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The Dual Origin of Modern Humanity

Ian Tattersall

Division of Anthropology, American Museum of Natural History, New York, USA

A B S T R A C T

Living Homo sapiens *can define itself using both behavioral and anatomical uniquenesses. But is this possible when looking backward? Using a strict morphological definition,* Homo sapiens *can probably be traced back in the fossil record to about 150 kyr ago, which fits well with molecular estimates for the ancestor of all living human populations. However, activities reliably indicating established symbolic cognition can be recognized in the archaeological record only back to under 100 kyr ago. Since it is probable that the potential for symbolic cognition was born in the genetic/structural alterations that also gave rise to the distinctive morphological entity* Homo sapiens*, it appears that the expression of the human symbolic cognitive potential had to await, for many millennia, the »discovery« of that potential through a cultural rather than a biological stimulus. Most plausibly, this stimulus was the invention of language. Modern human symbolic cognition is not an extrapolation of pre-existing evolutionary trends, suggesting that* Homo sapiens *is not biologically »fine-tuned« for any specific behavior patterns.*

Key words*: origin,* Homo sapiens*, cognition, evolution, exaptation*

Introduction

Homo sapiens has always found itself oddly difficult to define. Indeed, when he first classified our species among the other primates in the tenth edition of *Systema Naturae*, the great Linnaeus himself[1] made do with the noncommittal statement *nosce te ipsum* (know thyself), in place of the anatomical features that he cited as diagnostic of every other animal species he classified. Almost certainly, the origin of this long-running difficulty, going back to Aristotle at least, and presumably beyond, lies in the fact that while we *Homo sapiens* have traditionally classified other organisms on the basis of their morphologies, it is by our own *behavioral* oddities that we are most deeply impressed. We are, it appears, so

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entranced by our cognitive uniqueness that we seem to take almost for granted the extensive anatomical peculiarities that stem from our unprecedented combination of encephalization with upright bipedalism. Yet the human fossil record is, of course, virtually entirely an osteodental one, and thus one whose systematic pattern we would normally analyze in morphological terms. And this in turn suggests that the intellectual template we have traditionally used for understanding the emergence of *Homo sapiens* may in some sense be inadequate, at least insofar as we implicitly treat our unusual morphology as a passive accompaniment to the principal theme of cognitive change.

Similarly, there is a widespread tendency among paleoanthropologists to look upon *Homo sapiens* above all else as the culmination of a single long-term trend towards increasing brain size, and hence implicitly as the highest expression of a pattern of gradually increasing behavioral complexity. In this formulation, enlarging brain size and cognitive elaboration have proceeded hand in hand, as natural selection has, generation by generation, reproductively favored the bigger-brained and hence presumably better intellectually-endowed. There are two problems here, though[2]. The first of them lies in the assumption that natural selection is somehow able in every generation to single out the intellectually more gifted for preferential survival and reproduction. This notion belies many awkward realities, most notably that it is the entire individual – a complexly integrated genetic whole – and not its various components, upon which natural selection acts. Natural selection can only vote up or down on the sum of the parts, not upon single traits; and, at another level, species also succeed or fail as wholes, dependent on prevailing environmental circumstances and on what competition happens to be around. As a result, it is unwise for paleontologists to try to trace the evolution of characters independently of that of the taxa in which they are embedded.

Which brings us to the second problem. In one strictly limited sense there has indeed been a progression toward increasing brain size as reflected in the hominid fossil record. Two million years ago hominid brains were not on average significantly larger than ape brains, especially relative to body weight. By a million years ago they had approximately doubled in size, and by a hundred thousand years ago they had doubled again (see summary in ref.[3]). These are, however, *averages* for our family Hominidae as a whole. If hominid evolution had truly taken the form of one single-minded within-lineage slog toward increasing encephalization, then despite the fact that the precise link between brain size and intelligence is unknown, such size increase would carry a strong implication that larger brain sizes had over the generations been favored by reproductive success. But, as the hominid fossil record continues to expand, it becomes ever clearer that human evolution has not been a story of fine-tuning within a single lineage. Instead, the pattern seems to have been one of the preferential survival of larger-brained species in a diverse group within which evolutionary experimentation appears to have been the rule, with multiple species originations and extinctions[4]. If this is indeed the case, we need of course to know a great deal about the systematics of that group, and about the attributes of its component species, if we are to make any useful statements about any precise patterns of brain size increase over time. And even with a rapidly improving fossil record, at this point in the history of paleoanthropology we have no idea at all of the precise number of species involved, or about the longevities or the brain size ranges of any of them[5]. Clearly, *Homo sapiens* is descended from

ancestors that were physically and cognitively unlike itself; but given the current woeful state of hominid systematics there is little that can be said at present about the *pattern* of this implied transformation from contemplation of the fossil evidence – or, indeed, from that of the observable behavioral accomplishments of our closest (but nonetheless quite distant) living relatives, the great apes. Indeed, on the cognitive level a much better indication of hominid behavioral transformation over the past couple of million years than that supplied by the fossil record is to be gained from the examination of the archaeological record which, indirect and incomplete though it may be, supplies a more reliable approximation of ancient hominid intellectual attainments.

Although archaeological traces are clearly the product of the extinct hominids whose remains compose the human fossil record, the comparison of the two sources of evidence against the established time scale makes one thing clear: innovation as expressed in the two records did not proceed in synchrony. Stone tool making, for example, was almost certainly invented by an archaically-proportioned hominid that we would classify as an australopith. Subsequently, the first deliberately-shaped stone tools (Acheulean handaxes) were made by hominids that had achieved modern body proportions, but that had for the first several hundred thousand years of their existence made simpler tools (based simply upon the existence of a cutting edge) that were effectively the same as those their australopith predecessors had made for a million years. These developments inaugurated a pattern of highly sporadic innovation in hominid technological history, one lesson of which is that we cannot use the appearance of new kinds of hominid to »explain« the arrival on the scene of new kinds of artifacts or inferred behaviors. Almost exactly the same kind of pattern seems to have applied in the arrival of *Homo sapiens*, the principal difference being that once our species began displaying new behaviors, those behaviors were of a completely unprecedented and unanticipated kind which, in their turn, led to an accelerated pattern of technological change.

Origin of *Homo sapiens*: The Physical Evidence

The lack of any workable and generally agreed morphological definition of *Homo sapiens* has historically been the greatest impediment of all to unraveling the details of our species' emergence. And over the past half-century or so any potential progress in this domain has been impeded by the pervasive influence in paleoanthropology of the linear model of human evolution by which species are viewed simply as arbitrarily-recognized segments of continuous lineages. This theoretical construct has fostered the primacy of a warm-hearted but ill-advised scientific ecumenicism that has enlarged the bounds of *Homo sapiens* beyond all biological reason. As a result, a diverse spectrum of morphologies has been gathered together under the banner of »archaic *Homo sapiens*,« with no attention paid whatever to where this motley construct might end and »modern *Homo sapiens*« might begin. In a final *reductio ad absurdum* it has even been proposed to extend our species to include virtually every *Homo* fossil since *Homo habilis*[6]. But if we are ever to understand how *Homo sapiens* emerged as the biologically individuated and osteologically highly distinctive entity it is today, we are going to have to bite the bullet and decide just what we mean morphologically (and more broadly, biologically) when we use the name *Homo sapiens*.

Living humans in fact compose a highly distinctive morphological entity. My colleague Jeffrey Schwartz and I[7–9] have pointed to nine cranial features that appear among hominoids to be autapomorphic to *Homo sapiens*, while additional such features have also been recently suggested by others[10]. Diagnostic skull characters of *Homo sapiens* include various features of the temporal bone, a bipartite supraorbital conformation, and the presence on the mandible of a true chin (which is a morphologically much more complex feature than the real or apparent swellings on the external symphyseal midline that can be discerned on a variety of fossil hominids[8]). And if we use possession of these features as our criterion for admitting fossil forms to *Homo sapiens*, we immediately find ourselves having to exclude the bulk of those fossil specimens that have been allocated to our own species in the past.

The oldest fossil form that has any reasonable claim to membership of *Homo sapiens* sensu stricto is that recently reported from the Ethiopian locality of Herto, and assigned in the idiosyncratic manner of its describers to the subspecies *H. s. idaltu*[11]. The Herto specimens have a limiting maximum date of ~160 ka, but their claimed minimum date of ~154 ka has been disputed by Faupl, Richter and Urbanek (2003), who believe that the hominid fossils and the associated Acheulean/Middle Stone Age artifacts may in fact be considerably younger than this. Unfortunately, it is not possible to determine from the published description the states of all potentially diagnostic cranial characters in the Herto hominids; but from what can be gleaned these specimens have a substantially better claim to membership in *Homo sapiens* than any other hominid fossils of comparable antiquity (assuming that the asserted minimum date is accurate). Among other early contenders, the oldest fossils that can lay claim to unquestioned *Homo sapiens* status are the Israeli Jebel Qafzeh 9 and 11 specimens, dated to ~92 ka[13]. There is no doubt that these fossils are *Homo sapiens* by the most stringent definition, but interestingly other fossils of similar age from Qafzeh (and from the penecontemporaneous nearby site of Skhūl) do not display the diagnostic *Homo sapiens* morphologies (see refs.[14,15]). Dated (with wildly varying precision) to the time period between Herto and Qafzeh is a motley assortment of African hominid fossils that have at one time or another been assigned to *Homo sapiens* or to something very close to it. These include the specimens from Singa, Omo Kibish, Klasies River Mouth, Border Cave, and Ngaloba, none of which – tradition notwithstanding – can be considered to fit within the strictest morphological definition of *Homo sapiens*[14,15]. Still less can various other African fossils of this time interval, such as those from Jebel Irhoud and Florisbad, that have also been touted at one time or another as close modern human relatives.

Comparative molecular analyses of both mitochondrial and nuclear DNA have produced varying convergence dates for the common ancestor of all modern human populations (see reviews in refs. [16–18]). However, most of these analyses permit the conclusion that this date lay somewhere in the range of 150 kyr ago, or maybe a little more. Of course, this figure may represent only a minimum age for *Homo sapiens*, if all living human beings are descended from a single ancestral population that substantially postdated the actual origin of its species. But it is very probably significant that, particularly with the discovery of the Herto fossils, the comparative molecular and fossil records at least provisionally agree that in structural terms *Homo sapiens* as we know it today was already in existence by about 150 kyr ago. At that time, there ap-

pears to have been nothing behaviorally out of the ordinary about this new entity, which shared the African continent, and the Old World in general, with an as yet imperfectly characterized variety of other hominid forms.

Origin of *Homo sapiens*: The Behavioral Evidence

Modern human behaviors are so wildly varied that it is hard to distill their essence. But if there is one thing that virtually all concerned can agree upon, it is that the cognitive processes of living people are most strongly unique in being *symbolic* (see contributions in the volume edited by Lock and Peters[19]). We *Homo sapiens* do not, like other organisms (as far as we know), respond to the world simply as it presents itself to us. Instead, our minds break that world down into mental symbols, which we can recombine to explain and reconfigure what we sense around us. And it is the ability to make such mental manipulations that, above all, allows us to understand and exploit the world in the unprecedented (not to mention potentially dangerous) ways that we do. Mental symbols – like the mind itself – are, of course, nonmaterial. But there are many forms in which they can be expressed in our external behaviors – as words, gestural signs, markings and modelings of various kinds, and so forth. And in the context of the attempt to understand through the archaeological record when and how our unique capacity emerged, a major problem lies in the recognition of reliable proxies for mental symboling.

The most dramatic and convincing evidence for the early expression of symbolic behaviors comes from Aurignacian Europe where, in the period beginning about 35 kyr ago, we find abundant and impressive evidence for the quintessentially symbolic activities of painting, engraving, sculpture, notation, music and so forth (see reviews in refs[20,21]). There is no doubt that the Aurignacians, besides exhibiting modern bony morphology, had a consciousness that was fully equivalent to that shared by all *Homo sapiens* today. But clearly, this consciousness was brought into Europe fully developed. Where did it come from?

Certain obscure, isolated and equivocal expressions aside, the earliest evidence for symbolic activities comes from various sites in Africa. Some activities documented from early on in that continent, including the making of blade tools (which appear in Europe coincident with the Aurignacians around 40 kyr ago) as early as 280 kyr ago or more, do not for most observers provide substantive evidence of symbolic activity. And reports of symbolic uses of space upwards of 100 kyr ago at South African sites such as Klasies River Mouth[22], though suggestive, remain inferential. For most students of the matter, the earliest unequivocal symbolic object that is known comes from Blombos Cave, near the southern tip of Africa. This is a polished ochre plaque, engraved with a distinctive geometric design, that is dated to between 80 and 70 kyr ago[23]. Interestingly, this piece is approximately coeval with sophisticated bone harpoon points from Katanda, in the D. R. Congo,[24] which generally resemble implements that only began to be produced in Europe at around 20 kyr ago. Also from the period between 80 and 70 kyr ago are the small backed microliths that briefly appear in Howieson's Poort levels at sites such as Klasies River Mouth, and pierced gastropod shells both from from Porc-Epic Cave in Ethiopia and Blombos[25] that were presumably strung and used in body ornamentation.

Taken together, these findings suggest that symbolically-mediated behaviors of modern human type were at least stirring among African hominids by around 80

kyr ago. To infer much more at this point may be a little premature. In a spectacularly erudite contribution, McBrearty and Brooks[26] argued, on the basis of the temporal distribution of the first occurrences of such behaviors as blade-making, grindstone-using, pigment-processing, point-making, long-distance exchange, marine resource exploitation, bone tool making, flint-mining, microlith manufacture, pattern incision and bead and image-making, for a gradual, additive acquisition of modern behaviors by African hominids in the period between about 280 and 40 kyr ago. And they concluded that this process was not necessarily launched by hominids that would fit the anatomical definition of *Homo sapiens*. However, it is far from clear that all of these behaviors, most especially those such as blade-making, with its extremely early origin, are reliable proxies for the possession of symbolic mental processes by the hominids concerned (whose identities are almost entirely unknown). And it is far from sure that they were all integrated parts of a single historical process. Further, it is also notable that, archaeologically, the Herto individuals and many other putative early *Homo sapiens* possess unremarkable Middle Stone Age – or even more archaic – archaeological associations.

Conclusion

So how and when did the modern human symbolic capacity emerge? Do we see its first glimmerings among hominids that did not look quite like us? Did it appear with anatomically-recognizable *Homo sapiens?* Or did it it begin to be expressed only after *Homo sapiens* had become established? To gain some kind of perspective on this we need to turn our attention beyond Africa, to the Levant, where good evidence exists that the same territory was partitioned in some way between *Homo sapiens* and *Homo neanderthalensis* for a period of 50 kyr or more (see review in ref.[27]). For in this region, between about 100 kyr and 45 kyr ago, both species appear to have manufactured identical tool kits; and there is little reason to suspect substantive technological or economic differences between them (though see ref.[28]). It was only when a Levantine Upper Paleolithic industry (similar to the Aurignacian but not identical to it) appeared that the local Neanderthals vanished. The Aurignacian itself was presumably invented by *Homo sapiens* émigrés from the Levant en route to Europe, where in little over 10 kyr they contrived to displace the Neanderthals from the entire huge area that they had formerly inhabited.

These observations suggest very strongly that the earliest *Homo sapiens* came into existence as an anatomical entity significantly before it acquired any behavioral modifications that markedly distinguished it from its immediate predecessors. In evolutionary terms, of course, this was a rather routine happening, since the only place where any behavioral novelty can be acquired is *within* a species. Clearly, there must be a structural basis to the extraordinary cognitive capacity of modern *Homo sapiens*; but evidently the new capacity was not exploited immediately.

Most plausibly, the appearance of the underlying capacity for symbolic thought occurred in concert with the biological reorganization that marked the emergence of *Homo sapiens* as an anatomically as well as reproductively distinct species. In conjunction with the apparently much later advent of symboli- cally-mediated activities, this of course implies that the human capacity for symbolic thought had to be *discovered* by its possessors, and that the underlying biological potential had to be released by some cultural innovation subsequent to its initial appear-

ance. Measured by its effects, this sequence of events was nothing short of stupendous. But in evolutionary terms it was actually an entirely ordinary phenomenon, for any novelty has to arise as an exaptation if only because in evolution function has to *follow* form. Any feature has to exist *before* it can be used, and genetic novelties necessarily arise randomly with respect to any future function for which they may later be recruited by natural selection.

What might the cultural stimulus for symbolic thought have been? The only obvious candidate for such a behavioral spur is the invention of language, which is the ultimate symbolic activity and is something that is so intimately tied up with human mental manipulations that it is difficult for us now to imagine symbolic cerebral transactions in its absence. Even the acquisition of language, of course, would not immediately have resulted in the expression of all the symbolic behaviors with which we are so familiar today. Quite evidently, the multifarious possibilities presented to us by the remarkable human capacity required independent discovery too; and indeed, learning how to exploit our amazing intellectual abilities is a process that is still under way today, as our accelerating technological progress eloquently demonstrates. The extraordinary cultural achievements of the Upper Paleolithic Europeans show that by 40 kyr ago the exploitation of the human symbolic potential was well advanced; but wherever and whenever this highly generalized capacity may have been initially discovered, substantially *after* the birth of *Homo sapiens* as an anatomical entity, the discovery of how to use it in new ways was a gradual process, and one that is still proceeding.

The recognition that the qualities we find most extraordinary in ourselves emerged late in the human evolutionary story, and exaptively rather than through the slow, gradual exertions of natural selection, begs a re-examination of the myths we hold about ourselves that stem from the prevailing gradualist notions of human evolution. Throughout most of hominid evolution, new hominid species could be looked upon as incremental improvements on their predecessors. But cognitively, *Homo sapiens* is truly unprecedented. The acquisition of our most striking autapomorphy represents an *emergent* event, in which a random genetic innovation must have combined with the existing result of millions of years of evolution to produce something totally new: a brain with an entirely unanticipated symbolic potential. Clearly, *Homo sapiens* has not been cognitively fine-tuned over the eons for anything. Our brains are not finely-burnished culminations of a long process of perfection. Evolutionary psychology and its alluring reductionisms to the contrary, our controlling organ has not been shaped by our »ancestral environment« to guide our actions in a specific set of ways. Even though as individuals we are – subject to environmental influence – the products of our genes, the human capacity that makes our species unique is actually a rather generalized one. Individually and collectively it is we, not our genes, that are responsible for what we do. And, so far, the cumulative effect of our free will has not been a salutary one for the global environment on whose health, like it or not, our own well-being will continue to depend.

Acknowledgments

It is a privilege to have been invited to contribute to this *Festschrift* in honor of our valued friend and colleague Horst Seidler. But this invitation poses its problems, too, for Horst's scientific interests and contributions over a long and distinguished career have been so wide-ranging that it is difficult to know how to re-

flect them adequately in a single, necessarily focused, article. Still, the core of Horst's interests has always been our own species, *Homo sapiens*, and in particular in its evolution, function, genetics, behavior and history. And perhaps the integration of these diverse interests is nowhere better sought than in the mysterious origin of the admirable and detestable, creative and destructive, seductive and infuriating – and invariably totally unpredictable – species that *Homo sapiens* is today.

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I. Tattersall

Division of Anthropology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA
e-mail: iant@amnh.org

DVOSTRUKO PORIJEKLO MODERNOG ČOVJEKA

S A Ž E T A K

Živući *Homo sapiens* može se definirati koristeći kriterije jedinstvenosti u anatomiji i ponašanju. No, je li moguće iste kriterije primijeniti i retrospektivno? Koristeći striktno morfološku definiciju, *Homo sapiens* se vjerojatno prema fosilnim zapisima može pratiti sve do unatrag 150.000 godina, što se dobro podudara s molekularnim procjenama o pretku svih današnjih ljudskih populacija. Međutim, aktivnosti pouzdano indiciraju ustanovljeno simboličko razmišljanje mogu se prepoznati jedino u arheološkim nalazima mlađima od 100,000 godina. Kako je vjerojatno da je potencijal za simboliku stvoren u genetskim/strukturalnim promjenama koje su istovremeno dale distinktivne morfološke karakteristike *Homo sapiens*-a, izgleda da je ekspresija ljudskog simboličko-kognitivnog potencijala morala pričekati više tisuća godina, na »otkriće« ovog potencijala koje se vjerojatnije odvilo zahvaljujući kulturalnim nego biološkim stimulacijama. Taj je poticaj najvjerojatnije bio jezik. Simbolička kognitivnost modernog čovjeka nije ekstrapolacija ranijih evolucijskih trendova, što sugerira da *Homo sapiens* nije biološki »dobro-postavljen« za neki određeni uzorak u ponašanju.