

Threats to our only science of life: evolution and the battles over meaning

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ABSTRACT

The theory of evolution by natural selection is the central organising principle of all science of life and, according to Daniel Dennet, it is “the most important idea anyone ever had”. Yet its broader significance in understanding human affairs is threatened by attacks from the right by religious fundamentalists and from the left by postmodernists, post-structuralists and others invested in the standard model of social sciences that emphasises culture as distinct from the biological substrate of minds and bodies. Evolution also faces threats from within when biologists themselves concede the study of human behaviour and meaning entirely to the social sciences and humanities or, more rarely, to religion. I argue that the attacks from the right and the left echo the same concerns; that evolution challenges the specialness of humans (it does), and that a naturalist world view endorses or exonerates bad behaviour (it mostly does not).

Key words: Natural selection; naturalist fallacy; moralist fallacy; religion; postmodernism; post-structuralism; standard social science model; society; morality

It is hard to imagine, in the first decade of the twenty first century, the sensation that the discovery of the gorilla caused in Victorian London. The first western accounts and formal description (based on a skull and partial skeleton) of a large new ‘indescribably fierce’ ape from West Africa introduced the western gorilla (*Gorilla gorilla*) to science. Public interest in this new ape was stoked both by astounding tales of the beast’s ferociousness and by an increasingly radicalised working class, intent on overturning establishment views of human uniqueness and a divine social order (Cosans 2009; Desmond and Moore 1991). The most imposing pro-establishment figure in science at that time was the anatomist Richard Owen, and he already had a formidable track record defending both the paragon status of humans and the status quo from the bestialisation of man and transmutational thinking (Desmond 1989), as evolutionary ideas were called at the time.

Owen lectured to the British association as early as 1854 on the impossibility of great apes, including the gorilla, walking upright. He made several strong assertions for human uniqueness, including that that human brains had structures (notably the hippocampus minor) that apes did not (Desmond and Moore 1991). These structures provided evidence, Owen claimed, that humans are so unique that they should occupy a sub-class of their own. Thomas Henry Huxley was foremost among the young turks who took Owen to task on this point and its broader implications. These included a seminal lecture on the theory of the vertebrate skull to the Royal Institution in March 1858, still months before the Darwin-Wallace (1858) paper on natural selection, and over a year before the publication of the *Origin* (Darwin 1859).

The modern view is that Huxley roundly defeated Owen and showed himself to be the better anatomist (Cosans 2009; Desmond and Moore 1991). Huxley continued

to develop his ideas in his lectures to the public, and at the school of the mines in the 1860’s which grew into his most important book *Evidence as to Man’s Place in Nature* (Huxley 1863) in which he argued that chimps, gorillas and humans are at least as similar to one another as any is to baboons, and that Owen’s ideas about human uniqueness were not supported by the evidence.

The stoush between Owen and Huxley was neither an isolated incident nor an academic scuffle over anatomy. It was really a fight over the relationship between humans and animals and the extent to which humans are special. This issue was explosively political in the battles over anatomy, medicine and reform in 1830’s London, battles in which Owen played a major conservative role (Desmond 1989). It was equally controversial in Victorian Britain in 1859 when Darwin published the *Origin* and had been a major reason Darwin was so slow to publish and to break ranks on evolution with his scholarly peers. It is also a major reason for the phenomenal reception that the *Origin* received when it was eventually published in 1859, and with the controversies that evolution still stokes more than 150 years later.

Huxley’s support for Darwin and natural selection is well chronicled (Cosans 2009; Desmond and Moore 1991). It is likewise well known how Owen turned bitter enemy of Darwin and his allies such as Huxley and Hooker, in part at least because natural selection obviated Owen’s own views on evolution and the history of life and in part because it more generally undermined Owen’s claims for human uniqueness (Cosans 2009; Desmond and Moore 1991). After the publication of the *Origin*, and again following publication of the *Descent of Man and Selection in Relation to Sex* in 1871, the issue of human-kind’s status as a mere animal was easily the most controversial issue.

Even Alfred Russell Wallace, co-discoverer of natural selection with Darwin later claimed that the human mind is so mysterious and complex that it could not have been fashioned by natural selection and must have been fashioned by a superior being. The idea that humans are special and especially that human minds, cultures and behaviour are somehow outside the laws of nature persists today as the most important threat not only to evolution, but to a materialist and rational view of life and what it means to be human.

Today, evolution enjoys a remarkable treble life: in biology, and in much of society, it is widely accepted as our only science of life, our central organising principle and “the most important idea anyone ever had” (Dennett 1995). Religious fundamentalists and many conservatives, however, view evolution as an anti-religious dogma governed by purposeless chance and therefore undermining our special status as reflecting the image of god. These are what I call threats to evolution from the right. These attacks are based on some obviously deep-rooted problems that fundamentalists have with biology and with rational evidence-based thought, but they continually come back to what I will call the apparent purposelessness and meaninglessness of evolution.

The third life of Darwinian evolution in modern society is one in which natural selection is not contested as the main driver of organic change in the natural world, but which is characterised by a persistent sense of the specialness of humans, and of human behaviour in particular. These usually take the form of threats from the left and within; the left because thinking of this kind often comes from the humanities and social sciences, with their standard model of social sciences that emphasises culture as distinct from the biological substrate of minds and bodies, and the relativist mumbo-jumbo of social constructionism served up by post-modern and post-structural analysis. Threats from within, because many biologists too readily concede the study of human behaviour and meaning entirely to the social sciences and humanities, in part as a consequence of the role of prominent yet radical biologists in the attacks from the left.

Threats from the right

Defending evolutionary science from the threat posed by fundamentalist religion, particularly Christian fundamentalism, and particularly in America, is a Herculean labour. New creationist strategies and movements popping up after each defeat like heads of the Lernean hydra. One of the most persistent issues that fundamentalists and conservatives raise with evolution is a deep concern that evolution via natural selection is, in their view at least, random, unpredictable and purposeless. I will shortly argue that neither natural selection, nor evolution in general are random or unpredictable, although I do believe that both natural selection and evolution are largely purposeless in exactly the sense intended by creationists.

Creationist emphasis on the randomness and unpredictability of evolution appears to those unaccustomed to scepticism to be devastating because even those with limited knowledge of the living world can

see that the apparent perfection therein cannot be due to chance or luck. But the only part played by randomness and unpredictability in natural selection is the origin of the genetic variation on which it acts. Beyond the chance occurrence of new variants by mutation, natural selection is an immensely powerful organising force, deterministically eliminating unfavourable mutations, favouring other mutations and integrating the relationships among genetic variants at both the genomic and the phenotypic level.

Experimental studies as well as natural experiments have demonstrated that these processes operate rapidly when organisms experience novel or altered conditions, yet the awesome power of natural selection is manifested over geological time scales that even the most rationally-inclined people find profoundly intimidating to contemplate. It is this decidedly non-random process of natural selection that is responsible for the adaptation, which is so often incredible yet never perfect, that we see in the living world.

The part that chance plays in evolution, however, means that the history of life carries the strong signature of contingency, with new adaptations only possible by altering the architecture that each organism inherits from its ancestors. The contingent nature of evolution is the main reason why adaptation is never perfect, and the imperfection of adaptation is a major point of departure between evolutionary biology and creationism. Evolution modifies the raw material that comes its way by accident of history (the ancestral organism) and by chance (mutations). There is no end point, no intention and thus no pre-determined direction. It is this lack of purpose that most irks the creationists, because there is no scope here to co-opt the natural law of evolution as one of the mysterious ways in which the deity works. It is not just that there is no purpose but that there can be no purpose because mutations arise and selection happens without reference to future utility and thus without any form of intention. There is no need to invoke gods, and just as crucially we have in no way been specially created. The only sense in which organisms are designed is that they are designed to fit the conditions and meet the challenges that their ancestors faced. Creationists recognise, rightly in my opinion, that this refutes all the claims that religions make to a purpose for our existence as individuals or as a species.

Most fundamentalist creationists are overwhelmingly conservative in their morality and political views due to their strong literal beliefs in scripture. A great deal of the power of the scripture to them comes from its ability to explain origins: who we are and where we come from. If evolution tells us where we came from, they argue, then surely it also tells us everything there is to know about who we are and what is right and wrong. That is, it must become our compass on our voyage to discover the meaning of life. Or as prominent creationist Philip Johnson puts it:

“Darwinian evolution is an imaginative story about who we are and where we came from. as such it is an obvious starting point for speculation about how we ought to live and what we ought to value. Methodological naturalism leads inevitably to metaphysical naturalism.” (Johnson 1993).

The problem here is that whatever evolution tells us about who we are, it is unlikely to be virtuous and it certainly isn't likely to be politically expedient. After all, aren't evolutionary biologists obsessed with conflict, violence and sex? The philosopher and historian of science, Michael Ruse, impeccably characterises Johnson's argument and the fear that underpins it:

"To the new creationists, Darwinism is a wolf in sheep's clothing. Secular religion in the clothing of empirical science.... From here it is but a short step to sex, drugs, and contempt for capitalism." (Ruse 1998)

Ruse argues that the creationists' biggest fear is not only that evolution will undermine religion but that it will replace it. The allegation that evolution (or indeed science) is just one of many belief systems, apparently on a par with religious accounts and folk explanations of human origins is one that surfaces increasingly often, particularly in creationist apologetics but also commonly in post-structuralist analysis (Segerstråle 2000). It is a facile allegation that indicates a willingness to ignore the methodological and philosophical underpinnings of science that set it apart from mythology, faith and personal opinion. Nonetheless it has some traction among people who do not understand science whether out of ignorance or willing disregard. The idea that methodological naturalism will lead directly to metaphysical naturalism is an interesting one, and one that I believe is half right.

Johnson is half right because there is strong evidence that scientists are less likely to be religious or belief in the existence of a deity than the general public (Ecklund 2007). Likewise, academics in the physical and life sciences are less religious than social scientists and biologists are the least likely to be religious among all scientists. Whether the apparent "metaphysical naturalism" of these scientists is a consequence of the methodological naturalism of science or because science appeals to people who are independently predisposed to a naturalistic world view remains to be resolved.

Dispensing with the naturalistic fallacy

Creationists like Johnson too hastily conclude, however, that a naturalistic understanding of the living world and of human origins leads to an alternative morality characterised by the same purposelessness as natural selection. Such morality would commit the naturalistic fallacy – the mistake of extrapolating from what is to what ought to be¹. Evolutionary accounts of human behaviour contain homicide, siblicide, infanticide, violence, slavery, sexual coercion, promiscuity, cannibalism, cheating, revenge and punishment in such extreme that they rival the carryings-on in the old testament. That is to say nothing of the adaptive behaviour that sociobiologists and behavioural ecologists have uncovered in other organisms, and that

might reasonably be predicted to be within the evolved human capacity. One can understand those wanting to believe that none of it is true, for surely if it is true then we are irredeemably savage creatures and there is little hope for peaceful, productive and profitable society?

Evolutionary psychology is delivering ever more sophisticated evidence regarding the evolution of human nature. Some of this evidence indicates that humans have evolved behavioural strategies that have historically been beneficial to the perpetrators, yet are in no sense moral. Martin Daly and Margo Wilson's exceptional body of work gives a compelling account of the evolutionary basis of homicide, including the many situations in which individuals kill each other and the historic contexts in which such killing is likely to have evolved (Daly and Wilson 1988). However, in no sense does this work morally sanction the loss of one human life at the hands of another. The insights Daly, Wilson and their colleagues provide into why young men are many times more likely than women or older men to kill one another or to be killed, and the role of asymmetry in wealth as a driver of male on male homicide (Daly et al. 2001) have the potential to alleviate a great deal of human suffering and a considerable burden on society. Although Daly and Wilson's work has had substantial impact in society, I do not believe that such impact has reached far enough, at least partly because of the difficulty that our institutions and those whose job it is to understand society have in dealing with the disconnect between adaptation (loosely, what is natural) and what is right.

There is more to human nature than the unsalubrious things that people do in pursuit of status, resources and sexual success. Humans are exceptionally social creatures with the capacity for great kindness and cooperation, and these traits too have their basis in our evolutionary past. Our capacious brains are devoted in large part to the functions that allow us to be social – remembering people's names and faces; gossiping in order to understand the relationships between various people that we know and even many we have never met; inferring, updating and storing information about the motivations, intentions and characteristics of others and allowing us to imagine how others might feel or react to a situation differently from ourselves. Once again, we must not commit the naturalistic fallacy even though jumping to an optimistic opinion of human nature is pragmatically less devastating than condoning violence or inappropriate sexual behaviour because it may have a biological basis.

Recent research in comparative psychology has led to the prediction that humans share, across societies and religions, a universal moral grammar that sets the fundamentals on which societies build their understanding of morality. This raises the interesting possibility, for which there is emerging evidence, that the very basis of morality has been fashioned by natural selection (Hauser 2006). If this is the case, then although simple rights and wrongs can no more be inferred alone from an adaptive understanding of how behavioural

1. Interestingly, the naturalist fallacy is a common misconception in modern Australian society. Organic farming, homeopathy, many foods, at least one low carbohydrate beer and a large portion of the shampoo market juxtapose in our minds their preferred concept of "natural" and "right" or "good".

phenomena have evolved than they can from ancient mythologies, the very basis of our systems of morality can be exposed to rational and materialistic study. In time, and with a much more nuanced public understanding of how our natures have been shaped by evolution and the interesting interactions that arise as we grow and learn within our cultures, it may be possible to liberate our moral foundations entirely from our evolutionary past: after all, we operate in such a different world from that inhabited by our grandparents, much less the world where our ancestors spent the last million years. The mismatch between our modern world and the worlds of our ancestors is, for example, thought to be an important cause of many modern disease epidemics (Gluckman and Hanson 2006). Could an evolutionary understanding of how we intuitively fathom right and wrong and how our experience shapes our inherited moral senses lead to solutions to modern moral problems in the same way that evolutionary medicine is revolutionising healthcare?

Although life derives no meaning in any traditional sense from evolution, it is increasingly clear that by understanding biology – and especially evolution – we can better understand pleasure, pain, insight, clarity, creativity and how and why we get the illusion of meaning and profundity. Also we can understand a great deal about how our social brains, combined with our social institutions, predispose many of us to religion (Dennett 2006). Once again, the successes of evolutionary biology continue to expose the sometimes quaint, often inane and occasionally dangerous thinking of religious fundamentalists. I think the fundamentalists are right to be afraid of evolutionary biology: Darwin's idea truly was dangerous to those who oppose a rational understanding of our world and of ourselves. It tells us a great deal about who we are and why we do what we do (Dennett 1995; Pinker 2002), including why we are superstitious and why we worship deities (Dawkins 2006; Dennett 2006). The threat is not entire, however, because it tells us much less about how we should live, particularly in the modern world. That, as we shall see, is something we have to work out from far more than evolutionary biology or religious doctrine.

Threats from the left and within

Evolutionary biologists also often fear to tread on the hallowed ground of human behavioural evolution, turf where religion, the social sciences and humanities have long staked out positions, and where those that do rush in are too readily labelled fools. Whether out of fear of foolishness, or a desire to avoid conflict with those who are often politically more sophisticated, we biologists often persuade ourselves that there are more interesting and tractable questions to answer about how the world works than questions about human nature. I believe that the hostility with which research on the evolution of human behaviour is often greeted is, as it was with the threats from the right, because evolution by natural selection is a genuine and direct threat to much of the business of the social sciences, particularly to the standard model of social sciences which gives overwhelming primacy to culture, learning and other forms of experience in shaping human behaviour.

In so doing evolutionary biology is perceived as a threat to some cherished ideas including the complete dissociation of gender and biological sex, race as an arbitrary social construct, and the progressive materialistic dialectic of Marxist philosophy. It is unfortunate, at best, that some of the most strident critics of modern evolutionary approaches to understanding humanity have come from among the ranks of distinguished biologists. These include Dick Lewontin, Steven Rose, Simon Levin and the late Stephen Jay Gould all of whom were mobilised by strong social justice concerns and to varying degrees by radical Marxism. They were instrumental in the transition from the old (pre 1960's) left who viewed science as an objective moral weapon in the struggle for social justice and equality to the new 'cultural left' who characterise science as just one form of social power, wielded by an elite often in defense of the bourgeois, white, patriarchal status quo (Segerstråle 2000).

The attacks from the left on evolutionary studies of human behaviour are remarkably similar in vehemency, although often more articulate and entertaining than those from the right. Unlike the attacks from the right, it is not the entire canon of evolutionary biology that is under assault, but rather any attempt to understand human behaviour in an adaptive framework. The concern is no longer the threat that evolution poses to human uniqueness among animals, but it remains concerned with meaning and morality. While the politics are usually from the other end of the spectrum, and Marxist dialectical materialism and poststructuralism are preferred recourses rather than biblical authority, I believe that this is still largely the same clash over meaning. In particular, those opposed to an adaptive understanding of human behaviour and society seem afraid to look in the mirror for fear of discovering that natural selection might have fashioned them in the image of an early Greek satyr rather than a god or at least a titan. I will argue that the profound discomfort with evolution that leads to the threats to science from the left and within once again stems from the idea that there may be little more meaning to life than the fact that we are simple apes fashioned over millions of years by the blind and banal process of natural selection. This discomfort is grossly misplaced.

For those who would attack evolution from the left, it is safer to believe that everything interesting about being human is culturally inherited or socially constructed. Rather than our fates and failures being in our stars, or at least our genes, they would be squarely in ourselves and, presumably, we would have the capacity to do something to avert our fates and ameliorate our failures. We can then only blame our failures on ourselves and the nebulous forces of socially constructed racial, class and gender differences that mysteriously yet inevitably emerge from those most vague phenomena – society and culture. It is argued by those that would oppose an evolutionary view of human nature not only that evolution robs life of meaning and morality (such as religion claims to deliver), but also that any biological basis to human differences might justify or be used to justify discrimination or oppression, and that a biological basis to human nature would rob us of free will, and thus responsibility for our

actions. A far better and more comprehensive account of the modern threats to a scientific understanding of human nature and an utterly compelling rebuttal of all of the arguments I have just listed is given by Steven Pinker in his exceptional book, *The Blank Slate: The Modern Denial of Human Nature* (2002). For brevity's sake, here, my argument is a sketch at best.

Much of the attack from the left hinges on the apparent determinism of biological explanation and the contrasting apparent plasticity of cultural explanation. The biology-culture or gene-environment dualism is part of an ancient and exceptionally well-travelled idea. This idea is at the heart of what Pinker (2002) has called "the last wall standing in the landscape of knowledge". The history of knowledge is littered with dualisms that have outlived their usefulness as rhetorical or pedagogical devices. Newtonian physics demolished the wall between celestial perfection and sublunary imperfection, Lyellian geology destroyed notions of the creative past and the unchanging present, and successive discoveries in biology obliterated the idea that the living world obeys different laws from the physical and energetic principles that apply to non-living objects. Pinker's last wall has many forms, among which Renee Descartes' (1641) distinction between the physical body and the mind, which he held to be the non-physical seat of consciousness and self-awareness, is one of the most important. The idea that human minds have a non-physical manifestation dates back at least as far as the earliest recorded philosophers, including Zarathustra and Plato.

The non-corporeal nature of mind has been consistently challenged by materialist science, and the recent renaissance in neuroscience has all but demolished it, at least within scientific circles. Nonetheless although mind-body dualism is on its last legs, elements of the last wall are still highly influential in the public consciousness and in academia. These include the distinctions between biology and culture, material and spiritual, instinct and learning, genes and environment and nature and nurture. Developments in modern genetics, behavioural science and neurobiology are slowly showing each of these dichotomies to be spurious, but they remain powerful and persistent ideas that recur persistently. More problematically, the standard model of social sciences which gives primacy to environmental, learned, social and cultural factors over inherited, innate and biological factors as determinants of human behaviour remains fiercely defended by a sizeable, yet shrinking proportion of social scientists. For some historic insight into the reasons, consider the words of John Stuart Mill, the influential liberal thinker, philosopher and British member of parliament.

"I have long felt that the prevailing tendency to regard all the main distinctions of the human character as innate, and in the main indelible, and to ignore the irresistible proofs that by far the greater part of those differences, whether between individuals, races, or sexes ... [are] produced by differences in circumstances is one of the chief hindrances to the rational treatment of the great social questions, and ... human improvement".

Mill goes on to say that *"this tendency is so agreeable to human indolence and to conservative interests generally that unless attacked at the very root, it is sure to be carried to even greater length than is really justified by the more moderate forms of intuitional philosophy"*. (Mill 1873)

Mill's point is an attack from the left on ideas that tend to be associated with biology and with evolution precisely because they might be misused to serve conservative interests. Mill can be forgiven for so starkly contrasting indelible innate tendencies against the environmental circumstances that shape an individual, given the state of biology in his time. It is less forgivable that with all we now know about the subtle interactions within the genome and between genome and environment, the stark contrast of nature from nurture and genes from environment are still propping up the last wall. It is also not difficult for me to sympathise with Mill's general position on human improvement, particularly given his substantial contributions to liberal thought and social reform.

It is, however, much more difficult to find sympathy with the majority of twentieth century social scientists whose thinking on the subject appears to have retreated into ever more extreme expressions of the primacy of experience over inheritance, such as those expressed by the 'Dean of American Anthropology', Alfred Kroeber that "Heredity cannot be allowed to have acted any part in history" (Kroeber 1915). Kroeber did as much as any single thinker to elevate culture as autonomous from minds and certainly from physical bodies or individuals, part of a completely separate world (Pinker 2002).

Developments in cognitive neuroscience are finally giving us the material pieces of the puzzle of the mind, consciousness and thought, allowing us to dispense with pointless mid-body dualism. Likewise developments in genetics are showing us how intimately genes and environment interact in building bodies, including brains. One of the most exciting developments in genetics concerns the imprinting of particular genes based on the parents' experiences of the world, such that those genes are silenced or at least their expression is down-regulated in the offspring (Wilkins 2005). Thus not only do genes and environment interact, but the environment faced by the parents can influence whether and to what extent certain transmitted genes are expressed in the offspring. And as Richard Dawkins argued more than 30 years ago (Dawkins 1982), the genotype can profoundly alter the environment an individual or his or her descendants find themselves in, with this environment forming part of the organism's extended phenotype.

Given the progress that science has made in demolishing the last wall, it is disappointing that those who would study the evolutionary basis of human nature are still cheaply attacked from the left as being biological determinists. The idea that human nature is determined exclusively or even chiefly by biology is as anachronistic and as unhelpful as the idea that biology has no place in the study of society and that culture and environment are the only or the major determinants of human behaviour. Evolutionary psychologists and human behavioural ecologists have moved well beyond the last wall, and are making long-needed progress toward understanding the evolutionary basis of human behaviour, including the

complex and subtle interactions between genes, natural selection, learning, culture and environment. Modern biology makes the old 'last wall' notions of immutable deterministic biology and flexible, mutable culture nothing more than anachronistic caricatures. Those of us most familiar with biology have no excuse for adopting the language of determinism or of committing the naturalist fallacy by interpreting the adaptive basis of behaviour as somehow morally right. We also have a responsibility to build a proper and more subtle public understanding of the biological basis of behaviour including how culture and learning operate on the substrate of biology. It is only in doing so that we can inoculate society against abuses such as eugenics.

Those with most invested in culture, likewise, have no longer have any defensible basis on which to deny biology or human nature. Many opponents of biological and particularly evolutionary approaches to human studies are more concerned with the fact that what we find out might be unpalatable or ideologically unsound (Rose 2009). Just as inferring what ought to be from what is (the naturalist fallacy), it is fallacious to misinterpret what one believes ought to be (e.g. socialist utopia, or that gender is entirely independent of biological sex) as the way the world truly is. This is the moralistic fallacy.

A recent high-profile case is the work of Joan Roughgarden who highlights the surprising array of sex roles and mating systems in the animal world as support for a biological basis for a variety of non-traditional sex roles and gender identities in human society (Roughgarden 2004). Further, Roughgarden and her colleagues contest the validity of sexual selection, one of the best-supported pieces of evolutionary theory on the basis of a pre-existing position that gender and sex-roles are more plastic and variable than a fairly narrow uber-competitive caricature of sexual selection (Roughgarden et al. 2006). I believe that the case for tolerance in our attitudes to gender identity is far too important to be left to flimsy analogies with the mating systems of many distantly related species. I know there is some comfort to be found in a biological explanation for sexuality or gender identity, but committing the moralistic fallacy entertains the possibility that whether a behaviour is acceptable or not can be bolstered or, conceivably, dismissed on comparative biological grounds. Contesting the material evidence supporting a scientific theory on the basis that it does not support the author's ideological viewpoint (i.e. committing the moralistic fallacy) can be immensely harmful to science and to society, as Lysenko and the history of Soviet genetics illustrates. In terms of the last wall and the standard model, it is hopeless and dishonest to dismiss the biological and adaptive nature of human behaviour out of the fervent wish that all of us come into the world with precisely equal potential in all respects, and that we are written by and thus both liberated and oppressed by our cultural influences alone.

Although I have argued that pitting biology against culture is spurious and outdated, I should conclude by considering where the modern science of human nature

leaves the questions of meaning and morality. Opponents of this science on the left are concerned that a biological basis to human differences might justify or be used to justify discrimination or oppression. Further, opponents of this science from both the left and the right have argued that an evolutionary view of human nature denies us free will and thus absolves us of responsibility for our actions, and that it robs life of meaning and morality.

First, let me dismiss the question of discrimination and oppression. Both extreme biological and extreme environmental/cultural views on human behaviour have been used to justify the most heinous oppression. Social Darwinism and eugenic ideas informed oppressive social policies, immigration policy and in no small part to Hitler's genocides. Many of the attacks from the left are fuelled by a determination not to allow these profound injustices to occur again. Yet the equally totalitarian application of environmental determinism has led to often murderous oppression of communist Russia, China, Cambodia and North Korea among many others. There is no doubt that views of human nature are intertwined with views of history and, therefore with ideologies of oppression. Surely it is better not to prop all our hopes for a fair and just treatment of all people on a single view of the basis of human nature. This is particularly true since there is compelling scientific evidence that evolution has in various ways shaped our tendencies to selfishness, cooperation, altruism, nepotism, sexual promiscuity, social monogamy, polygamy, polyandry, infanticide and homicide. If we are to make sense of ourselves and our lives, we have to see past the naturalistic fallacy and the moralistic fallacy and oppose injustice and oppression for their own sakes.

The demolition of the last wall puts paid to determinism, both biological and environmental, and with it to the idea that our will is constrained in such a way that we are not free to act and therefore cannot be held accountable for our actions. That said, much work is needed if we are to understand ourselves and the extent to which hidden and complex genetic and environmental factors manipulate us and cloud our judgement. There is a difference between quashing free will and accountability on one hand and helping people to master their own behaviour, understand their motivations and reveal to them how they deceive themselves on the other hand.

Last, on the central question of meaning and morality, we must arrive at an understanding of how we draw meaning from our lives and how we arrive at morality by the difficult path of philosophical and ethical argument and empirically resolving how societies and the individuals that compose them work. Evolutionary psychology, anthropology, sociology and other sciences can help us to understand at least in part how emotions, morality, superstition and religion have evolved (via many generations of interwoven genetic and cultural evolution), but none of them alone can tell us in simple and absolute terms what we should do or what is right¹. I will, until presented with evidence to the contrary, concede that much.

2. Neither, for that matter, can an antiquated fiction like the Judeo-Christian Old Testament or any other single form of knowledge.

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