The Artificial Ape: How humans invented themselves

Philip Guelpa
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The Artificial Ape: How Technology Changed the Course of Human Evolution, *by Timothy Taylor. Palgrave Macmillion: 2010, 256 pages*

It is an established understanding in modern anthropology that humans are distinct from other animals in our overwhelming reliance on technology. Humans have substituted tools and other forms of cultural adaptation for the evolution of biological modifications of their bodies by which other animals adapt to their environments.

Although some other species, most especially chimpanzees, our closest evolutionary relatives, make limited use of tools, technology is central to human existence. No human societies, regardless of how simple their cultural assemblage may appear, can function without tools and other equipment and the knowledge to use them.

Humans are part of nature and at the same time separate and opposed to it. We are the product of biological evolution, but have created culture (in the broad, anthropological sense) which allows us to transcend the limitations of our biological bodies. How did this transition from purely biological to hybrid biological/cultural being occur? Was there a simple, gradual increase in intelligence among human ancestors that eventually gave rise to modern humans? Or were there critical points of transition at which revolutionary changes took place?

Archaeologist Timothy Taylor proposes in his new book *The Artificial Ape* that a critical change occurred which permitted the appearance of the genus *Homo* from earlier hominins (humans and their direct ancestors) of the genus *Australopithecus*. Taylor contends that a technological innovation permitted proto-humans to overcome a biological limitation on increasing brain size, without which humans as intelligent, cultural creatures could not have evolved. From that point on, according to Taylor, human biological evolution has been profoundly influenced by technology. In that sense, he proposes, we are artificial creatures of our own making; or, as formulated by the famous Marxist archaeologist V. Gordon Childe, "Man Makes Himself".

Ever since Charles Darwin proposed his theory of biological evolution by natural selection, the place of humans in the development of life has been the subject of intense interest and controversy. Although Darwin accepted the implication of his theory that humans, just as much as any other organism, were the product of millions of years of evolution, he recognized and struggled with the obvious ways in which humans were also distinct from other animals.

Darwin understood, in a general sense, the importance of technology for humans in substituting for biological adaptations. The tremendous growth in knowledge of the human fossil and archaeological record since Darwin's time has permitted a much more detailed examination of this process than was possible for him. As is always the case in science, many new questions have been formulated which could not have been conceived previously.

In *The Artificial Ape*, Timothy Taylor proposes the provocative idea that Darwin was wrong about human evolution. As Taylor admits, this is partly a literary device to capture the reader's attention. He is not proposing that evolution by natural selection is not operative for humans as it is for other organisms, nor that humans are not descended from common ancestors with other apes. He does argue, however, that human's elaboration of and increasing reliance on technology has taken us in an evolutionary direction which cannot be understood with reference to natural selection alone. Specifically, he proposes that a particular technological innovation, the invention of the baby sling, is at the root of the evolutionary trajectory which permitted the growth in human brain size and, concomitantly, intelligence.

The physical form and intelligence of human beings are a product of the dialectic (although Taylor does not use this term) between biology and technology. Humans cannot exist purely "in nature," that is without technology. We do not have the biological equipment to survive naked (i.e., with no tools or equipment of any kind) in the wild. This is the result of at least two and a half million years of evolution in which technology (and the intelligence to use it) allowed humans to disperse and survive in every environment on the planet without, for the most part, developing physical adaptations to cope with these environments, as do other organisms.

By itself, the foregoing description is not new. What is new in Taylor's interpretation is the examination of the critical point which he proposes first set humans off in this direction. There is a great paradox in early human evolution. The fossil record demonstrates that, beginning with the appearance of the genus *Homo*, there has been a progressive and quite substantial increase in the ratio of brain size to body size as compared with other apes, and with animals more generally. This increase in brain size is thought to reflect growth in intelligence and is roughly correlated with the growing sophistication in material culture (i.e., tools and other artifacts) found in the archaeological record.

Increasing brain and thus skull size present a biological dilemma of extreme evolutionary import. Whereas most apes (as well as other mammals) are quadrupedal (i.e., they walk on four limbs) and their bodies are held roughly horizontal as they walk, humans are bipedal (i.e., walk on two legs) and their bodies are held vertically. In order to accomplish this change in posture and locomotion, a significant re-engineering of the pelvis had to occur. Among other consequences, this reduced the size of the birth canal, the opening in the pelvis through which the birthing infant must pass. While quadrupedal animals give birth relatively easily, modern humans have difficulty in passing an infant through this narrow opening. This difficulty is most especially due to the relatively large size of the fetal skull at term.

Australopithecines, the major group of human ancestors prior to the appearance of the genus *Homo*, were bipedal, but had generally small body sizes and their brains were barely larger than those of chimpanzees. The limitation in the size of infants at birth due to the constraint imposed by the reduced size of the birth canal would appear to have created a very strong selective pressure against brain enlargement and, consequently, also limited the increase in intellectual capacity. In other words, natural

selection would have worked *against* increasing brain size.

This condition existed for several million years. Indeed, there is currently no definitive archaeological evidence that australopithecines engaged in the systematic production of stone tools. Given the capacity of modern chimpanzees for limited tool production and use, it is likely that australopithecines had at least equivalent capabilities. There is likely to have been an australopithecine technological repertoire, perhaps largely based on organic materials, which formed the stepping stone to later developments, but these are thus far invisible to archaeological research. The known archaeological record begins with the earliest stone tools, referred to as the Oldowan industry, concurrent with the appearance of the earliest members of the genus *Homo*, *Homo habilis* (i.e., "Handy Man"). Oldowan tools appear to be associated with the butchering of animal carcasses, whether obtained by hunting or scavenging.

With the evolution of the first members of the genus *Homo*, from some lineage of australopithecines, brain size began to increase. Although there are virtually no fossilized hominin infants, it is to be expected that the relative increase in brain and skull size of an individual would have had to begin in the developing fetus (i.e., before birth), as it does in modern humans. Thus the following paradox, referred to as the "obstetric dilemma," is posed.

Increasing intelligence, as marked by the first recognizable stone tool industry is roughly coincident with the increased brain size in the first members of the genus *Homo*. However, there is no concomitant increase in the size of the pelvic opening. Larger brained infants would have been confronted with an under-sized birth canal and would, therefore, have died, perhaps killing the mother as well. This is clearly an evolutionary impasse. Nevertheless, human brain size did increase. What changed? According to Taylor, the solution was a combination of biology and technology.

The biological adaptation to this paradox was that humans evolved what in comparison to other apes is premature birth. Human infants are highly altricial. That is, they are born at a relatively earlier stage of fetal development than is the case in other apes, and indeed most other mammals. Therefore, their body size and most importantly their skulls are smaller than they would be if infants were born at a developmental stage more typical of other apes, even though the skulls are already larger than those of other ape infants compared to their body size. This premature birth means that human infants are helpless and delicate. They can't even hold their heads up by themselves. An unsupported motion can easily lead to a broken neck.

Other ape infants have to be able to cling to their mothers almost immediately and maintain themselves as their mothers move around since having to hold a dependent infant with one hand severely impedes the mobility of a quadrupedal mother. Newborn human infants are incapable of clinging and remain so for many months. This problem is compounded by the fact that human mothers do not have a horizontal back on which older infants can ride, as is done by gorillas and chimpanzees. Nor do they have substantial body hair for the infant to hold.

There is even a further complication. One of the key distinguishing characteristics of the earliest human ancestors, in addition to and probably correlated with bipedality, was a gradual shift from life in forested environments to living in parkland and open grassland. This required travel between resource locations and places of relative safety (perhaps groves of trees). Such a lifestyle would have posed a problem for the movement of infants and even young children who had to be transported across dangerous, open ground. Furthermore, Taylor cites experimental studies that show that carrying a child "free hand" is awkward and quite demanding with respect to energy expenditure.

Taken together, Taylor argues that from the point of view of purely biological factors, increasing intelligence, entailing an increase in brain size, would have confronted insurmountable negative selective pressure. While "premature" birth addresses the birthing problem, the resulting helpless infant requires a substantially greater degree of care and protection than is the case in other apes. Such helpless infants would have been a significant handicap to early hominins attempting to survive in an environment requiring travel across open ground where a variety of predators roamed. In short, humans should not exist.

This is the point at which, according to Taylor, the elaboration of technology, most especially carrying technology, allowed humans to transport helpless infants efficiently over distances. Carrying an infant in an over-the-shoulder sling solves several problems. It is more energy efficient than simply carrying in the arms. It allows easier walking and, if necessary, running. It also frees the hands for other tasks. Taylor contends that this technological innovation opened the possibility for survival of big-brained offspring in a new and challenging environment.

The elaboration of other technologies, including the processing and cooking of food and the development of effective cutting implements in the form of chipped stone knives and other tools provided early humans with access to a broad range of resources which allowed them to spread rapidly (in an evolutionary sense) into new environments without having to undergo extensive biological adaptation. These and other technological innovations permitted the procurement of increasingly high-quality sustenance for the nutrient-hungry brain and also permitted reduction in the dental apparatus and, most importantly, the musculature needed for powerful biting and chewing. Reduction of the cranial musculature allowed the cranial bones to become thinner, thus permitting the expansion of the skull's internal volume to fit a larger brain. So, again, technological development and biological evolution were dialectically connected.

Although Taylor does not raise this, the invention of effective carrying technology would also have permitted the transportation of quantities of food and raw materials from source locations to residential or use areas. The logistical organization of resource procurement and habitation across a landscape is fundamental to hunter-gatherer economics. For example, the locations of sources of raw material to make stone tools are not necessarily near where the tools are to be used. Early humans had to develop strategies of movement across the landscape which allowed them to visit a succession of resource areas in such a way that they had the right tools in the necessary quantities when needed. All the game animals in the world are of no use if you don't have the spear points to kill them or the cutting tools to butcher them.

There are a number of problems and caveats which should be considered when evaluating Taylor's hypothesis. One problem is that the baby sling, which according to Taylor was the crucial invention which permitted the survival of large-brained, but helpless infants, was made of organic material. Therefore, as he acknowledges, it will be difficult to confirm its existence at this early time by direct archaeological evidence. Artifacts made of organic materials, as opposed to stone, tend to deteriorate due to natural processes. Although new analytical techniques are repeatedly opening windows onto kinds of data that previously were thought inaccessible, the chance of recovering specific evidence of a several million-year-old baby sling made of plant fibers or animal skin, is vanishingly small.

Furthermore, there are other factors, not necessarily excluding the baby sling hypothesis, which are likely to have played important roles in compensating for the birth of helpless infants. Among these are increasing parental and even grand-parental investments in child care. Also, the elaboration of a sexual division of labor (i.e., different economic roles for males and females) may have allowed for such things as the establishment of central bases from which specialized foraging teams could have made expeditions to procure and bring back specific resources. In that way, less movement of vulnerable offspring would have been necessary.

Some of Taylor's other propositions are open to question. For example,

his contention that modern human brain size has undergone a small evolutionary reduction, since we now rely so much on technology and cultural information storage that we don't have to use our brains as much as earlier humans, is open to attack on a number of fronts. Among these are that a decrease in overall body size would have a proportional effect on brain size. Moreover, the complexity of modern life poses different, but certainly no less challenging demands on the brain than those posed by the need to have an intimate, detailed knowledge of the natural environment. Furthermore, intelligence is not simply a factor of size. Brain architecture (e.g., the relative development of different portions of the brain) also plays an important role. Human brains are markedly distinct in form from those of other apes. A relatively small decrease in overall brain size has no effect on its structure.

The foregoing notwithstanding, Taylor's hypothesis has the value of focusing attention on a critical point in early human evolution and, more generally, of emphasizing the centrality of technology from the very beginning of human existence. It is an intriguing contribution to the materialist study of how humans came to be.