enough to recognize that these characteristics of the human transformation work to nullify the constraints of biological evolution. By mutating the environment through artificial reconstruction, by perceiving into the surroundings beyond just evolutionary necessity, humans have gained for themselves an unprecedented level of biological freedom, a freedom with revolutionary and immense consequence. Today humans can *sense* this freedom, they have even given it a name —it is called *free will*. But it is important to understand that free will is not something neurological or psychological or even philosophical. Human freedom is derived from the entirely observable actions of humans reconstructing their environment to their own benefit, and from the entirely observable consequence that humans have largely unshackled themselves from the chains of biological evolution. Unlike every other species, and unlike humans from not that long ago, humans today find themselves no longer evolution-bound.

To say that humans were once pure animal implies that the phrase no longer applies. But of course humans are still animal, that part of the terminology must remain intact—humans are born, humans die, humans retain all the usual animal needs and instincts. So in the phrase *pure animal*, it is the word *pure* that must disappear, implying in turn that humans in their

modern circumstances are to be described as animal *and* something else. This something else should capture what has been added because of the human transformation, capture what distinguishes modern humans from all the other animals, and distinguishes modern humans from their former purely animal selves. Thus I would propose that modern humans be characterized by the phrase *animal and construct*.

The term *animal* of course requires no further explanation. The term *construct* has been chosen because it has dual effect, capturing the two essential and related aspects of the modern human condition:

1. The artificial reconstruction of the human environment; and
2. The novel behavior forged by that artificial reconstruction.

What determines the non-animal aspect of humans today is the non-natural setting in which humans live. Ironically, many humans are scarcely aware that they live in an artificial environment—a surrounding of clothes, houses, schools, cars and so on seems entirely "natural," having been the default for almost every person from birth. But in fact there is almost nothing of nature left in the human environment—literally everywhere one looks one sees instead artificial reconstruction. To get a sense of just how enormous and just how widespread this alteration has become, consider the North American continent and what it must have looked like just a few hundred years ago, when the human impact was still minimal and widely spaced, the land a nearly untouched natural splendor—mountains, prairies, swamps, woodlands, rivers, streams—nature in its most pristine abundance. Now take a good look at what the North American continent has become today. All across its vast area we now find a blanketing cornucopia of artifacts: roads, houses, towers, wires, pipes, fences, shopping malls, office complexes, airports, bridges, tunnels—the catalog of construction goes on and on. Plus think of all the large cities, where almost nothing remains of what stood there before. And it is not just the expansiveness of all this change, it is also its detail and depth. Think of just one apartment building, then think of just one floor in that building, then think of just one room on that one floor, and then count all the room's artificial contents: television, carpeting, air-conditioner, furniture, utensils, pictures, books, computers—once again, the catalog of construction goes on and on. We humans live in an ocean of artificiality, we find it "natural" only because we are so thoroughly drenched in its ubiquitous effect.

As pervasive as all this environmental construction has become, perhaps even more profound are the behavioral changes this construction has engendered. Every environmental mutation prompts a human behavioral consequence: controlled fire impacts the way humans prepare and eat food, clothing changes the range of human movement, etc. Indeed it is something of an ongoing cycle: an environmental change prompts a behavioral change, which in turn provides the means for further environmental change, and thus the mutations, both environmental and behavioral, accumulate. Today the enormous catalog of artificiality in the human environment is matched by an equally immense catalog of newfound and unnatural behaviors: cooking, driving, reading, writing, calculating, showering, shaving, voting, changing channels, changing clothes, playing video games—once again, the list goes on and on. And every one of these newfound human behaviors can be traced back to some new artifact introduced into the human environment, something that did not exist there before. We drive because there are cars on the street, we read because there are books on the shelf, we shave because there are razors in the cabinet, etc. Thus we see how the word *construct* and its two related components—the reconstruction of the human environment and the behaviors those reconstructions engender—captures exactly the amount of change that has been layered onto humanity over the course of the human transformation. For if we were to remove every artificial feature that now exists in the human environment, and if we were to suppress every human behavior that can trace its origin back to those removed artifacts, then all that would then remain would be our biological and evolutionary selves, all that would then remain would be the pure animal that *Homo sapiens* once was.

Finally it should be noted that the circumstance of humans as both animal and construct creates something of a paradoxical conflict—these two aspects of modern humanity do not always play so well together. The animal aspect of humanity has the insistent effect of tugging humans backwards in time, towards an era of more restrictive biological need and of temporal and spatial immediacy. Humans today still experience the pressing urges of food, sex, dominance and safety, betraying the species' survival-and-procreative underpinnings, and we may not fully recognize how much of our modern living has been slyly arranged to serve as an outlet for these evolutionary demands. Hunting, org charts, sports rivalries, pornographic web sites: tear away all the sublimation and what remains are ardent attempts to scratch the itch of an unquenched animal need. Thoreau understood that need, having famously included a passage in *Walden* about happening upon a woodchuck on the path, and wanting to seize it in his hands and devour it raw. There is nothing surprising or maladjusted about any of these desires, actions and behaviors, they are the inevitable consequence of humans still retaining all the characteristics of a biological organism.

At the same time, the constructive aspect of humanity propels humans in the opposite direction, towards expanding innovation and towards a broader temporal and spatial awareness. Environmental reconstruction does require diligent and persistent effort, but the long-term rewards of that effort have now become apparent to almost everyone—a greater satisfaction of needs, abundant physical comforts, a counterweight against boredom, and a sense of forward purpose. Plus we should not forget the most *fundamental* reward that human construction bestows, namely a much greater degree of human freedom. The most challenging obstacle on this path towards human progress appears to be the overcoming of rudimentary instinct. To expand their horizons beyond just the here and now, humans must build up the discipline to postpone their immediate needs, must find the strength to delay their gratifications. Abstinence, austerity, rigor, sobriety, monasticism, willpower—so many different forms of asceticism, all targeted to suppressing the beast within. These strivings are, in the most fundamental sense, entirely unnatural, but for all that they are in no way to be derided. Human progress appears to be a noble quest, a swimming against the tide, an endeavor to build an actual paradise here on the planet Earth.

This inner human conflict between animal and construct is both challenging and relentless, and it is a conflict that has been growing more intense ever since the first days of the human turn. But what else could have been expected? What else could have been expected for a species fashioned by two entirely different processes, processes that work to oppose each other and that run in counter directions? What else could have been expected for a species originally forged in the long-running furnace of biological evolution, and now so lately and so thoroughly reshaped by a process that works to defy all of evolution's effects?