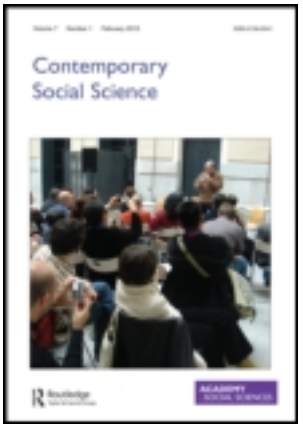

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The biological myth of human evolution

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The most significant paradox in the study of human evolution is that human evolution over the last few million years has been bio-cultural evolution, and it is thus perversely unscientific to try and imagine it as simply a succession of biological processes and effects. Without confronting the cultural aspects of human evolution, one cannot approximate the reality of human origins or human nature. The failure to do so explains why biologically reductive theories of human evolution are generally rejected by anthropology.

Introduction: the Pioneer Plaque

In 1972, NASA launched Pioneer 10, an unmanned space probe, on a voyage outside of the Solar System. In the event that the probe was intercepted by aliens, astronomer Carl Sagan vigorously lobbied for the probe to contain a depiction of the senders. Sagan prevailed, and eventually the probe went up with a drawing supervised by Sagan (and astronomer Frank Drake) and vetted by NASA (Figure 1).

Of course, the two people in the picture do not represent the actual senders of the spacecraft, but rather represent the group in which the actual senders intended to convey their own membership—not the nation, not the ecosystem, not the neighbourhood, but the species. That is why they show a youngish, well-built male and female. What sense that might make to alien minds is a good question, but is not the question I am interested in posing here. Nor am I going to pose the question of whether the male is issuing a generalised greeting of some sort ('Hi! Welcome to the galaxy!') or a warning ('Halt! This is a private nudist colony!').

Instead, I want to ask the question of why indeed they are naked and depilated. After all, when the aliens trace the probe back to Earth (a map is conveniently featured on another part of the plaque), would they not be surprised to find the humans

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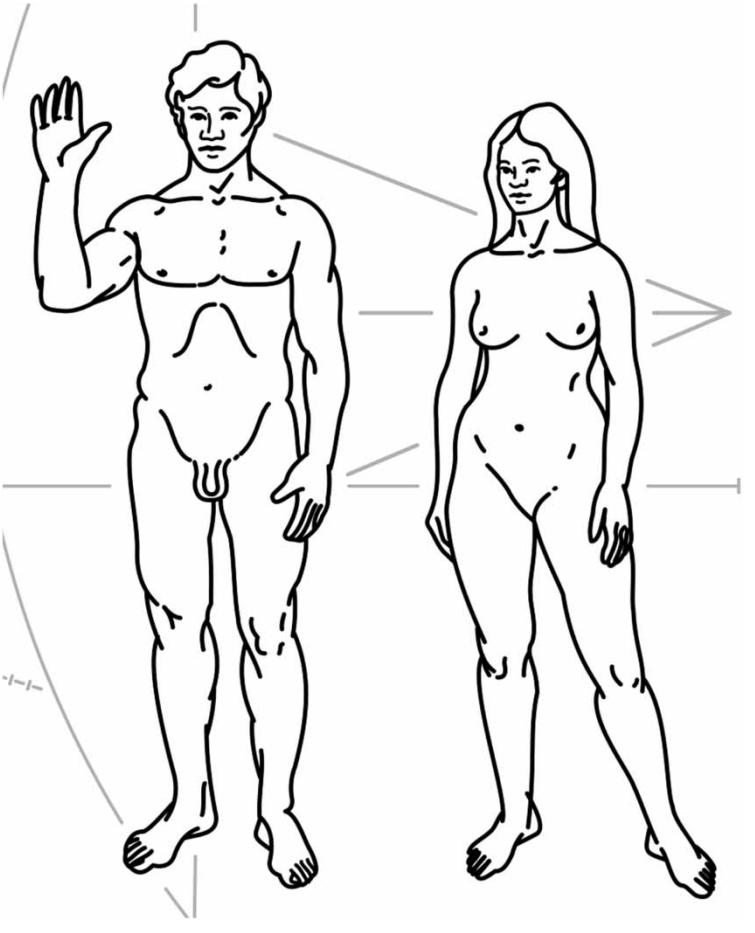

FIgure 1. Detail of the Pioneer plaque

clothed? Would they recognise us, if all they can match to the illustration is our face and hands? Or would they be angry at us for lying about what we look like, and proceed to annihilate us on that basis?

We probably do not have to worry too much about that, but a real question remains. Why choose to send aliens an image of what we look like, and then show us differently from what we actually look like, except while showering or having sex? The answer is that the astronomers intended to convey a 'natural' image of our species, one stripping humans of their culture. And yet not only is that a lie, for that is not what the aliens will see when they land among us, but also it is a lie about a lie, for in imagining itself to be free of cultural information, it nevertheless conveys cultural information. Certainly the haircuts and bikini waxes are cultural; as are the gendered postures and gazes, with only the man looking you straight in the eye. (To a baboon, that would be a threat gesture; let us hope the aliens do not see it that way.)

I use this example to illustrate two points: (1) the cultureless human is an artefact of the imagination, and (as discussed below) a non-Darwinian imagination at that; and

(2) the vacuum created by removing culture from the human object is readily filled by the imagination of the scientist.

The myth of human nature without culture

The earliest philosophers and mythologists that we know of appreciated that they lived in a different state than do wild animals, and sought to understand, explain or at least explore that fact. The most famous is the story of Adam and Eve (literally, 'Earth' and 'Life'), who exist in a baby-like state of nakedness and amorality until the snake and the fruit, and subsequently must lead 'real' adult human lives of labour, childbirth and, of course, the knowledge of good and evil. The next most famous is the Babylonian story of Enkidu, whose transformation from animal into man (and friend of Gilgamesh) is mediated by a sexual seduction.

The point is that the state of being human is the result of a transformation out of an earlier state, when we were like the animals. The transformation took place in the dim historical past, or in a mythical time and place, but it invariably answers the question: What were we like before we were 'civilised', or before we were fully human? What was the basic nature of humans like before the acquisition of humanity—brought about in one case by the knowledge of good and evil, or morality; and in another by the love of a good harlot?

What these stories share is the fundamental assumption that there is an imaginable state of humans without humanity, or human nature before the acquisition of human culture. Perhaps, then, all we need to do to reconstruct that primordial nature is to imagine what that 'man in a state of pure nature' might be like. The phrase was popular among the 18th-century French *philosophes*. Nevertheless, it had been used by Thomas Aquinas ('*Sed quia possibile fuit Deo ut hominem facere in puris naturalibus* . . .'), and the imagined creature had even been introduced into political polemics by Thomas Hobbes in *Leviathan* (1651). The mind that imagines a person with the beastly nature, but lacking the humanising culture, of modern people is a pre-Darwinian mind. Such a thought experiment is independent of Darwinism (*contra* Konner, 2002; and Pinker, 2003), and is inconsistent with modern knowledge of human evolution.

That is the myth I wish to discuss in this paper: The idea that you can analytically separate human biology from culture and meaningfully study only human biological evolution, or that there is a 'natural history' of being human that is not a 'natural/cultural' history.

Culture is actually inextricably part of the story of human evolution in three distinct ways.[1] In the first, and most basic, sense, culture is detectable in the material record as lithic technology, that is, as stone tools, by 2.5 million years ago. With short thumbs and small brains, living apes do not make stone tools (a bonobo named Kanzi was taught to make and use them, although his 'level of expertise is significantly below that seen in Oldowan hominids', according to Schick & Toth, 1994, p. 139). So these implements mark a point in the evolution of our species, the origin of technology. They are a shorthand for anthropologists, however, insofar as they are not so much the

first tools, as the first tools *identifiable as such* in the archaeological record. Rope or nets, for example, which those stone tools would have been quite useful for making, would not be identifiable to archaeologists, nor would bone or wood implements. The twigs and rocks used by living chimpanzees, for example, would not be recognisable as tools, and their living spaces have only the subtlest elements of a human archaeological site (Mercader *et al.*, 2002). The point is that we have been co-evolving with technology for over 2.5 million years; natural selection has as much adapted us to it as surely as cultural selection has adapted it to us. Our hair, for example, is distinctly different from that of the apes in several ways. Unlike the apes, the hair on our heads would be a sensory nuisance, covering our faces unless carefully tended. That tending, however, is not simply utilitarian, for in human societies generally, one's hair and other manners of self-decoration symbolically announce aspects of one's status. And indeed, the very first images of the human form that we have—the 25,000-year-old 'Venus figurines'—show the hair carefully tended (Figure 2). That is, with Upper Palaeolithic technologies they groomed a biological feature of negative survival value, imbuing it with symbolic social meanings; and the same might well be true of the sexually dimorphic human facial hair. Its social and symbolic value must have outweighed what a pain it was to develop in the first place (for apes have neither long facial hair nor long head hair), and must have been there from the very beginning (Thierry, 2005). The biological feature had to co-evolve with the cultural ability to take care of it, and to ascribe meaning to it. Culture is thus an *ultimate* evolutionary cause (Mayr, 1961) of the human condition.

The second sense in which human biology is inevitably cultural is in the sense that the environment in which any human develops it itself constituted by the local traditional economic, linguistic, dietary, behavioural and social features that constitute human 'culture'. Animal and plant domestication, for example, lead to less exercise for the developing jaws, which in turn leads to a reduction in adult facial size. This is known as 'developmental plasticity' and is widely thought to involve reversible modifications to the DNA, or epigenetics (Kaplan, 1954; Bateson *et al.*, 2004; Jablonka & Lamb, 2005). Maternal stress and diet affect the developing foetus;

FIgure 2. Detail of the 'Willendorf Venus'

child-rearing practices affect children not only psychologically, but also physically, as in the skull shape associated with the practice of strapping an infant to a cradle-board. Although genetic differences among populations exist, they play a small role in explaining health-risk disparities. Rare genetic diseases, such as sickle-cell anaemia, are not a major factor in explaining the average seven-year difference in life expectancy between whites and blacks in the United States. In modern society, the major differences in health risks across populations are attributable to economic and social causes (Gravlee, 2009; Kuzawa & Sweet, 2009). The environment in which every human being develops is a cultural environment. Culture is thus also a *proximate* cause (Laland *et al.*, 2011) of the human condition.

And the third sense in which human biology is invariably cultural lies in the very nature of the science itself, in explaining who we are and where we came from, as any origin myth does, but with the modern cultural authority of science behind it. As a consequence, scientific narratives of human evolution share many of the features of hero myths (Landau, 1984), and of origin narratives generally (Stoczkowski, 2002). The mythmaker brings common elements in general circulation to the listener, and integrates elements that resonate meaningfully with the audience (Lévi-Strauss, 1962). In particular, narratives of origin invariably contain political information, since origins are histories and histories are political. Archaeological work, for example, is routinely co-opted for nationalistic ends (Abu el-Haj, 2001; Meskell, 2002). Nor can one escape that situation: scientific work on human beings has always incorporated cultural values.

Why there is no escape

While the fruitfly biologist has the luxury of studying things that have very limited political meanings, the anthropologist is obliged to study entities that are themselves the products of political history (nation, tribe, state, ethnicity), and produces knowledge that has immediate cultural relevance (Coon, 1968). Darwinism, for example, is a theory of kinship, in that it speaks of descent from an ape ancestor. The story of a transformation of animal into human is not in itself terribly unusual, but of course Darwinism is not about werewolves. A story of an animal ancestry is not terribly unusual either, but neither is Darwinism about totemic clans. However, like other theories of kinship and descent, Darwinism situates a person in a particular cognitive universe of other species and other people. That makes it political.

The very first generation of Darwinian biologists were faced with the rhetorical challenge of presenting the descent of humans from apes in the absence of a fossil record documenting that transition. Ernst Haeckel, in *Natürliche Schöpfungsgeschichte* (1868; English translation, *The History of Creation*, 1876), solved the problem by creatively inserting the non-European peoples of the world into the slots connecting Europeans to the apes. With the aid of over a century of hindsight, it can be seen that in order to score points against the creationists, Haeckel was rather quick to sacrifice the full humanity of the non-white races. He had little difficulty in solving the scientific problem with the cultural knowledge of his day.

Some decades later, Tennessee passed the Butler Act, prohibiting the teaching of human evolution (not Darwinism per se, but specifically 'any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals'). The greatest trial lawyer in the United States, Clarence Darrow, works *pro bono* for the only time in his career, on behalf of the defendant, John T. Scopes (Larson, 1997). In preparation for the trial, Darrow reads the textbook (Hunter, 1914) out of which Scopes is accused of teaching. What he discovers is that after hygiene, photosynthesis and Darwinism, the student is introduced to the innateness of crime, sterilisation as its remedy and old-fashioned (even for 1925) white supremacy. Moreover, this seems to represent the normative ideas of the biology community, for they have signally failed to criticise these ideas. Darrow (1925) immediately begins attacking them, and evolves within a year from biology's greatest defender to its greatest basher; and the scholars whose views on extinct fish he had valued so highly now become 'irresponsible fanatics' (Darrow, 1926, p. 137) for their views about living people. Somehow, the biologists had come to think that the fact of ape ancestry was more important to fight for than the fact of social injustice—a priority not shared by the lawyer.

Once again, narratives of human diversity were entwined with narratives of human ancestry, the historical became political, and the scientific community found its 'Darwinian' politics more difficult to defend than its Darwinian biology. In the ensuing decades, we will see modern American gender relations inscribed upon monkeys (Sperling, 1991) and australopithecines (Lovejoy, 1981). We will see chimpanzees evolve from primordial hippies (Goodall, 1971) to manipulative strategisers (Goodall, 1986) to paramilitary units (Wrangham & Peterson, 1996). This does not mean that there is no reality, but it does mean that we cannot, and do not, take this literature at face value, because we know that the science is an intrinsically cultural science.

History shows very clearly the pervasive influence of cultural ideas upon scientific narratives of human evolution. This influence stems from a fairly straightforward biological fact: that we are humans, studying humans, that is, studying our own ancestry and diversity. The intellectual distance implied by classical laboratory science between the subject and object, between the observer and the observed, simply is not there. We are not humans studying flies, but humans studying ourselves.

One way of getting around the problem is to deny being human. In the earliest work of human evolution, Thomas Huxley (1863) attempted to convince his readers that they ought to be zoologically classified with the apes because they are so physically similar to apes. Faced with the blurred distinction between scientific subject and object, then, Huxley creatively argued that an unprejudiced zoologist, one from the planet Saturn, would certainly see things his way. This trope, invoking science fiction as fact, has proved to be remarkably resilient. In his science bestseller, [*The Rise and Fall of*] *The Third Chimpanzee*,[2] biologist Jared Diamond (Diamond, 1992, p. 2) explained, 'A zoologist from Outer Space would immediately classify us as just a third species of chimpanzee …', despite the non-existence of extra-terrestrial zoologists, much less of any idea how they might classify terrestrial life if they did

exist. Indeed, the diversity of classificatory systems simply among human societies suggests that the aliens might well employ criteria that we have not even thought of.

An alternative way around the problem is to acknowledge that however much we might like to keep the distinction between subject and object clear, we simply are stuck as humans studying our own place and history, and consequently we can never escape the cultural value that such reflexivity brings to a scholarly enterprise. This can be scientific, but it is a different kind of science, one in which cultural ideas invariably pervade the process, because the subject is a politicised and mythologised one, and we understand it in a highly cultural context. It can be scientific because it is premised on the reality of being a human studying humans, however, which is certainly a firmer scientific ground than pretending to be a Martian.

In this case, then, one is obliged to appreciate that nature and culture co-produce scientific facts about our ancestry, and that however authoritative one might wish one's pronouncements to sound, they are not objective and cannot be objective, because the science is structured in a way that prevents them from being so. One simply does not theorise oneself in relation to boron or Jupiter as one does in relation to the neighbours or to the ancestors (White, 1947). The best one can do, then, is to recognise what cultural knowledge is incorporated into the scientific facts, and try to transcend the silly mistakes of one's predecessors (Lewin, 1987). Unfortunately, although we recognise this in principle as well as practice, we hardly ever talk about it, and it is predicated on knowing what mistakes have already been made, and why they are mistakes (Eldredge & Tattersall, 1982).

Anthropology biologised

At the time that natural selection was being codified as the central principle of British biology, a principle called 'the psychic unity of mankind' was being codified among German anthropologists (Köpping, 1983). It was relatively simple: we are a single species, and it is possible to understand diverse people from other cultures because our brains work the same way, and so our biology is effectively a constant in understanding the diversity of human lifeways. Uncontroversial as this proposition may sound today, German anthropology actually stood in opposition to German evolutionism, the most popular version of which held that humans comprised multiple species, at different distances from the apes (Haeckel, 1868). Consequently no enterprise of cross-cultural understanding (i.e. ethnology or early anthropology) would effectively be possible, for our brains are actually wired differently than those of other peoples (Marks, 2010). From these premises, Haeckel drew the immodest conclusion that after reforming biology, he would produce

> an important and fruitful reform of anthropology. From this new theory of man there will be developed a new philosophy, not like most of the airy systems of metaphysical speculation hitherto prevalent, but one founded upon the solid ground of comparative zoology. (Haeckel, 1876, p. 367)

Eventually, his followers on that solid ground would produce the worst anthropology the field has ever known.

Haeckel, however, also produced a strange template in casting himself as the voice of modern scientific, Darwinian biology as a contrast to the foolish anthropologists. In paraphrase, it looks like this: 'Anthropologists are fundamentally mistaken about their subject because ignorance and closed-mindedness have impaired their critical faculties. I will now correct them because I have no intellectual prejudices.'

During the First World War, the Australian–British neuroanatomist Grafton Elliot Smith used that template in challenging anthropologists with his pet theory that all civilisations had arisen in Egypt. This came at a time when anthropologists had begun to appreciate the creative abilities of diverse indigenous peoples, and had recognised that civilisation is a complex historical process, not a state of achievement. Thus he categorically rejected the ideas about culture, and the histories of diverse and ancient peoples 'put forth *ex cathedra* by the majority of modern anthropologists' (Smith, 1915, p. vi)—and invented his own. Unfortunately, his anthropological methods were not as rigorous as those that real anthropologists had been developing, and he eventually managed to see all manner of mythological, artistic and technological motifs as identical to, descended from or cognate with all others (and ultimately from Egypt). Historically minded American anthropologists such as Alexander Goldenweiser (Goldenweiser, 1922) found Smith's work valueless, and younger British anthropologists simply abandoned historical speculation for functional analysis (Stocking, 1995). His stature in medical (and palaeo-) anatomy ensured that his ideas would be aired, and his knowledge of Egyptology was impressive, although real Egyptologists were also very critical of his work (Crook, 2012). Nevertheless his anthropology was an exercise in anti-intellectualism; in contemporary anthropology, we have become accustomed to the bluster of the autodidact in the name of creationism or ancient astronauts (von Däniken, 1968).[3]

In the footsteps of Smith, biological scientists have challenged normative anthropology from time to time. Most commonly these have been reactionaries writing on the issue of race, or more generally, the genetic interpretation of history. Franz Boas's paradigmatic *The Mind of Primitive Man* (1911) showed that biology (i.e. 'race') was an irrelevant variable in explaining 'civilisation', for the latter was actually the result of historical cultural processes. Nevertheless the human geneticist Charles Davenport, for example, posited alleles for feeblemindedness to explain political, economic and social stratification in his *Heredity in Relation to Eugenics* (1911); and decades later the plant geneticist C. D. Darlington (1969) attempted to explain social inequality naturalistically by recourse to other imaginary properties of the gene pool. By the 1960s, some American biologists were actually working against the Civil Rights Movement—notably, the anatomist Wesley Critz George and geneticist Reginald R. Ruggles Gates (Jackson, 2005).[4] Paramount among their arguments was that American anthropology had been intellectually hijacked by an 'equalitarian' agenda, led by Boas and his communist/Jewish anthropological associates (Putnam, 1961; Schaffer, 2007). Astonishingly, vestiges of this argument can still be seen in the work of some contemporary biologists, when confronted by recent advances in race theory (Sarich & Miele, 2004; Leroi, 2005).

So why does the genetic explanation of history not just die, like the geocentric Solar System? Is there something else at stake, aside from some self-interested public relations work for genetics?

Of course there is. The fundamental question of relevance here is: why is there social inequality? One answer might be that it is the result of long-term injustice and exploitation, and therefore we should work against inequality and for social justice; this was first formalised by radical scholars of the 19th century (Marx, 1867). Radical writers on the other side of the political spectrum, however, identified the inequality, but saw no injustice; to them, the social inequality was merely an outward manifestation of an underlying natural inequality (Gobineau, 1853). To the extent that some people had more than others, they deserved it, for they constituted a natural aristocracy. The basis of that aristocracy is invisible, but any possibility of visualising it would be politically very powerful. Science is irrelevant to the first explanation, where the issue is simply social justice; but as a tool for visualising the otherwise invisible naturalistic basis for social inequality, science may be very useful to the second explanation. The science might be as specialised as the IQ test, or brain size, or skull form, or more broadly it might simply be the belief that everything significant in the course of one's life is innate. Social class being significant in the course of a life, consider the implications of these two statements, made near the beginning and end of the 20th century, respectively.

> Permanent progress is a question of breeding rather than of pedagogics; a matter of gametes, not of training. As our knowledge of heredity clears and the mists of superstition are dispelled, there grows upon us with an ever increasing and relentless force the conviction that the creature is not made but born. (Punnett, 1905, p. 60)

> We used to think our fate was in the stars. Now we know, in large measure, our fate is in our genes. (James D. Watson, cited in Jaroff, 1989, p. 67)

Both statements are obviously rubbish as biology, but both are from important, indeed eponymous, genetic sources—one of the 'Punnett square', universally memorised by biology students, and the other of the 'Watson–Crick double helix', also universally memorised by biology students. But regardless of their biological vacuity, the statements are full of political meaning, for the very reason outlined above. I cannot say whether either of them actually believed their own words, but certainly they remained scholars in good standing after saying them—which would not have been the case if they had said, for example, that the Earth was created in 4004 BC. (Watson's fall from grace would come two decades later, after explicitly querying the intelligence of Africans to London's *The Sunday Times*, and having his subsequent speaking engagements in the UK summarily cancelled.)

Thus, once again, the ostensible statements about 'nature' are actually full of 'culture'. The statements exist not solely in a naturalistic universe of heredity and DNA, but simultaneously in a cultural universe of morality, politics, history and economics. However they may have been intended, the statements were scientifically false, possibly 'good' for genetics by raising public interest in it, and morally 'bad' by reinforcing social hierarchies and rationalising the perpetuation of injustice. If a

background in molecular biology or entomology did not prepare one for the polysemic aspect of scientific pronouncements about human origins and diversity, well, that is why anthropology is its own specialty.

To study human origins rigorously, then, we must grapple with two unique scientific issues, which became increasingly clarified over the course of the 20th century. First, narratives of human origin are bound up in narratives of human diversity, and both are highly mythologised and political. And second, although it is tempting to see 'slavery' in ants, or 'courtship' in birds, these are not homologous to the human condition, and we actually have little precedent in zoology for understanding human evolution, behavior or diversity.

Human evolution is not biological

While it may be attractively pseudoscientific to imagine human evolution as simply biological history driven by simple biological processes, the most fundamental aspects of human evolution belie that assumption. They are not biological features with biological histories, but biocultural features with biocultural histories. To assert the equivalence of, say, bird plumage and sports cars in attracting mates (Diamond, 1992, p. 175) is to ignore the fact that the sports car is manufactured and sold, and has only been in existence for a few generations. The sports car is not a biological fact, as the bird's plumage is, but an artefact, with an entirely different ontology. Their equivalence is not a fact of biological evolution, but a metaphor—like equating a tree and an umbrella for both providing shade. To understand any aspect of human evolution as if it were like bird plumage may thus be very misleading. Briefly consider the five principal features of the human condition: bipedality, brain, skin, language and sexual dimorphism, and note how they are to be understood bioculturally, rather than simply biologically.

Bipedality

We identify the two-legged stride as the initial feature separating an evolving human lineage from its ape ancestors, evident in the form of nearly every part of the body—the head atop the chest, rather than in front of it; the spine more curved; the hands relieved of weight-bearing; the pelvis, hip and knee supporting the body's weight, rather than trailing after it; the foot more stable and less flexible, and the big toe adjusted for weight-bearing rather than for grasping. Nevertheless, the anatomy of the ankle appears to be more variable in *Ardipithecus* and *Australopithecus* than was thought a decade ago (Lovejoy *et al.*, 2010; Zipfel *et al.*, 2011; Haile-Selassie *et al.*, 2012). Whether these structural variations had biomechanical consequences, which might suggest different kinds of walking in different hominid species, or whether they represent anatomical noise, like the fact that about half us have a big toe longer than our second toe and about half of us have a longer second toe, is unclear. Nevertheless, the very use of bipedalism as an evolutionary marker conceals

a shorthand. After all, chimpanzees and gorillas can and do walk bipedally under certain conditions.

The evolution of bipedality, therefore, was not the change from a quadrupedal state to a bipedal state, but rather a constraint on the locomotor options of the ancestor, who evolved from something that *could* be bipedal to something that could be nothing *but* bipedal (Stanford, 2006). It was not the acquisition of anything new, but a choice to concentrate exclusively on one of the things that it had been doing occasionally. What evolved was obligate bipedality from facultative bipedality, or the integration of what was originally a behavioural choice into our genomes. Bipedality is as 'hard-wired' as any human feature, but it arose in an effectively Lamarckian fashion; that is, our ancestors chose and learned to do it, and now we, their descendants, are programmed to do it (West-Eberhard, 2005). And yet, we are also not born doing this biologically innate habit. As infants, we learn how to move like adults; it actually takes a few years. And like other learned things, there are many ways of walking, and they differ by place and circumstance. Clearly, 'innate' and 'learned' are not antonyms.

Brain

We can readily document the three-fold expansion of the chimp-brained *Australopithecus afarensis* to the human-brained human. We like to think that it made us smart, and that being smart enabled us to think rationally, along the lines of, 'Say, that fire stuff is both dangerous and useful. I wonder if there is a way to subjugate and control it?' That has been a popular way of thinking about why we have such big brains since the Enlightenment—the better to solve problems with (Falk, 1992).

There are other possible reasons than utilitarian problem-solving, though. The expanding communicative power of modern computers has necessitated the development of spam filters, antivirus software and identity-theft protection. It is certainly conceivable that the expanding communicative power of language in early human ancestors necessitated the development of intelligence to distinguish truth from lies, as language made it easier to mix them up. Chimpanzees have been observed to exhibit deceptive behavior, but they do not lie. Only humans lie, and we do it because language permits us to. Language is the way we evolved to communicate, but it also strained our ancestors' limited thought processes as it permitted them to communicate better nonsense and bolder fibs to one another. In other words, the enhancement of our thought processes may have been a response to the new communication system rather than to any environmental challenges in nature.

Humans adapt today, of course, principally culturally. We have come a long way from chipped stones to nuclear bombs, and our brains have had a lot to do with it. But the history of human adaptation is technological, not cranial. Our foreheads and chins, the marks of modern humanity, first appeared in Africa between 150,000 and 200,000 years ago; but many tens of thousands of years elapsed before representational art appears, much less metallurgy or the wheel or sliced

bread. And we do not have a learning curve for it: When people first began to carve and paint, it seems they began to do it very nicely. That suggests latent capabilities that were always there biologically, and were eventually discovered culturally, like the ability to type or drive a car. We can all do it, some can do it better than others, some never learn it, and for most of human history nobody at all did it.

The modern human head, therefore, is effectively disconnected from human history, which is a social and technological history, involving the capacity of banding together to augment personal memory with social history, which in turn produces recurrent cycles of innovation, adoption and improvement, which then leave a material record. But the disconnect between physical form and technological difference creates a paradox, since we do indeed associate technology with cranial form for over 2 million years of prehistory. That prehistory involves humans adopting technologies and adapting to technologies, and becoming increasingly reliant upon them for survival.

The most crucial aspect of gradually substituting technological for biological adaptation is that we reached a threshold at which the technology became autocatalytic, and working upon the appropriate social and cranial substrates, eventually produced history (Childe, 1936). Human biology is thus again relegated to a constant in understanding technological difference; to the extent that biological difference may correlate with technological difference, it is non-causal. Necessity, not neurology, is the mother of invention.

Skin

Although it is one of our most conspicuous differences from the apes, our skin leaves no fossil evidence, and our knowledge of how it evolved is at best indirect. Most fundamentally, however, our skin's function is different from that of the apes in two significant ways. Physiologically, it is involved in thermoregulation, to permit humans to dissipate heat by sweating, rather than by panting. Presumably the reduction of body hair was necessary to make the evaporative cooling process efficient, and the switch away from panting was made necessary by having co-opted the tongue for communicatory purposes.

Unlike the apes, our skin also serves a complex set of social functions. First, at puberty we develop regions of hair growth in the axillary and genital regions, which do not have homologues in the apes, and whose function is to retain the smelly secretions of specialised sweat glands. Second, the skin is the site of body art, presumably having been decorated initially by natural pigments, such as ochre and ashes, and also communicating social information, although in this case visual rather than olfactory. And third, whatever selective pressures may have been operating on the skin were certainly altered by the practice of making and wearing clothing, which itself has those dual functions, social and thermoregulatory.

Finally, our most familiar example of natural selection on the human species involves the relationship between melanin content of the skin and global latitude (Jablonski & Chaplin, 2010). Nevertheless, the primary pattern of variation in

human skin is quite different than it is in chimpanzees. Chimpanzees often darken as they age, such that lightly pigmented and darkly pigmented individuals may be found in the same group. In humans the primary pattern of variation in this trait is between-group variation; in chimpanzees it is within-group variation, and not related to latitude (Montagna & Yun, 1963). One would be misled quite readily in trying to understand much about human skin—its function, variation and evolution—by recourse to chimpanzee skin in any other way than as a contrast, for human skin can only be fully understood bioculturally (Jablonski, 2006).

Language

Our mode of communicating is of course quite different from that of an ape. Yet all existing languages have equivalent expressive capabilities, and we have no well-grounded idea what a partly formed language might even be like. Further, not only does it help us communicate, but also it gives us a unique marker of group identity. Pronunciation, vocabulary and other aspects of language help to tell us who we are and who we are not; that is, they encode social information. Unlike walking, we have little in the way of a material fossil record to tell us anything about how and when talking evolved (the tongue and larynx do not fossilise); but like walking, talking is both innate and actively learned. And again, what other animal takes several years just to earn how to communicate?

Most significantly, language is rules: rules about what sounds matter (phonetic), what correspondences to make between sound combinations and objects or states (lexical), how to combine them appropriately (grammatical), and the inflections of tone or movement that modify or emphasise the sounds. The thing about rules, though, is that they are inherently arbitrary. We have rules because there are various possible ways of doing things, and the rule says to do it this way. Considering language as rule-based behavior reveals two significant features. First, language is a microcosm of general human thought and behavior, which consist of local rules of conduct (i.e. culture)—how to think and act, out of the many possible ways of thinking and acting. Second, to try and understand language biologically, as cultureless nature, is not very illuminating (Everett, 2012).

Further, reduction of the canine teeth is another classic aspect of the human condition, although the aspect that is most often modelled is their lack of sexual dimorphism, unlike the canine teeth of the great apes (see below). This is commonly understood as the product of a diminution of the competition for mates, that is, as weakened sexual selection. Nevertheless, it is awfully difficult to speak intelligibly through large, interlocking canine teeth, and it is certainly conceivable that sexual selection had nothing to do with it—and that same natural selection that restructured our tongue, larynx and brain for the purpose of learning to communicate in this unique symbolic fashion might have been at work on our canines as well. Or perhaps they worked in complex synergy; for the fact remains that we are the only anthropoid primate species with small, non-dimorphic canine teeth—which suggests a unique evolutionary history for them.

Sexual dimorphism

The differences between men and women have been of evolutionary interest since Darwin's (1871) work. Natural selection explained the differences between species as the result of competition for resources; sexual selection would explain the differences between the sexes as the result of competition for mates. Diverse species, however, have different patterns: some have flamboyant males, other flamboyant females, and some have low levels of sexual dimorphism (Zuk, 2003).

Humans, of course, have biological differences between the sexes, but there are also cultural differences in the form of rules and expectations for girls and women versus boys and men. In the mid-20th century we began analytically to bracket off the cultural expectations from the natural physical differences as 'gender' in opposition to 'sex' (Mead, 1949). The arena, once again, was political: were the social inequalities experienced by women facts of nature or facts of historical injustice? The ethnographic data showed that many aspects of the social relations between men and women that we consider 'natural' are actually different elsewhere, which in turn suggests that what we experience is not in large part the result of a universal human nature (sex), but of a parochial local history (gender).

What does evolution tell us about the naturalness of human socio-sexual relations? In *The Third Chimpanzee*, Diamond (1992) points the reader to the sexual dimorphism in human body size, and explains that '[a] zoologist from Outer Space ... would instantly guess that we belonged to a mildly polygynous species' (p. 71). The implication is that it is natural for a husband to be unfaithful to his wife, but not vice versa, for the aliens would testify that biologically we are somewhat like Hamadryas baboons. But suppose the aliens looked at our canine teeth instead, which are also sexually dimorphic in polygynous primate species, but are *not* so in humans? By that feature, the aliens would see us as similar to the monogamous gibbons, whose canines are the same size in both males and females.[5] Or suppose they look at our sexually dimorphic facial hair, or subcutaneous fat deposition, or mastoid process on the bottom of the temporal bone of the skull, none of which has a homologue in our close primate relatives, and which thus imply a different, non-comparable pattern of sexual dimorphism in our species? Or suppose they note the sexual dimorphism in who tends to cut their hair short and who tends to augment their facial coloration, unlike any other primates? I suspect that my alien, who examines the totality of the information, would conclude that there is no natural form of human socio-sexual organisation discernible from the patterns of human sexual dimorphism in the context of primate sexual dimorphism.

The alien would also observe that the relationship between the familiar and the natural is a complicated one, and that the act of naturalising the familiar is a political act; for this discussion is not about natural, biological matters at all, but about biocultural matters.

The reason that human patterns of sexual dimorphism are different from those of other primates, and defy our placement into a simple taxonomic scheme of primate socio-sexual relations, has to do with our evolutionary history. In generating a

species so dependent upon social learning for its survival, evolution not only increased the size of our head, but also extended our period of immaturity. Expelling a large-headed infant through the birth canal makes a human mother's task more difficult than a chimpanzee mother's task; consequently, human birth is almost invariably social, that is, someone else is around to help (Trevathan, 2010). Nor does it end there. Assuming a four-year inter-birth interval, a chimpanzee mother with a newborn infant will be weaning a four-year-old and leaving an eight-year-old on its own. The 12-year-old chimp already has its wisdom teeth. A human mother with a newborn and a four-year-old, however, also has an eight-year-old who cannot fend for itself, and a 12-year-old who may still be a decade away from the maturity implied by erupting wisdom teeth. In other words, to support this evolutionary reliance on culture, the human life history evolved, and the mother came to need a lot more help than did her small-brained ancestors (Hrdy, 2009). Where would that help come from?

The answers seem to be: menopause and marriage. Chimpanzee females breed more or less until they die; human females stop breeding, but do not die for another few decades, which permits them to give their own daughters the assistance at motherhood they require (Hawkes *et al.*, 1998; Caspari & Lee, 2004). Additionally, the system of familial obligations that constitute marriage (as opposed to 'pair-bonding') operate to provide the human female with another source of assistance that the chimpanzee female does not need. In general, those obligations will extend beyond the spouses themselves, linking their families into a network of obligations and expectations. Marriage creates in-laws; pair-bonding does not (Barnard, 2011).

Why do not anthropologists find much value in speculations about sexual selection in humans? Because once again the relevant ontology is not biological, but biocultural (Fuentes, 2004; Schultz, 2009). Thus, whatever genetic properties might accrue to the descendants of bigger, stronger males would likely be mitigated by the evolution of foresight, language and weaponry to make it increasingly more difficult for a single big, strong male to dominate the others physically. Moreover, stories of caliphs with 900 children notwithstanding, one of the most obvious consequences of marriage is to tend to equalise the reproductive output of men, both compared with one another and compared with women. Mate choice in humans is also not predicated on just biological features, but on cultural features as well—reputation, wealth, wisdom, honour, proficiencies of various kinds—which are likely to randomise, if not outweigh, any small biases in favour of specific biological features. Indeed, it is not even clear to what extent humans have generally chosen their own mates, with arranged marriages still common in many parts of the world. That is, marriages have often been between families, not between individuals. Thus, while many things may correlate with snapshots of human mate choice in the modern age, it is very unlikely that such small biases have been either universal or consistent enough to be an evolutionary force upon our species. Such correlations may be sociologically interesting, but their relevance to understanding our evolutionary history is minimal (Rose & Rose, 2000; McKinnon & Silverman, 2005; Richardson, 2007).

We have, in the ethnographic record, only a tiny sample of the myriad ways in which to be human, and we still have trouble grasping and communicating the alienness of other lifeways without the transformative experience of ethnographic fieldwork. To the extent that anthropology is science, it is not a science like laboratory science, for it is fundamentally experiential, and the Martians cannot help us out with it. Over the course of the 20th century, anthropologists abandoned the search for the biological causes of culture as futile, and began to focus instead on how adaptable the human brain permits us to be, in allowing its owners to adapt to as diverse a set of conditions, in as many ways, as we indeed have. We thus work with two well-supported conclusions about the human brain: (1) it is effectively a constant in understanding differences or similarities in the behavior of human groups; and (2) it is not the sole producer of the human mind, which is also formed by social history and circumstance.

Conclusion: anthropological exceptionalism

No other living species has evolved as we have, which makes it difficult to model human evolution as simply biological processes, with precedents in zoology (Pagel, 2012). The reason human evolution cannot be studied from a strictly zoological perspective is that such an endeavour begins by denying the very facts of our existence that we are trying to explain—how we came to be the creatures that we are, weak and slow-moving, unable to survive without the non-biological environment that our ancestors made, yet nevertheless overrunning the planet; genetically almost identical to chimpanzees, yet driving them and all the other apes to extinction. We did it by evolving into biocultural animals, animals who look at the things around them and ask what they can do with this stuff. While other species live in material, ecological environmental contexts, humans are shaped by their historical environment, that is, by the things our ancestors said and did, and in turn construct our present environment technologically, socially, politically, economically and linguistically. To the extent that we can find approximations of ourselves in other species, this is nevertheless what we evolved to be, and our evolution is consequently subject to rules that are not readily apparent in the evolution of other species (Sterelny, 2012).

To try and represent humans as non-cultural beings is a fool's errand, the residuum of a pre-modern scientific approach to understanding the human condition. This is itself simply an instance of a deeper and broader myth, that humans are scientifically understandable independently of culture—either your own or that of your remote ancestors. To begin the study of humans by imagining that you could free yourself or your object of study from culture, then, would be as regressively anti-intellectual a proposition as any that comes from a modern creationist or climate change denier. Modern studies of human evolution are engagements with the biocultural; the determinism may be weaker, and the interpretative elements may be self-consciously more evident, but we no longer pretend that we are Martians, or that our subjects are automatons. We are humans studying human ancestry and diversity, and there are few, if any, precedents in the history or diversity of life to guide us.

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Notes

1. 'Culture' is used here in the anthropological sense of a symbolic, linguistic, historical environment, limited among extant species to *Homo sapiens*, rather than in the ethological sense of 'learned behaviour'. In the latter usage, one still has to distinguish what humans do from what other animals do, for example, as 'cumulative culture' (Mesoudi, 2011). This replicates the distinction that the anthropological usage of 'culture' is intended to denote, but more clumsily.
2. The book lost '*The Rise and Fall of*' on its American release.
3. There were interesting convergences between the sloppy methods of Erich von Däniken and Smith. For example, Smith insisted on having discovered an Indian influence on the Maya by interpreting the artwork on a Maya stela as depicting an elephant; von Däniken's Maya stelae show rocket ships.
4. The geneticist Theodosius Dobzhansky referred to Gates privately as 'a mutant'; Theodosius Dobzhansky to Ashley Montagu (12 July 1947), Ashley Montagu Papers, American Philosophical Society.
5. Unlike the non-sexually dimorphic canine teeth of a human, the non-sexually dimorphic canines of a gibbon are large.

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