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BOOK REVIEW

Kim Sterelny: The Evolved Apprentice: How Evolution Made Humans Unique

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In 1985 The Smiths twittered as merry as larks: "From the ice-age to the dole-age, There is but one concern, I have just discovered: Some girls are bigger than others…". Good song, wrong theory. There is more than one single concern that drives the evolution of our species—or so Kim Sterelny argues convincingly in his rich and lucid book *The Evolved Apprentice*.

The Evolved Apprentice offers nothing short of a theory of human nature by providing an account of human evolution from within natural science, yet from a philosophical point of view. Ever since the times of Aristotle, one of the core projects of philosophy concerns the question of human nature. The traditional response of philosophers to the problem of human nature has been an affirmation of the anthropological difference. The anthropological difference defines a quality that distinguishes all human beings from all non-human beings, particularly from all non-human animals; moreover, the anthropological difference is supposed to explain the unique features of the human mind. According to the classical definition, humans are rational animals, with rationality or reason being the key quality that marks off the human kind and the human mind. One of the first philosophers to break with the traditional approach was David Hume. In a remarkable footnote in the section "Of the reason of animals" of his *Enquiry concerning human understanding*, Hume cheerfully notes that the obvious difference between the cognitive competences of humans and animals is not due to one key dissimilarity, as Descartes and Locke claimed, but rather to the interplay of many, mostly gradual differences (Hume 1999, 167).

The contemporary answer of the philosophical naturalist to the question of human nature has it that human beings are a species of animals and part of nature. That's how things stand apparently. Yet, humans are not "just another species of large mammal"—as Sterelny aptly puts it in his forerunner book *Thought in a*

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Hostile World (Sterelny 2003). Indeed, we are very peculiar beasts, peculiar in ways relevant to evolutionary theory. In contrast to our closest relatives, there is something special in the human evolutionary trajectory, since modern chimpanzees very much resemble their ancestors five million years ago, but we don't.

However, and perhaps surprisingly, most contemporary models of hominin evolution are still very much in the grip of the time-honoured anthropological difference, as they represent attempts to demonstrate in numerous ways that the evolutionary peculiarity of human life and the human mind follows from one single key adaptive breakthrough. In contrast to Aristotle and along with Hume, Sterelny is deeply sceptical about 'key-breakthrough' models of hominin evolution. The model he offers instead strongly emphasizes positive feedback loops among different features of hominin life that were novel to, or greatly amplified in, our lineage. We are, thus, faced with more than just one key feature: "There is no master adaptation whose origin explains the rest." (p. 20).

More precisely, Sterelny offers a challenge and a viable alternative to the 'standard picture' of human evolution. According to this picture, human evolution was primarily driven by social rather than environmental selection pressures; the fittest among our ancestors were those who were successful at securing the fruits of cooperation while avoiding its costs. The social game of assessing motives for cooperation and improving the means for cheating fuelled the evolution of our large brains. Likewise, and importantly, the standard picture claims that evolution created an architecture of domain-specific mental modules containing rich innate information that allows humans to solve complex adaptive problems without effort and wasting time. This is the much-debated massive modularity thesis. The evolutionary argument for this thesis has it that selection would have favoured minds that come prewired with the sort of information that makes them more successful at solving adaptive problems. The standard picture, thus, focuses on adapted minds, based on two well-known approaches from the philosophy of mind: nativism and individualism. Since the human mind is supposed to contain preinstalled, task-specific information, the standard picture takes a nativist stance; and, since the cognitive power of the human mind is explained by extra-large brains and task-specific mental modules, the picture is unfailingly an expression of individualism.

While Sterelny accepts the tenets of the standard picture that social cooperation has been crucial for hominin evolution and that many routine tasks our ancestors faced are cognitively demanding, he rejects the idea that prewired modules can do the trick of effortlessly solving complex problems, and he claims that the problem of managing cooperation is misunderstood. Against nativism, Sterelny's empiricist and externalist model of human evolution holds that humans evolved to become adept social learners, and against individualism he claims that human cognitive competence is a collective achievement. This achievement not only involves strict dependence on others, it likewise involves strict dependence on our environment being organized in ways that strongly enhance our mental capacities. In short, adapted minds are fine, but insufficient. What one needs in order to be more than just another species of large mammals are adapted environments.

Here is an important example of a positive feedback loop. Our ancestors have both created and responded to a unique foraging mode, a mode that is both social

and involves certain effects on hominin social environments. At some point in the human past (in the Pleistocene), climatic changes encouraged a shift to a new mode of exploiting resources in the environment, namely, cooperative foraging. This altered mode involves the cooperative hunting of large game. In turn, it therefore entails at least three different elements, namely, rich ecological information about the game and the local ecology, flexible cooperation, and adequate hunting technology. Ecological information and technology requires intergenerational transmission by social learning. It just seems most implausible that both ecological knowledge and technical skills could have been invented from scratch in each generation. Moreover, the relevant information and skills are both much too variable and too specific to be innately stored. Better be behaviourally flexible if you go for large and dangerous game.

The general problem with the standard model is its massive underrating of the ecological and social variability in early human environments. Innate information doesn't get you very far when you're faced with a constant string of new problems. Sterelny calls this "the problem of novelty". He takes it to be the central problem that needs to be solved by an account of human evolution. The problem of novelty is the problem of designing minds that are flexible enough to adapt themselves to whatever tight spot or embarrassment of riches they should happen to find themselves in. Learning solves this problem; stores of innate information don't.

So far, so good. However, if you are not under the spell of the innate information idea due to the magic charm of the poverty of stimulus curse, it doesn't come as a big surprise that learning is a key feature in human evolution and—come to think of it—in the evolution of other species, too. Sterelny offers a specific proposal of how our ancestors acquired the bulk of their cultural knowledge: the Apprentice Learning Model (ALM)—hence the title of the book. ALM is introduced and developed in the first two chapters and refined throughout the remainder of the book. Chapter 3 tackles the question of why Neanderthals went extinct and why the human lineage took such a long time to become behaviourally modern. In rough outline, Sterelny claims in anti-individualistic manner that the extinction of Neanderthals does not rely on intrinsic differences just between the Neanderthals and *Sapiens* species, but rather on individual group interactions. Chapter 4 provides an account of the cooperation syndrome typical of humans and defends his model against various alternatives. The most notable example is the Grandmother Hypothesis, which withstands the idea that human evolution is basically driven by cooperation and learning, and explains typical human life history changes as a side effect of increased body size. (as The Smiths already knew: "Some girl's mothers are bigger than Other girl's mothers"). Chapters 5 and 6 treat the problem of free riders and discuss different strategies of cooperative units in dealing with deception and defection. Chapter 7 is then concerned with the cultural evolution of norms and criticises the basic analogy exploited by defenders of moral nativism, namely, the weak analogy between linguistic knowledge and moral knowledge. Faithful to his anti-nativist and anti-individualist stance, Sterelny accepts the grounding of moral cognition in biology, yet refrains from invoking domain-specific information to account for it. The final chapter critically takes up the suggestion that our tendency toward strong reciprocity might be explained by some form of group

selection. Instead of concentrating on the rich and convincing applications of ALM, however, let's focus in the following on key features of ALM itself.

Apprentice learning is defined as supervised and organized trial and error, that is, learning which takes place in an environment seeded with props and other cognitive tools. It requires neither explicit teaching nor learning institutions. The standard picture supposedly not only underestimates the degree of variability in early human environments, it also misjudges the degree to which the informational demands of learning can be offloaded onto the environment. According to ALM, humans excel in a special sort of niche construction, namely epistemic engineering. We are good at creating social and physical environments that make learning tasks easier to bear. Generally speaking, human evolution consists in human responses to selective environments which earlier humans have built.

According to an understanding of heritability in terms of population genetics, a trait is heritable if variation in the trait can be explained by variation in the genes, as opposed to variation in the environment. Heritability in this sense is thought to be mandatory for natural selection to take place. Now, many important human traits are not heritable in this way, since they vary across and within cultures and environments. From a more general point of view, however, what is required for natural selection to take place is that a trait be robustly transmitted, such that the variant in the parent tends to reappear reliably in the offspring. As Eva Jablonka and Marion Lamb have argued, however, there are other inheritance systems besides the genetic system. They identify, for example, four types of inheritance systems (genetic, epigenetic, behavioural, and symbol-based), each of which provides variations on which natural selection can act (Jablonka and Lamb 2005). Similarly, Sterelny has argued before—building on the work of Kevin Laland and others on niche construction (Odling-Smee et al. 2003)—that natural selection can act on traits even if they vary with the environment rather than with the genes, as long as environments can themselves be transmitted down a lineage (Sterelny 2003, 2007). And this feat can be achieved by niche construction—a process whereby living beings, through their activities, modify their own niches and, thereby, transform selection pressures (Sterelny 2010).

So, an apprentice in an adult workshop has access to tools, working models of tools, to raw materials, to any number of intermediate stages in the process from raw materials to finished products, and to adults working on different tasks. The epistemically engineered world of an apprentice is therefore also a richly structured learning environment, endowed with salient features where trial and error learning is far off from random search in a homogenous space of possibilities. In other words, this environment is not poor in stimulation. Once a stimulating learning environment is in place (perhaps it just starts with generously tolerating youngsters who are curiously hanging around in adult work spaces), further learning would increase the probability that an innovation in one generation would establish itself also in the next generation. The intergenerational flow of technical expertise would then elaborate upon this primitive starting point by building up an apprentice system. As tools became more important in adult practices, children were exploring a world increasingly littered with raw materials, by-products of tool making, or partly constructed tools. In the course of this development, expertise was acquired

and exercised based on some very rich environmental support. The apprentices would have had opportunities for observational learning, receiving advice and seeing demonstrations, engaging in guided trials, and embarking on appropriately assigned tasks. The pay-off for the adult practitioner, of course, would have been an offloading of basic or simple tasks onto the apprentice. Now, learning takes a unique form in our species, since we can accumulate 'cognitive capital', and the way we managed the accumulation of cognitive capital is, according to Sterelny, crucial for human evolution. Importantly, this accumulation depends on the construction and stabilisation of special learning environments, that is, it depends on epistemic engineering, rather than genetic transformation.

In sum, the central point of ALM is that cognitive competence and skills develop in an environment adaptively organised to make relevant information ready and available. Cognition is socially and environmentally supported. Improvements in the bandwidth, fidelity, and flexibility of apprentice learning all stem from changes in the coevolving, interconnected parameters of our capacities for coordination and information-pooling in structured environments, rather than from one single key breakthrough in evolution.

Sterelny's argument is both scientifically and philosophically informed. Although the philosophical aspect might not be obvious to all readers, the empiricist, anti-individualist, and externalist angle which Sterelny takes on the question of human evolution—and thus the good old problem of human nature—is certainly informed by the most interesting trends and debates of contemporary philosophy of mind. The range of research and resources Sterelny incorporates, discusses, examines, assesses, and puts to scrutiny is most impressive. There are informed and elaborated references to an extraordinary wealth of distinct research domains. What is the book's most convincing aspect is perhaps the integration of this wealth of research into a relatively simple, yet solid explanatory model.

The Evolved Apprentice is a serious challenge for defenders of the 'standard picture' and it offers a helpful framework to philosophers of mind, philosophers of biology and researchers working on human evolution, archeology, or paleoanthropology. It is food for thought for scientists working in the humanities and the social sciences who are interested in questions of human nature and cultural transmission, not least since many working in the humanities are still in the grip of a picture according to which evolutionary accounts of human nature and cultural transmission amount to some form of crude genetic determinism (Marks 2012). Sterelny's book should not only be seen as a valuable contribution to the on-going debate concerning human evolution, but also as a guiding model for how to achieve a multidisciplinary synthesis from a philosophical point of view when advocating a naturalistic empiricism.

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