

Second Movement. Evolutionary Uniqueness of Humans

1 A Transcending Dung-Beetle¹

In 1996 two French biologists, Claude Nuridsany and Marie Perennou, produced a film entitled *Microcosmos*. The film starred not human actors but much smaller creatures, mostly insects. Thanks to magnifying cameras, a human layperson could see the world of these organisms and follow their ways of living. A biologist may take the film not as an ordinary naturalistic documentary, but as a profound meditation about life and its meaning.

In a sequence of the film a viewer can observe a dung beetle—to which Carl Linnaeus gave the generic name *Sisyphus*, inspired by the hero of an ancient Greek myth—rolling a ball of horse manure twice its size. The ball became stuck on a twig and the creature was struggling to free it. As biologists know, the ball represents a most valuable treasure for the beetle: it will lay its eggs in the manure that will later serve as feed for its offspring. The behavior of the beetle is biologically meaningful and rational: the struggle of the observed animal to loosen the stuck ball was the struggle for survival; it served its Darwinian fitness and ensured the continuation of onticity of the species.

Yet the dung beetle has no knowledge of the function of manure, nor of the horse that dropped the excrement, nor of the human who owned the horse. *Sisyphus* lives in a world that is circumscribed by its somatic sensors, a species-specific world that the German biologist and philosopher Jakob von Uexküll would have called the dung-beetle's *Umwelt*. The horse, too, has its own *Umwelt*, as does the human. Yet, the world of the horse, just like the world of the man, does not exist for the beetle.

If a “scholar” among dung beetles attempted to visualize the world “out there,” what would be the dung-beetles’ metaphysics, their image of a part of the world of

¹This text is inspired by an essay published under a similar title in EMBO Reports 11: 410, 2010, and is a modification of it. See Footnote 3.

which their sensors furnish no data? What would be their truths, or even the Truth, revealed, and thus indisputable?

One animal in every four on Earth is a beetle. The biologist J.B.S. Haldane quipped that the Creator must have “had an inordinate fondness for beetles.” Apparently, beetles are very successful animals. Are we, humans, so very different from dung beetles?

As to the number, we are a successful biological species, too: the total number of humans has newly surpassed 7 billion individuals. Just as do beetles, we occupy most diverse territories on Earth. By birth we are similar: *inter faeces et urinas nascimur* (we are born between feces and urine) as theologian Aurelius Augustine sighted 1600 years ago. Humans also have a species-specific *Umwelt* that has been shaped by biological evolution. A richer one than is the *Umwelt* of beetles, because we have more sensors than they have. Relative to body size, we also possess a much larger brain. The larger brain and the greater number of sensors allow human metaphysics to be more extensive and impressive than would be the metaphysics of the dung beetle.

In contrast to beetles, our species has evolved at a much higher rate than they have. Beetles originated about 300 million years ago and the oldest fossils of beetles indicate that they may not have been much different from the beetles living now. The oldest fossils of the genus *Homo* are only 2.3–2.4 million years old. Our species *Homo sapiens* appears to be the only surviving species of the genus and may have evolved in the last 500,000 years, although fossil data, supported by data from sequencing of mitochondrial DNA, suggest that anatomically modern humans originated in Africa within the last 200,000 years from a single group of ancestors. Modern humans continued to evolve in Africa and had spread to the Middle East by 100,000 years ago and possibly as early as 160,000 years ago. Modern humans only became well established elsewhere in the last 50,000 years (Wood and Richmond 2000). In our days, we can find humans in Antarctica, in artificial towns built on seas, in space vehicles orbiting the Earth, and possibly soon humans will be present on the planet Mars.

Yet, until quite recently, we continued to share the common fate of our fellow dung beetles. We strived for survival. Just as in their case, there is undeniably a world outside the confinements of our species-specific *Umwelt*. But if the world of humans is too complex for the neural ganglia of beetles, we now have evidence that we live in a world that similarly exceeds the seizing capacity of the human brain.

From where does this evidence come? It comes from science, an activity specific to our species and invented by it. Science is one of those activities by which we transcend our biology. In many of these activities, including science, humans roll their balls, no less worried and obstinate than the beetles. But in contrast to the latter, humans often act even if the action is biologically meaningless, at the expense of their Darwinian fitness and thus, seen by the lenses of biology, irrational (Fig. 1).

Applying the biological gauge on the two animals, the humans are—even in science, the paragon of rationality—less rational than are the beetles.



Rational dung-beetle and irrational human

Fig. 1 From the biological point of view, the behavior of a dung-beetle appears to be rational, whereas the behavior of a human individual to be irrational

2 The Uniqueness of Humans

The capacity to transcend one's own biology makes the human species different from all other biological species. In the Darwinian era (A.D.), this statement may sound strange. Before Darwin, human uniqueness posed no doubt to all theologians in the West and also appeared obvious to the majority of philosophers. Biologist Carl Linnaeus, the founder of biological taxonomy, who preceded Darwin by one century, created in 1735 a hierarchical classification of the natural world, dividing it into the animal kingdom, the plant kingdom, and the mineral kingdom. Linnaeus conceived of all members of the kingdoms as God-given (and therefore "natural") and unchanging since their creation. He classified humans, because of their conspicuous anatomical resemblance to apes, among the primates, and thus placed man and monkeys under the same category, *Anthropomorpha*, meaning "manlike." But he also defined six aspects in which humans were unique mammals: theological, moral, natural, physiological, dietetic, and pathological.

For Darwin, humans were products of evolution by natural selection just as all other living organisms. Yet, many devoted Darwinists insisted that humans are special. Julian Huxley, a cocreator of modern "synthetic theory of evolution," in a book entitled *Man in the Modern World*, has an introductory chapter called, "The Uniqueness of Man," probably written in the 1920s (Huxley 1947). He pointed out that for the first followers of Darwin, "man was an animal like any other," but later the pendulum has swung in the opposite direction: humans are different. Some other biologists published books or essays carrying a similar title. Huxley made a list of eight characteristics he believed to be unique to the human species. Other biologists presented similar lists, with up to 21 distinct features specific to humans.

In 1996, biologist George G. Simpson published a memorable paper, "The Biological Nature of Man" (Simpson 1966). He enumerated 10 distinct anatomical traits of humans, and also listed 10 psychological traits, which according to him Charles Darwin had already considered as most distinctive for humans. They included the capacity to use and make tools in great variety, self-consciousness, language, in some humans a sense of beauty, and in most of them a religious sense, which includes awe, superstition, belief in the animistic, supernatural, or spiritual. Simpson noted that according to Darwin normal humans have a moral sense,

“they ethicize.” But, as Simpson emphasized explicitly, Darwin’s purpose was to show that the characteristics which made humans unique are nevertheless “fore-shadowed” in other animals.

Indeed, Darwin concluded in 1871 in his book, *The Descent of Man*, that the differences between humans and animals are “one of degree and not of kind.” In 2008, psychologist Derek Penn in a paper with two coauthors argued that Darwin was mistaken: “The profound biological continuity between human and nonhuman animals masks an equally profound discontinuity between human and nonhuman minds” (Penn et al. 2008).

The apparent gulf between humans and other animals (including humans’ closest evolutionary relatives, the great apes) may appear most intriguing in view of the fact that molecular analysis indicated that there is 99.4 % nonsynonymous DNA identity between humans and their nearest relatives, chimpanzees (Wildman et al. 2003), and that the last common ancestor between humans and chimpanzees diverged only 4–8 million years ago (Wood and Richmond 2000), which is, at the evolutionary scale, a very short period. The spectacular similarity in DNA sequences between humans and chimpanzees, which not long ago fascinated evolutionists and the general public alike, may now be taken merely as a proof of the very short evolutionary distance between the two species, and of nothing more. In fact, the number of genes in the two species may be identical.

The number of human genes has recently been updated by Ezkurdia and coworkers and reduced to 19,000; 1700 fewer than the genes in a previous annotation. This new estimate is not much different from the number of the genes in nematode worms, *Caenorhabditis elegans*. It has been concluded that “more than 90 % of human genes produce proteins that originated in metazoans or multicellular organisms of the animal kingdom hundreds of millions of years ago; the figure is over 99 % for those genes whose origin predates the emergence of primates 50 million years ago,” with the corollary that the number of new genes that separate humans from mice may even be fewer than 10 (Ezkurdia et al. 2014). These figures support the general idea which is in fashion nowadays that the physiological and developmental differences between animals are caused by gene regulation rather than by differences in the basic functions of their proteins. It does not exclude a possibility that humans differ by some alleles of the genes that they shared with the apes or that regulation of some pivotal genes in the latest evolutionary phase of human evolution may have become a starter of some revolutionary innovations; but it apparently implies that the “bookkeepers” of the innovations may have no longer been the genes.

Two recent books by prominent neuroscientists tackle the question of human uniqueness. Michael Gazzaniga considered a long list of traits, tried to find a single theme that tied all them together, and concluded, “Just like other animals, we are constrained by our biology. [...] But the ability to wish or imagine that we can be better is notable. No other species aspires to more than it is. Perhaps we can be” (Gazzaniga 2009). This aspect of human abilities and behaviors is considered later in this book. Vilayanur Ramachandran in his book, which carries the subtitle, *A Neuroscientist’s Quest for What Makes Us Human*, claims, as do many of his predecessors, that “We are [...] something unique, something unprecedented,

something transcendent. We are something truly new under the sun, with uncharted and perhaps limitless potential [...]. Any ape can reach for banana, but only humans can reach for the stars. Apes live contend, breed, and die in forest—end of story. Humans write, investigate, create, and quest” (Ramachandran 2011).

The crucial Ramachandran’s statement seems to be this one: “We are the first and only species whose fate has rested in its own hands, and *not* just in the hands of chemistry and instinct.” The recurrent theme of the present work is the assertion that humans do not have their fate in their hands and the claim that this assertion should be abandoned as a neo-Enlightenment illusion. But taking the word “hand” not as a metaphor but as a real object, an organ of the human body, we can posit: the gulf that separates humans from other animals and makes humans unique has its origin and its basis in the uniqueness of the human hand.

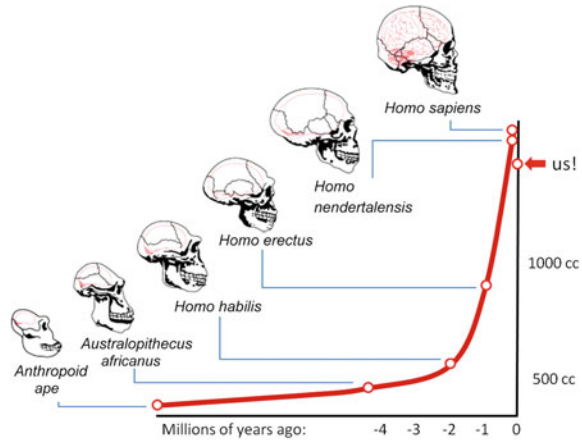
3 Animal Artificiens

The hand is an anatomical organ that can be found in no animal on Earth, with the single exception of humans. Charles Darwin in his opus on the descent of man stated that “Man could not have attained his present dominant position in the world without the use of his hands, which are so admirably adapted to the act of obedience of his will.”

Minor anatomical changes between humans and their closest relatives, the great apes, had made humans bipedal mammals. As already mentioned, human lineage diverged from the last common ancestor with its closest living relative, the chimpanzee (*Pan* genus), some 4–8 million years ago, evolving into the australopithecines and eventually, about 2.3–2.4 million years ago, the genus *Homo*. At least five different species belonged to the genus. The line leading to the modern humans may have started with *Homo habilis* and continued with *Homo ergaster* around 1.9 million years ago, followed by *Homo erectus*. From this species several other species may have evolved, among them *Homo neanderthalis* and eventually, some 500,000 years ago, *Homo sapiens*. The most remarkable feature of the evolution of the genus *Homo* was a continual increase in the brain mass from a cranial capacity of about 500 ml up to about 1300 ml, so that the brain of humans is about three times the size of that of chimpanzees or gorillas (Bradbury 2005) (Fig. 2). Interestingly, the size of the brain of modern humans appears to be a little smaller than was that of the Neanderthals.

Bipedalism evolved well before the brain size started to expand conspicuously. Australopithecines were probably already bipedal, as has been inferred from their fossils from 4.2 to 3.9 years ago. There are at least 30 different hypotheses of the origins of bipedalism (Niemitz 2010). Possible reasons for the evolution of human bipedalism include freeing the hands for tool use, sexual dimorphism in food provisioning (male as hunters, females as gatherers; or the carrying of meat “over considerable distances” as a key factor), changes in climate and habitat (from jungle to savannah: hominines descended from the trees and adapted to life on the

Fig. 2 Evolution of the brain size of primates up to modern humans



savannah by walking on two feet) that favored a more elevated eye position, and to reduce the amount of skin exposed to the tropical sun. The postural feeding hypothesis asserts that chimpanzees were only bipedal when they ate. While on the ground, they would reach up for fruit hanging from small trees and while in trees, bipedalism was utilized by grabbing for an overhead branch. These bipedal movements may have evolved into regular habits because they were so convenient in obtaining food. Alternatively, human ancestors, even with their original arboreal habits, may have lived not far from a shore, and wading in shallow water they may have found rich food with little investment; and wading behavior may have triggered upright posture. Bipedalism may have been one of the central elements of the general defense strategy of early hominids, allowing warning display and intimidation of potential predators and competitors with exaggerated visual and audio signals and also male phallic display.

Whatever the reasons, walking on two legs freed the front limbs from their role in locomotion (Wilson 1998b). Evolution got an opportunity for unbounded experimenting and complexification. Bipedality engendered, as an evolutionary starter, a number of successive innovations that culminated in a qualitative break that highlights human uniqueness.

The hand became the organ of grasping. Grasping presupposes coordination of fingers and the thumb and motor coordination became the first driver of encephalization, increase of the brain mass and particularly of motor neurons. It also engendered increasing the number of sensory neurons and the hand became at the same time the “sensory hand” (Mountcastle 2005).

Grasping and sensing a material enabled early humans’ crafting of tools, to become “toolmakers.” The paleoanthropologist Louis Leakey originally argued that the origin of *Homo* related directly to the evolution of toolmaking (Leakey 1996). Indeed, the species name *Homo habilis* (meaning “handy man”) refers directly to the making and use of tools and *Homo ergaster* (“working man”) to work. A first tool may have been a simple coarse-chipped flint. A stone tool dated 2.5 million years ago

Closing Human Evolution: Life in the Ultimate Age

Kováč, L.

2015, X, 125 p. 13 illus., 9 illus. in color., Softcover

ISBN: 978-3-319-20659-2