Some Thoughts about the Evolution of Human Behavior

a Literature Survey

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With edits by

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(students of the author from the first day of his teaching career)

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Preface

I am a geologist and a paleontologist. Why would I, with no prior experience in archaeology or anthropology, or with the benefit of any academic training in those disciplines, enter into a consideration of the morphological and cultural changes associated with the remains of *Homo*? I have had extensive experience with the morphology and taxonomy of marine invertebrates, earlier Paleozoic through Triassic, with the biogeography of such organisms, with their paleoecology, and with trying to understand their evolutionary relations. This background permits me to consider the corpus of material developed over two centuries by archaeologists and anthropologists from a somewhat different perspective.

I am particularly concerned to consider whether the overall behavioral conservatism displayed by marine invertebrate taxa, as well as many terrestrial taxa, is also characteristic of *Homo* from its first recognition in the Late Pliocene to the present (Boucot, 1990; Boucot and Poinar, 2010). Are the many major cultural changes documented so thoroughly by generations of archaeologists and anthropologists best viewed as changes in technology rather than as truly organic, evolutionary changes? In other words, are the overall basics of human behavior conservative and unchanging?

I have tried to extract data from the rich archaeological and anthropological literature, Late Pliocene and younger, useful in addressing this question. Some scholars may protest that an outsider with no experience or training in archaeology and anthropology has no business in muddying the waters. But I suggest that an outsider with a fresh point of view might be able to contribute to additional understanding of what the archaeological and anthropological record provides.

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Introduction

The following is a sample of what information the anthropological and archaeological record provides on the antiquity of human behaviors; these are merely examples, and are not exhaustive by any means. Conard (2005) concluded that truly 'modern' behaviors first appear in the Aurignacian and its equivalents; not everyone will agree with his conclusion although the compilation he made is impressive, but the sampling problem is always with us (think here of such rarities as musical instruments!). D'Errico et al. (2003; see also d'Errico, 2003) represents the opposing view, and also provides a comprehensive compilation. Henshilwood and Marean (2003; see also Bar-Yosef and Vandermeersch, 1993, for an earlier discussion of the problem) contribute to the discussion, maintaining that we are far from having all the data necessary to properly answer the basic question. Much of the argument might boil down to the first appearance of fully modern graphic art in the European Aurignacian and graphic art of equivalent age in Indonesia, and whether or not this might be a preservational artifact.

John A. Moore, a distinguished biologist, addressed many aspects of the same problems we consider here in his 1985 'Science as a way of knowing – human ecology'. His concerns were humankind's destructive effects on the natural environment that makes life possible. He was especially concerned with the destruction of soils and water supplies, to which one must add today the damage to the world's oceans. As a background to his ecological concerns, he briefly reviewed what was known in 1985 about human history and cultural development since the first appearance several million years ago of *Homo.* His review is very perceptive. I have covered the same ground with the addition of information provided by many workers in the past thirty years, with the results closely paralleling Moore's. As a paleontologist and geologist, I have added a number of items he did not cover, but again, our conclusions are similar.

The review by McBrearty and Brooks (2000; see their Figure 13; see also Brooks, 1996) of behavioral evidence available to 2000 provides entrée to the literature and a critical evaluation of that literature. Potts and Sloan (2010; see also Schick and Toth, 1993) provided a well-illustrated running account of many of the factors and types of evidence involved with human behavior and evolution.

The term 'cultural evolution' might just as well be termed 'technological evolution', since the developments in stone tools are just as much technology as they are culture; technology is not a synonym for the developments brought on only during the industrial revolution.

Thesis

After reviewing the voluminous anthropological and archaeological literature available to me, I have arrived at a conclusion concerning their evolutionary-behavioral significance. I conclude that the quantum evolutionary gap between the great apes and the hominins led to the initial and continuing presence of the basic human behaviors. These are the basic behaviors that sharply separate us from the great apes and their direct ancestors.

In the following treatment I will consider those basic behaviors that have left a significant ancient record. The antiquity of the record of these basic behaviors is a consequence of many sampling factors. I will try to summarize these sampling factors while considering each basic behavior. For some of these basic behaviors the evidence is of great antiquity and appears to be very reliable. For others the record is very limited, largely a consequence of various sampling factors. It would be a serious mistake to consider the lower time limit of each basic behavior as the 'true' lower limit without considering the sampling factors involved.

The sampling situation is seriously impacted by the fact that the bulk of late nineteenth- and twentieth-century anthropological and archaeological work has been centered on Western Europe, with Eastern Europe and Asia, with the exception of the Middle East, attracting far, far less attention.

First Appearance of 'New' Behaviors or New Technologies?

While trying to better understand the evolutionary-behavioral implications of the anthropological–archaeological record I have been struck by the apparently 'sudden' appearance of specific human behaviors. The question arises whether these 'sudden' appearances are real, or alternatively, represent the incompleteness and other defects of that record. For example, the first evidences of human use of fire occur far back in the Paleolithic with the finding of hearths beneath which there is fire-baked clay. Are these 'first' hearths evidence of the earliest human use of fire, or merely artifacts of a defective record compounded by limited investigation of potential hearth sites? Was the use of fire by humans a transitional rather than a sudden event? Berna et al. (2012) demonstrated the use of fire in an Early Acheulian South African cave site (Wonderwerk Cave) reliably dated 1.0 million years; this is currently the oldest reliable demonstration of the use of fire. Present evidence about the first appearance of 'fire' is inconclusive, undoubtedly a sampling artifact, although Wrangham's (2009) conclusions regarding the significance of *Homo* as small-mouthed, and with other cranial features that are consistent with a diet of cooked food, necessarily place possession of fire at the very first appearance of *Homo.* When one adds to this the need of the developing human infant for 'baby food' (see the section on Infant Nutrition) that involves cooking, the use of fire coinciding with the appearance of the *H. erectus–H. sapiens* lineage is very positive.

Tryon and McBrearty (2002) suggested that the transition from the Acheulian to the Middle Stone Age in Africa is not abrupt, and that the abandonment of handaxes and cleavers of Acheulian type was followed by their replacement with various points. However, this 'transition' may have involved abrupt origination at a single site, a very limited area, followed by 'transitional' spread to distant areas; the record is inadequate to solve this question.

The major changes in stone-tool sequences, and the evidence of geographically diachronous appearance for some of them, Oldowan to Late Paleolithic, fit this model. Barham and Mitchell (2008) suggest that the Oldowan appearance coincides with significant climate change that might have been causal rather than coincidental. Lordkipanidze et al. (2013) described a *Homo erectus*-type skull from Dmanisi where Oldowan-type tools have been found. However, Panger et al. (2002) raise the possibility that pre-Oldowan hominids might also have been capable of generating stone tools, since hand anatomy and phylogenetic relations are in agreement with this possibility despite the absence of positive evidence.

The artistic capabilities present in the Aurignacian, far earlier than the Neolithic, as discussed below, may be a sampling artifact owing to the absence or non-recognition of Aurignacian-comparable cave art in Africa and Asia except for Sulawesi (Aubert et al., 2014) and Borneo (Aubert et al., 2018).

D.E. Lieberman (2013, p. 203) emphasized that it was the advent of the Neolithic, with agriculture and village life, rather than the hunter-gatherer style of life, that made civilization possible. Does his suggestion conflict with the more gradualistic view of human cultural development

provided by McBrearty and Brooks (2000)? Not necessarily. This might be a sampling problem. Moore (1985, p. 532) quoted Sir Leonard Wooley concerning the advent of the Neolithic 'instead of having to live where food abounded [man] made it abound where he lived; this says it all!'

The initial Neolithic 'appearance' of evidence for farming is an excellent example. The evidence suggests that farming first appeared, following the Natufian, in the Early Neolithic pre-pottery interval of the Near East, in a geographically limited area. From this region it spread outwards both east and west, reaching northern Europe only very late in what could be considered the Iron Age. The point is that 'new' behavioral–technological innovations may well originate in one restricted area from which they spread out (diffused) later in time, i.e., in a geologically very short time span.

When one comes to the 'sudden' appearance of the short-lived Copper Age, followed quickly by the Bronze Age, we are on more solid ground. Both Craddock (1995) and Chernych (1992) indicated a Sixth-Millennium BC initiation of the Copper Age. Craddock (1995) made it clear that the initial use of native copper was quickly followed by the development of technology to smelt copper ores, particularly copper carbonates like malachite and sulfides like chalcopyrite. The question arises: was this 'sudden' appearance triggered in a single locality, possibly by a single person or group, or alternatively over a very short interval by different human groups? There is no good answer to this question, but its global Old-World suddenness is unquestionable; it is a real phenomenon, not a sampling artifact.

The initial appearance of the Bronze Age and its subsequent spread is another good example (Chernych, 1992). Chernych (1992, Figures 2, 3, p. 2-3) made the obvious point that new technologies do not simultaneously affect all human populations. For example, until very recently natives of the northern fringes of Eurasia and Arctic North America were considered to be still in the Late Paleolithic!

Turning to the Industrial Revolution and the torrent of inventions it involved leading to the present day, it is clear that in many prominent cases a single individual or a small group was responsible for the innovative techniques, followed by their widespread adoption far from the original site.

Taxonomy

Stringer (2002) reviewed the evolutionary relationships between various forms of *Homo*; his summary was reasonable as of 2002, but Dennell (2009) produced an even more comprehensive account of what is currently 'known' and what major areas of ignorance remain concerning the evolution of *Homo.* The hominids are not as closely related to chimpanzees and gorillas as has been suggested earlier. White et al. (2009) described *Ardipithecus ramidus* from the earlier Pliocene of Ethiopia as not bipedal and more primitive than *Australopithecus,* to which it is possibly related (see Lovejoy et al., 2009b, and D.E. Lieberman, 2013). Spoor et al. (2015) and Villmoare et al. (2015) provided convincing evidence that early *Homo*, *H. habilis,* and a related form dated at 2.8 million years are more advanced than *Australopithecus* and might be related to the *H. erectus–H. sapiens* lineage although distinct from it.

Berger et al.'s (2015) account of the new species *Homo naledi* may well make necessary some changes in our concepts of human evolution, but until the material is reliably dated and subjected to further study this is uncertain.

Sawyer et al. (2015) discussed the relatively recent Russian hominid discoveries at Denisova Cave in the Altai Mountains of southern Siberia. The skeletal material consists of a finger bone, a toe bone, and several molars; the molars differ significantly in their morphology from those of Neandertals and *H. sapiens.* They described the DNA evidence suggesting that the Denisovans are distinct from Neandertals and *H. sapiens* and shared a common ancestor with them. A certain amount of DNA derived from Denisovans is present in modern humans from Southeast Asia and Oceania (Reich et al., 2011), with the inference that archaic Denisovans lived over a broad geographic range from Siberia to tropical Asia.

D.E. Lieberman (2013) provided a very insightful up-to-date account of current thinking about hominin evolution and the relations of the various species currently thought to belong to *Homo.* Boaz and Ciochon (2004) review the possible relations of *H. erectus* in time from other homininid taxa.

Lieberman and Bar-Yosef (2005) provided a useful account of the evolutionary relations of the 'specific' taxa belonging to *Homo.*

Tomasello (2009) pointed out, using studies with young infants, that cooperation may be one of the most critical human traits separating us from other taxa, although others have similarly appealed to language capability.

Harmand et al. (2015) described stone tools 3.3 million years old from Lomekwi 3, West Turkana, Kenya. The only 'contemporaneous' homininid of this age is *Kenyanthropus*, which is not well known. *Kenyanthropus* has small molars, a more *Homo* trait, but until information about its rib cage, pelvis, feet, etc. are known it is too soon to be sure about its affinities. If remains of this taxon are eventually found at the same horizon as the Lomekwi 3 stone tools, then a case might be made about the tool's maker. In any event these stone tools from Lomekwi 3 significantly predate the oldest Oldowan tools.

Quantum Evolution

George Gaylord Simpson (1953), in many ways the leading paleontologist of the Twentieth Century, provided the concept of 'quantum evolution' to explain one of the leading dilemmas facing the concept of organic evolution. Darwinian evolution suggests that one species gives rise to another, that there are no 'gaps' morphologically or otherwise between one species and its descendant species. Therefore, in principle, there should be a continuous chain of species leading from an ancestral family and/or higher taxon to its descendant family or higher taxon. But neither the fossil record nor the present biota provides such species-to-species chains between supposedly ancestral families and higher taxa to their descendant family and higher taxa. For example, there are no species intermediate between the members of the dog and cat families or from their putative, older ancestral family. This is very troubling. Simpson, an experienced taxonomist, was well aware of this dilemma. It demanded an explanation consistent with modern biology. He suggested that the 'missing' species chains between ancestral and descendant families could be explained by appealing to the following: 1) very small populations; 2) highly endemic location; or 3) very rapid evolution. *If* these three qualifications be granted, it is reasonable that both the fossil record and the evidence of the present should provide no positive evidence for the 'missing' species. He pointed out that this concept is in agreement with the concepts of genetic theory with rates of evolution being inversely related to overall population size (see his Figure 47, upper figure, for a graphic depiction).

Hominin Evolution

The evolution of the hominins can be explained by the concept of quantum evolution. There is no 'chain' of intermediate species leading from a putatively ape-like ancestral family to the hominins. The hominins are classed as a subfamily within the Hominidae, but this is an arbitrary artifact of classification that does not truly indicate the skeletal and morphological features, digestive-tract morphology and physiology, life history, cognitive changes, and other items that separate the lineage of *Homo erectus, H. sapiens,* and *H. neanderthalensis* from the great apes, i.e., from gorillas, chimpanzees, bonobos, *Australopithecus* plus *Ardipithecus,* and *Homo habilis.* Again, there are no known intermediate species involved in this revolutionary development.

Gagneux and Varki (2001; Varki, 2001) pointed out that there must be a great variety of still largely unknown genetic differences between humans and the great apes. They did produce one distinct difference in a common mammalian cell-surface sugar where humans and the great apes are very distinct.

The selective factors responsible for the episode of quantum evolution that produced the hominins several million years ago are very uncertain.

One can provide a list of the significant items involved in this quantum-evolution 'leap' from the great-ape category to the hominin category. Such a list includes: making and use of fire for cooking, supported by skeletal evidence of *Homo*'s small mouth; reduced size of post-

canine teeth; reduced chewing capability indicated by lack of muscle-attachment areas for the appropriate muscles; indications of a longer small intestine and shorter colon suggested by the absence of an expanded chimpanzee–ape-type pelvis for support of a paunch; and the need for soft, mushy food for infants beginning at about six months; relatively parallel-sided rib cage as contrasted with the funnel-shaped chimpanzee–ape type; shoulder anatomy designed for accurate throwing and clubbing; skeletal modifications supportive of bipedalism; hands with a shortened thumb modified for use of fingers in tool manufacture and use; foramen magnum positioned beneath the skull rather than behind it; a female pelvis requiring a 90° rotation of the foetus during delivery; and 90% right-handedness as contrasted with 50:50 for the great apes. The level of sexual dimorphism in *Homo* is much lower than in the great apes and most other primates. Wrangham and Carmody (2010) pointed out that humans are just about the only primates that sleep on the ground, their safety ensured by using fire to deter predators. Human females are sexually receptive at any time, in contrast to the great apes, whose sexual relations are restricted to the brief estrus interval. Humans need to clean the anal region after defecation owing to the close proximity of their limbs due to their bipedal posture. A long menopause among humans contrasts with the situation among the great apes. Absence of penile spines and facial vibrissae in *Homo* also contrasts with the great apes and other primates.

McBrearty (2007) made it clear that the Upper Paleolithic European replacement of the Neandertals by the Cro-Magnons is a biogeographic event, and is not of an evolutionary character.