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THE DOMESTICATION OF HUMANS

ABSTRACT: In the last few years it has become evident that the European Upper Paleolithic "replacement" model was initially based on false evidence and that most of its propositions can be or have been refuted. This paper reviews the key evidence of the model, the skeletal, archaeological and genetic factors inherent in it, and how they have failed to support the model. It is shown that the change from robust to gracile Homo sapiens occurs gradually in all four continents then occupied by humans and that there are many intermediate fossils. In Europe, it is shown; there are currently no known specimens of reasonably "modern" remains until the Gravettian, while all Early Upper Paleolithic traditions, including the Aurignacian, seem to be attributable to Robusts, such as Neanderthaloid people. The rapid gracilization of all humans of the Final Pleistocene is attributed here to suspension of natural evolutionary developments by culturally mediated breeding patterns favouring skeletal gracility.

KEYWORDS: Final Pleistocene – Modern human – Neanderthal – Paleoanthropology – Material culture – Genetics – Sexual dimorphism – Selective breeding

INTRODUCTION

For one and a half centuries, since human bones were excavated in the Kleine Feldhofer Cave in the Neander valley by two workmen in August 1856, paleoanthropology and Pleistocene archaeology have sought to discover how humans became human by studying their skeletal remains. The results are a range of views and a continuous series of controversies spanning this entire period of research, commencing with the Neander Valley find and ending with human remains from Liang Bua in Flores. This paper contends that most tenets of the dominant model of late hominin evolution are false, and it rejects the traditional focus of paleoanthropology and Pleistocene archaeology on the physical aspects of human evolution in formulating constructs of human modernity. The possibly most hotly debated issue in human evolution is the origin of what are defined as anatomically modern humans. In recent decades this debate has greatly favoured a single origin of such "Moderns", and the replacement of all robust humans of the Late Pleistocene by an intrusive population from Africa. But the modernity of human behaviour is not determined by skeletal evidence, not even by stone tool technologies.

It is indicated by the "storage" of symbolism outside the brain, especially in the form of paleoart (the collective term defining all art-like manifestations of the remote human past). This argument was first advanced by R. L. Gregory (1970: 148), who suggested a circumvention of the need for continued brain growth by holding information in a more reliably stable and relatively permanent form, and it was subsequently developed by Merlin Donald (e.g. 1991: 124–161).

The domestication of animals and plants consists of the collective genetic alteration of their physiology, behaviour or life cycle through selective breeding. Historically, this process is thought to have begun with the gradual domestication of the wolf in the Final Pleistocene (possibly in the order of 15,000 years ago), and the domestication of numerous plants and animals during the Holocene. In general, the term has been used for such alterations caused, intentionally or unintentionally, by humans, but it has not so far been applied to humans themselves. In fact humans are often considered to be the initiators of domestication, even though there are numerous examples of domestication by other species. Many animal species have domesticated others, for instance to modify foods

indigestible by the domesticators, or for their labour or simply to serve as food source. Humans, of course, are animals too, but to what extent they might be the product of their own "domestication" has not been the subject of any attention.

This subject will be considered here, but before this is possible, it is necessary to briefly review the processes of recent human evolution, particularly during the Late Pleistocene. At the beginning of that period, about 130,000 years (130 ka) ago, only one human subspecies is thought to have existed, archaic or robust *Homo sapiens* (ignoring the controversial issues relating to a later putative *Homo floresiensis* and a series of Javan fossils). The European representative, exemplified especially by *Homo sapiens neanderthalensis*, is certainly the best known of this group, but there were similar contemporary populations also in the rest of the world then occupied by humans. Their technocomplex comprised the Middle Paleolithic or Mode 3 industries in all of their area of distribution, but called the Middle Stone Age in sub-Saharan Africa. This mode of technological production (Foley, Lahr 1997) is based on specific types of stone implements, recognizable by their typology and retouch. The cultures of these people were sufficiently advanced to support skilled navigation of the open sea, leading not only to the peopling of Australia (possibly in the order of 60 ka ago), but also to incredible further feats of seafaring. These included the settlement of very small islands hundreds of kilometers from any nearest land, such as Buka Island near New Ireland, still by people with a Middle Paleolithic technology (Bednarik 1999). Their colonization of extremely cold regions (the Arctic Circle by about 135,000 years ago; Pavlov *et al.* 2001, Schulz 2002, Schulz *et al.* 2002) disproves the notion that there were habitable regions of Europe that were unoccupied at that time. Instead it needs to be assumed that largely contiguous populations occupied most parts of the Old World as well as Australia in the second half of the Late Pleistocene. Therefore a mass movement of populations is a most unlikely demographic scenario, especially as these populations all shared similar technologies.

Perhaps roughly 50 ka ago began a process of gradual gracilization in these people, probably continuing today. It involved a reduction in muscle power and skeletal robusticity, but it is considered to have affected most especially the skull. Bone thickness and prognathism were reduced, the cranial vault became more rounded, and the supraorbital tori and occipital extensions disappeared gradually. The most important aspects of these changes were the following:

1. They were universal; they applied to all human populations of the Late Pleistocene, even those with poor genetic connections to other breeding populations, as in Australia and Tasmania.
2. These modifications involved no significant change in cranial volume; in fact the brain of Neanderthals is on average larger than that of the subsequent, more gracile people of the Eurasian region in question.

3. In an evolutionary sense, these changes are regressive and contradict the canons of evolution: they resulted in organisms that were physically weaker and more prone to fatal trauma, and had smaller brains at a time when demand on neural function is thought to have increased sharply. These changes apparently engendered no evolutionary benefit in the form of a trade-off.

It follows that if the trend from robust to gracile *Homo sapiens* is to be explained biologically, these and similar factors need to be accounted for satisfactory. For instance, it is not adequate to suggest that, in one region, such as Europe, the Graciles replaced the Robusts without any interbreeding. Not only is the contention of breeding incompatibility highly tenuous, or indeed unacceptable and perhaps refuted by the skeletal evidence, such an explanation would not account for the general and universal trend. Similarly, it would need to be explained why the human species has been so extraordinarily successful in its recent phylogenic history, despite such an ostensible trend of reducing evolutionary fitness.

The counter argument usually offered is that these reductions were more than compensated for by significant improvements in intellect, and the introduction of advanced social systems, communication and other inferred capacities that improved evolutionary advantages. However, none of these changed capacities have actually been demonstrated, or proven to have coincided with the appearance of Graciles. Their utilization here is the outcome of accommodative circular reasoning rather than a rigorous interpretation of empirical observation. For instance, where humans with a Mode 3 (Middle Paleolithic) production survived long enough to provide ethnographic insights (in Tasmania), there is no indication of an absence of essentially "modern" forms of communication, social systems, intellect or cognition. Nor is there any credible proof that these and similar features were lacking elsewhere before the appearance of Graciles. On the contrary, art-like productions, including rock art, portable engravings and proto-sculptures were produced hundreds of thousands of years ago, as were beads and pendants (Bednarik 2003). The latter are particularly telling indicators of the non-anatomical status of their users, because they demand both self-awareness and a social structure supporting the complexity of the semiotic dimensions of such objects (Bednarik 2005a).

No significant changes to the human brain, either in size or in the structure or arrangement of specific brain regions, can be cited in support of recent dramatic changes in neurophysiological capacities in humans. There is not one iota of evidence that there was any difference in the tools, ornaments, life style or any other potential measure of abilities, between presumed robust and gracile populations living at the same time in the same regions, anywhere in the world – be it in Australia, the Levant, Africa or in Europe. In Australia, the two types of humans are thought to have lived contemporaneously, leaving precisely the same cultural remains, including paleoart. In the Levant, robust

and gracile populations may have been coeval during up to 100 ka (Arensburg 2002). Moreover, Levantine Robusts (Tabun, Kebara, Amud) differ significantly in their skeletal morphology from the Neanderthals of Europe and it has been questioned whether they should be described as Neanderthals. In Europe, two perceived cultural traditions, the Châtelperronian and the Aurignacian, had traditionally been attributed to Graciles, but they are now both assumed to be traditions of Neanderthals, or at least post-Neanderthals, their direct descendants (Bednarik 2006, 2007a). The second of these "cultures," the Aurignacian, includes artistic masterworks of a sophistication not matched by most hunter-fisher-forager societies, and certainly not matched for the rest of the Pleistocene, i.e. the subsequent >20 ka. The self-promoting assumption of modern people that the Robusts of 30 or 40 ka ago were not as culturally, cognitively or intellectually advanced as their more gracile contemporaries is reminiscent of the claims of recent centuries, that indigenous peoples of various continents were culturally, cognitively or intellectually backward. It is almost certainly just as false.

EUROPE'S HOMININS OF THE EARLY "UPPER PALEOLITHIC"

To consider the course of human evolution over the last thirty or forty millennia of the Pleistocene, it is essential to first review what we know about its physical evidence – and especially to correct some very influential misconceptions. Without such preliminary considerations it would be impossible to effectively explore the question why and how modern people developed over the Final Pleistocene. There have been numerous corrections to the existing record just in the last few years. For instance, an extraordinary number of European human fossil remains, previously attributed with confidence to the Upper Paleolithic, have recently been found to be in fact of the Holocene. In Germany alone, these revisions have shown that only one of the numerous *Homo sapiens sapiens* fossils there is older than 13 ka BP, the interred specimen from Mittlere Klause in Bavaria, being around 18,500 radiocarbon years old. The human remains of four individuals from Vogelherd in Germany have long been prime exhibits of the school claiming that modern Europeans invaded from Africa between 30 and 40 ka ago (Bräuer 1981, 1984a, 1984b, Stringer 1984a, 1984b, 1985, 1989, Stringer, Andrews 1988, Mellars, Stringer 1989, Wainscoat *et al.* 1986, Wainscoat 1987, Cann *et al.* 1987). They dated these specimens to about 32 ka BP, claiming they were of the Aurignacian tool tradition (Churchill, Smith 2000a, 2000b). Yet any examination of the main specimen, the skull of Stetten I, reveals its modern appearance, both anatomically and in terms of its preservation. More careful commentators have long warned that "judging by its appearance it would fit much better into a late phase of the Neolithic" (Czarnetzki 1983: 231, my translation). Gieseler (1974) had expressed similar concerns

about Stetten II, a cranial fragment, and H. Müller-Beck (pers. comm. 2002) also favoured an attribution to the site's Neolithic occupation. Direct dating now places all four specimens between 3980±35 BP and 4995±35 BP, i.e. in the Late Neolithic (Conard *et al.* 2004).

Another German find, the Hahnöfersand calvarium, was described as so robust that it was judged to show typical Neanderthal features, and was dated to 36,300±600 BP or 35,000±2000 BP (Bräuer 1980). Recently secured direct dates from this Neanderthal find place it at 7470±100 BP or 7500±55 BP (Terberger, Street 2003). When the skull fragment from Paderborn-Sande, which Henke and Protsch (1978) had established to be 27,400±600 years old, was opened for sampling, it still released a smell of putrefaction: it is only 238±39 carbon years old (Terberger, Street 2003). Yet another cranial fragment, from Binshof, dated by Protsch to 21,300±320 BP, is in fact only 3090±45 years BP. The skull from the Kelsterbach site, 31,200±1600 years old according to Protsch and Semmel (1978; also Henke, Rothe 1994), is now also thought to be of the Holocene, probably of the Metal Ages (Terberger, Street 2003), but has disappeared from its safe.

Before we wonder how all these mistakes could have possibly occurred, we need to reconsider many more specimens of supposedly Early Upper Paleolithic (EUP) Europe that have been falsely interpreted. Another key find often cited by the replacement advocates is the "modern" Robust from Velika Pećina, Croatia, now known to be only 5045 ± 40 radiocarbon years old (Smith *et al.* 1999). Like the Vogelherd and other specimens, those from Roche-Courbon (Geay 1957) and Combe-Capelle (originally attributed to the Châtelperronian levels; Klaatsch, Hauser 1910) are now thought to be Holocene burials (Perpère 1971, Asmus 1964). Similar considerations apply to the partial skeleton from Les Cottés, whose stratigraphical position could not be ascertained (Perpère 1973). Human skeletal finds from La Quina, La Chaise de Vouthon and Les Roches are too fragmentary to provide diagnostic details. The *os frontale* and fragmentary right maxilla with four teeth from La Crouzade, the mandible fragment from Isturitz and the two juvenile mandibles from Les Rois range from robust to very robust. The Fontéchevade parietal bone does lack prominent tori but the site's juvenile mandibular fragment is robust, and the remains from La Rochette now appear to be of the Gravettian rather than the Aurignacian. The same applies to the Crô-Magnon specimens, which have long been held up as the paragon of Aurignacian "modern" humans. Their recent re-dating to about 27,760 carbon years BP seems to place these "type fossils" of "modern" skeletal anatomy in Europe into the Gravettian (Henry-Gambier 2002). Moreover, the very pronounced supraorbital torus, projecting occipital bone and other features of Crô-Magnon cranium 3 are Neanderthaloid rather than gracile.

The same pattern is even more pronounced in the many Czech specimens of the time, whose full physical modernity is not at all evident. For instance, the Mladeč

sample, now dated to between 26,330 and 31,500 BP (Wild *et al.* 2005), is certainly not "modern," but of a form of "post-Neanderthals" of distinctive sexual dimorphism (see below). It shares this "intermediate" position with numerous other very robust specimens from the same region, such as those from Pavlov and Předmostí (both between 26 and 27 ka), Podbaba (undated), and the slightly more gracile and more recent population from Dolní Věstonice. Morphologically similar specimens also come from other parts of Europe, including Cioclovina (Romania), Bacho Kiro levels 6/7 (Bulgaria) and Miesslingtal (Austria), while the maxilla from Kent's Cavern, United Kingdom (~31 ^{14}C ka BP) and the Romanian remains from Peştera Cioclovina (~29 ^{14}C ka BP) are undiagnostic and lack archaeological contexts. In fact, a pattern of features intermediate between the archaic *Homo sapiens* and *Homo sapiens sapiens* is found in literally hundreds of Eurasian specimens of the last third of the Late Pleistocene. They include examples, some of them much older, from right across the breadth of Eurasia, such as those from Lagar Velho, Crete, Starosel'e, Rozhok, Akhshtyr', Romankovo, Samara, Sungir', Podkumok, Khvalynsk, Skhodnya, Narmada, as well as Chinese remains such as those from the Jinniushan and Tianyuan Caves (Shang *et al.* 2007). This presents an overall picture that is very different from that which the replacement protagonists prefer. Their model cannot tolerate intermediate or liminal forms, nor can it allow hybrids, yet in Europe there is a clear continuation of Neanderthaloid features right up to and into the Holocene (e.g. Hahnöfersand, Drigge). Similarly, in Australia clear Robusts occur frequently up to the very end of the Pleistocene, e.g. on the Murray River.

The earliest liminal "post-Neanderthal" finds currently available in Europe are the Peştera cu Oase mandible from Romania (Trinkaus *et al.* 2003), apparently in the order of 35 ka years old, and the partial cranium recently found in another part of the same cave (Rougier *et al.* 2007). Both lack any archaeological context and are not "anatomically modern." The six human bones from another Romanian cave, Peştera Muierii (~30 ^{14}C ka BP), are also clearly intermediate between robust and gracile Europeans (Soficaru *et al.* 2006). *There is thus not a single gracile specimen now in all of Europe that can safely be linked to Aurignacian or other EUP occupation evidence*. On the other hand, there are at least six EUP sites that have produced human skeletal remains attributed to Neanderthals: the Châtelperronian layers of Saint Césaire (~36 ka) and Arcy-sur-Cure (~34 ka) in France, the Aurignacian of Trou de l'Abîme in Belgium, the Hungarian Jankovichian of Máriaremete Upper Cave (~38 ka; Gábori-Csánk 1993), the Streletsian of Sungir' in Russia (which yielded a Neanderthaloid tibia from a triple grave of "Moderns"), and the Olschewian of Vindija in Croatia (Ahern *et al.* 2004). The Neanderthals at the latter site are the most recent such remains reported so far (28,020 ± 360 and 29,080 ± 400 carbon years BP). Like other late specimens they are much more gracile than most earlier finds – so much that many consider them as transitional (e.g. Smith, Raynard 1980, Wolpoff *et al.* 1981, Frayer *et al.* 1993, Wolpoff 1999, Smith *et al.* 2005).

History therefore seems to be repeating itself here: until 1979, the Châtelperronian had been considered to be of "Moderns," and after its "Neanderthal" makers were recognized, it was argued that they must have "scavenged" the tradition's portable paleoart objects from "Moderns" (e.g. White 1993, Hublin *et al.* 1996). In this it was ignored that the numerous beads and pendants of the Russian Spitzinian tradition are even older, >40 ka (Bednarik 2007b: Fig. 4). We have seen similarly absurd suggestions concerning the use of tools and fire by *Paranthropus robustus* at Swartkrans, explained away as evidence of "imitation" of human behaviour. Moreover, beads have been in use for hundreds of millennia, e.g. at El Greifa site E, Bedford, St. Acheul, Repolust Cave; cf. Bednarik 2005a). Now we are facing the realization that the Aurignacian as well as all other EUP traditions seem to be the work of Neanderthals. Instead of the much-vaunted replacement, all evidence suggests a general trend from robusticity towards gracility, occurring over tens of millennia – just as it is found anywhere else then occupied by humans. Even the "late Neanderthals" (who could just as easily be called very robust "Moderns") present significant reduction in "Neanderthaloid" features, such as mid-facial prognathism and supraorbital tori (e.g. La Quina 9, Vindija). Between 35 and 30 ka ago, they begin to grade into populations of still extensive robust traits, especially in the males, but of progressively more gracile features. After 25 ka BP, robusticity still continues to decline, right up to the Late Holocene. Therefore the assumption of a replacement by an intrusive population has no justification, such an event cannot be located at any particular point in time, nor can it be attributed to any perceived sudden change in technology.

CULTURAL AND GENETIC EVIDENCE

The EUP industries of Eurasia first appear fairly simultaneously between 45 ka and 40 ka BP, or even earlier, at widely dispersed locations from Spain to Siberia (e.g. Makarovo 4/6, Kara Bom). Senftenberg, a clearly Upper Paleolithic blade industry in the middle of Europe has even been dated to 48,300±2000 (GRO-1217) or >54,000 years BP (GRO-1771) (Felgenhauer *et al.* 1959, 60). The Aurignacian of El Castillo level 18, in Spain, seems to commence well before 40 ka ago (Cabrera Valdés, Bischoff 1989; carbon dates of 40,000±2100, 38,500±1800, 37,700±1800 BP). At Abric Romani, the lowest AMS dates from the Aurignacian average 37 ka BP, but the probably more relevant uranium-series dates point to a sidereal age of 43 ka BP (Bischoff *et al.* 1994). At El Pendo (González Echegaray *et al.* 1980), the Lower Périgordian (i.e. Châtelperronian) industry, attributed to Neanderthals in France, overlies two Early Aurignacian levels, a stratigraphic pattern also observed in France, e.g.

at Roc de Combe (Bordes, Labrot 1967) and La Piage (Champagne, Espitalié 1981). The Châtelperronian at Morín Cave has been dated to about 36,950 carbon-years BP, an antiquity similar to that of the same tradition at French sites (37–33 ka BP). The most recent "Middle Paleolithic" occupation known in Spain, however, is at Abric Agut. According to both radiocarbon and U-series dating, it occurred 13 to 8 ka BP, i.e. at the Pleistocene-Holocene interface (Vaquero *et al.* 2002). Like many other finds, it shows how illusory the separation of the Middle and Upper Paleolithic cultures is (Bednarik 1995a).

The Iberian pattern of a mosaic and gradually decreasing component of Middle Paleolithic technology of regional EUP lithic industries applies through much of Europe. In southern Italy, variants such as the Uluzzian (Palma Di Cesnola 1976, 1989), the Uluzzo-Aurignacian and the Proto-Aurignacian (43–33 ka BP) have been reported (Kuhn, Bietti 2000, Kuhn, Stiner 2001). The Olschewian of the Alpine region, another Aurignacoid tradition (42–35 ka BP), developed from the final Mousterian (Bayer 1924, 1929, Bächler 1940, Brodar 1957, Malez 1958). Further east this mosaic includes the Bachokirian of the Pontic region (>43 ka BP), the Bohunician of east-central Europe (Svoboda 1990, 1993; 44–38 ka BP), and the Spitzinian of Russia (>40 ka). The Streletskian remains dominated by bifacial artefacts are inspired by the Eastern Micoquian or Mousterian, in parts of Russia still contemporary. Indeed, the regions of the Don river, the Crimea and northern Caucasus experience the coexistence of seven accepted tool traditions between 36 ka and 28 ka BP: the Mousterian, Micoquian, Spitzinian, Streletskian, Gorodtsovian, Eastern Szeletian and Aurignacian (Krems-Dufour variant). The introduction of a first fully developed "Upper Paleolithic" tradition (the Kostenkian) appears only about 24 ka at the Kostenki-Borshevo site complex. A succession of traditions connecting Middle Paleolithic biface technocomplexes, including the late Eastern Micoquian, with typical Late Paleolithic ones, continues through the Szeletian of eastern Europe (Allsworth-Jones 1986; 43–35 ka BP), the Jankovichian of Hungary, and the Altmühlian (ca 38 ka BP), Lincombian (38 ka BP) and Jerzmanowician (38–36 ka BP). These "intermediate" industries all demonstrate the continuity between Middle and Upper Paleolithic technocomplexes. A degree of regionalization precedes this period even in the Late Mousterian (Kozłowski 1990, Stiner 1994, Kuhn 1995, Gamble 1999, Riel-Salvatore, Clark 2001), marked by both miniaturization and increasing use of blades, by improved hafting and the use of backed or blunted-back retouch, apparently heralding subsequent developments. The artificial dichotomy has only served to overemphasize gradual changes in technology (Fedele *et al.* 2003). The specious separation of Middle and Upper Paleolithic has even less currency in Africa (e.g. Howieson's Poort, Amudian), India (Bednarik 1994a, Bednarik *et al.* 2005) or China (Xing Gao, Norton 2002), or in Australia (where the Middle Paleolithic mode of production [Foley, Lahr 1997] continues until well into the Holocene).

Instead of a sudden change of technology at any time during the time interval from 45 ka to 25 ka ago, we observe a complex mosaic of regional traditions which, in general, exhibit a gradual change of several variables, such as tool size, knapping method, retouch and reuse. This suggests in all cases *in-situ* evolution of cultures, rather than the effects of intrusive traditions. It also mirrors the development in human morphology documented above. Moreover, wherever robust and more gracile forms of humans apparently co-existed locally, be it in the Levant, in Australia or in any part of Europe, they are thought to have shared fairly similar cultures, technologies, even ornaments. The notion that one can trace ethnic differences through tool assemblages is therefore unlikely to be helpful in understanding the cultural dynamics of this period.

This is even more apparent when we consider the distribution, temporally and spatially, of evidence suggestive of symbol use, such as paleoart, beads and pigment use. To explain the sudden appearance, about 33–32 ka ago, of sophisticated art at such sites as Hohlenstein-Stadel (Schmid 1989), Hohle Fels (Conard *et al.* 2003), Vogelherd (Riek 1934), Galgenberg (Bednarik 1989), Chauvet Cave (Chauvet *et al.* 1995, Clottes *et al.* 1995, Bednarik 1995b, Clottes 2001), l'Aldène (Ambert *et al.* 2005, Ambert, Guendon 2005) or Baume Latrone (Bégouën 1941, Bednarik 1986), three basic possibilities could be considered: the arrival of new people with a new culture; or an extraordinary local development of these faculties; or a taphonomic explanation (cf. Bednarik 1994b). To demonstrate the first we would need preceding evidence of such artistic works from regions through which this imagined intrusive population passed. No such evidence has ever been presented. To succeed in replacing a resident population, these migrants would have to arrive in significant numbers, yet such change cannot be attributed to any specific point in time. The second alternative, sudden *in-situ* development, involves no replacement of people, but it is an unlikely explanation. The third, a scientific explanation, is logical and by far the most persuasive, yet it is not usually considered. It suggests a more gradual development and a taphonomically truncated record. Cave art, especially, is almost certainly the result of a taphonomic fluke (which invalidates practically all of its popular interpretations), but the same explanation also applies to portable art.

Another aspect of this phenomenon is that of its timing and cultural attribution. At least in southern Europe, the combined effects of the Campanian Ignimbrite event (between 35,600±150 and 33,200±600 carbon-years BP; Barberi *et al.* 1978, Deino *et al.* 1994) and the roughly contemporary Laschamp geomagnetic excursion (Fedele *et al.* 2002, 2003) are assumed to have rejuvenated carbon dates in the wider region. Paleoart such as the early phase in Chauvet needs to be assumed to be perhaps 35 to 38 ka old, because the Campanian Ignimbrite event occurred most probably 40,012 years BP (Fedele, Giaccio 2007). It is safely attributed to the Aurignacian (contra Pettitt,

Bahn 2003), a tool tradition we now recognize as the work presumably of Neanderthals (Bednarik 2005b, 2006).

Perhaps more relevantly, paleoart such as beads, pendants, cupules and linear petroglyphs, portable geometric engravings and manuports, as well as pigment use, has been demonstrated to occur widely in pre-"Upper Paleolithic" contexts (Bednarik 1992, 2003). The Lower Paleolithic corpus, hundreds of millennia old, ranges from the solidly dated 540 cupules at two Indian sites (Bednarik *et al.* 2005) to the several hundred Acheulian *Porosphaera globularis* fossils indisputably used as beads (Bednarik 2005a); and from the Bilzingsleben engravings (Bednarik 1995c), now confirmed to be deliberate (Steguweit 1999), to the demonstrated use of red pigment in various continents (Bednarik 2003). This evidence is more than adequate to demonstrate hominin "modernity", because it proves the external storage of symbolic information (Gregory 1970: 148, Donald 1991), which is demonstrated even by a single instance. It is supplemented by the evidence of hominin seafaring ability by 840 ka ago at the latest (Bednarik 1999), another indicator of advanced cognition in the hominins concerned. Once again, the idea of a need to explain the appearance of "art" in Europe by postulating an intrusive population and a wholly fictional replacement scenario looks absurd.

It is therefore justified to ask what could have led to this replacement paradigm. We have already considered one factor, the numerous false datings of European Final Pleistocene human remains. Another is the creation of artificial plateaus through dating, interpretation and dogmatic research models. More important still appears to be the false sense of security imported from biased genetic research propping up the "African Eve" model. This very popular theory proposes that gracile humans from Africa invaded Europe, and replaced the resident "Neanderthals" either by genocide, by out-competing them, or by introducing new diseases ("African Eve"; Stringer, Andrews 1988). Another model concedes that there was interbreeding between the two populations, squarely contradicting the key element of the first theory: that the two populations could not interbreed ("Afro-European *sapiens*"; Bräuer 1984c). Also proposed have been a "wave theory" (Eswaran 2002) and an "assimilation theory" (Smith *et al.* 2005), which like Bräuer's theory are merely variations of the Multiregional Theory (Relethford 2001, Relethford, Jorde 1999, see Wolpoff, Caspari 1996). To support the various African invasion models, different research teams have produced different genetic distances in nuclear DNA, i.e. the distances created by allele frequencies that differ between populations (e.g. Cann *et al.* 1987, Vigilant *et al.* 1991, Ayala 1996). Some geneticists concede that the model rests on untested assumptions; others oppose it (cf. Barinaga 1992, Templeton 1996, Brookfield 1997). The various genetic hypotheses about the origins of "Moderns" place the hypothetical split between Moderns and other humans to times ranging from 17 to 889 ka BP. They all depend upon preferred models of human demography, for which

no sound data are available. The divergence times projected from the diversity found in nuclear DNA, mtDNA, and DNA on the non-recombining part of the Y chromosome differ so much that a time regression of any type is extremely problematic. Contamination of mtDNA with paternal DNA has been demonstrated (Gyllensten *et al.* 1991) and Kidd *et al.* (1996) have shown that, outside Africa, the elements the haplotypes are composed of largely remain linked in a limited set of them. The genetic picture in Africa as well as elsewhere has been found to be far more complicated than the Eve proponents ever envisaged. Gutierrez *et al.* (2002) have shown how the much-promoted claims that Neanderthals were genetically different from modern Europeans, based on very fragmentary DNA sequences, are seriously misleading. Their analysis suggests that the pair-wise genetic distance distributions of the two human groups overlap more than claimed, if the high substitution rate variation observed in the mitochondrial D-loop region and lack of an estimation of the parameters of the nucleotide substitution model are taken into account. Pruvost *et al.* (2007) have demonstrated the rapid deterioration of DNA after excavation, and the substantial loss of genetic material in fossils through treatment and storage. The fragmentary sequences secured from such specimens and their interpretations may be questioned. More reliable are genetic studies of living populations, which have shown that both Europeans and Africans have retained significant alleles from multiple robust populations (Hardy *et al.* 2005, Garrigan *et al.* 2005, cf. Templeton 2005). The Neanderthal genome seems to include an excess of human-derived single nucleotide polymorphisms (Green *et al.* 2006). Teeth are considered the most reliable indicator of genetic distance or proximity, and a comprehensive study of the fossil dental record has shown unambiguously that European populations are consistently related to those of Asia, and not to Africans (Martinón-Torres *et al.* 2007). This is confirmed by the cellular traits of tooth enamel compositions, which Europeans share with "Neanderthals", but not with Africans (Weiss, Mann 1978).

Relethford (2002) has detected drastic spatiotemporal changes in the genetic profiles of three recent Chinese populations, negating the idea of regional genetic homogeneity. Assumptions about a neutral mutation rate and a constant effective population size are unwarranted, and yet these variables determine the outcomes of all the genetic calculations. For instance, if the same divergence rate as assumed by one such model (2%–4% base substitutions per million years) is applied to the human – chimpanzee genetic distance, it yields a divergence point of 2.1 to 2.7 million years, which we consider unambiguously false. Nei (1987) suggests a much slower rate, 0.71% per million years, according to which the human-chimpanzee separation would have occurred 6.6 million years ago, which is close to the estimate from nuclear DNA hybridization data, of 6.3 million years. However, this would produce a divergence of Moderns at 850 ka BP, over four times as long ago as the favoured models, but Nei

has since abandoned his prediction. To explain away the perplexingly late split of the Moderns, some of the short-range geneticists have even resorted to suggesting mtDNA transfer between "proto-humans" (e.g. australopithecines) and proto-chimpanzees (i.e. species presumably separated by millions of years of evolution), while at the same time excluding such a possibility for robust and gracile, fully human populations (Hasegawa *et al.* 1985). Another genetic model (Pennisi 1999) has modern humans evolving from two discrete populations, one resulting in modern Africans, the other in non-Africans. In the absence of any reliability of the proposed rates of nucleotide changes and the many variables still to be accounted for effectively, the contentions by the replacement advocates are clearly premature, and nucleotide recombination renders their views redundant (Strauss 1999).

The base-pair substitution rates of all global models were based on the usually false assumption of single colonization events and their timing. Many islands and some continents were colonized more than once (Bednarik, Kuckenburg 1999). For instance in Australia, the lineage of the earliest known "anatomically modern" remains, Lake Mungo 3, has been shown to have probably diverged before the most recent common ancestor of contemporary human mitochondrial genomes (Adcock *et al.* 2001). The available genetic data suggest that gene flow occurred in Old World hominins throughout much of recent human evolution (Templeton 1996), as confirmed by all available paleoanthropological and archaeological empirical evidence. Genetic drift, introgression and episodic genetic isolation, rather than mass migration, probably account for the mosaic of hominin forms through time.

The abandonment of EUP occupation sites in southern Italy suggests dramatic effects on the ecosystem and human population there and elsewhere, caused by the CI event and the immediately subsequent Heinrich Event 4 (Heinrich 1988). The changes in stone tool technology over the subsequent millennia, Fedele *et al.* (2002, 2003) suggest, are the effects of a bottleneck induced by environmental conditions demanding changes and improvements in technology. The dynamics of demographic adjustments and adaptation could plausibly affect genetics and human morphology. A reduction in gene pool size is the most effective factor in the acceleration of phylogenetic change in a population, particularly if combined with genetic drift and introgressive hybridization across contiguous populations subjected to demographic adjustments. Genetic bottlenecks, however, tend to reduce fitness in the population (Bryant *et al.* 1986), rather than bring about the population's "supremacy" (cf. Hawks *et al.* 2000). Moreover, there is no evidence that the humans subsequent to the CI event were anything other than late Neanderthals; there is no indication of the presence of "more modern" types in Europe at that stage (40 ka BP). Nor are the pre- and post-IC event artifact assemblages sufficiently different to postulate any involvement of intrusive populations.

IN LIEU OF A MYTHOLOGY

The use of unproven taxonomic technological divides, especially that between the Middle and Upper Paleolithic, as reified tools of analysis and definition, is as unfortunate as the use of minor skeletal differences, such as those between "Neanderthals" and "Moderns", in inventing movements of populations. Human culture is what determines humanness, and overemphasized cranial differences or trivial skeletal differences between robust and gracile *H. sapiens* populations lacking appreciable cultural differences are of limited relevance to questions of recent human evolution. The unwillingness of the short-range protagonists to learn from evidence conflicting with their dogma is also of concern (e.g. Mellars 2005). Concerning the "explosion" of the "Upper Paleolithic," there is no evidence that the rate of technological development in Europe between 45 ka and 28 ka, the time still dominated by Neanderthaloids, was greater than the rate during the second half of the period so named. On the contrary, the significant cultural revolutions we find in the Gravettian, Solutrean and especially Magdalenian technological traditions are at least as momentous. This is so even before we consider the highly distorted nature of all Pleistocene records, which omit, for instance, all evidence of the presumably more advanced half of the human world population. That half of humanity lived on seashores, in deltas and along the lower reaches of the major rivers. Because of the subsequent rises in sea level, we have no knowledge of the cultures, technologies or human morphology of any Pleistocene coastal people. If the presumably more sedentary coastal populations in Europe had been more gracile than the more mobile tribes of the hinterland – the only ones we can have any evidence of – this could easily account for the available data, much in the same way as the cave art is a result of taphonomically truncated evidence. When sea levels approached their present state, during the Early Holocene, we detect yet another invented "revolution," the Mesolithic. Its appearance is at least partly attributable to coastal people becoming visible for the first time on the archaeological record. So much of pre-historic archaeology seems to be made up of such misinterpretations of essentially taphonomic factors.

Constructive dialogue is very difficult in this epistemological environment dominated by false deductions and accommodative reasoning. If hypotheses were framed in terms of falsifiability, their inherent flaws could be detected by refutation.

The replacement proponents had strongly contended that "a whole spectrum of radical cultural innovations" (Mellars, Stringer 1989: 8) appeared with the beginning of the Aurignacian, and that the "symbolic explosion model for the Middle–Upper Paleolithic transition, criticized by Bednarik, has the merit of emphasizing the entirely modern character of the Aurignacian behaviour" (d'Errico 1995: 618). According to them, the people of the Aurignacian are "indistinguishable" from us in terms of cognition,
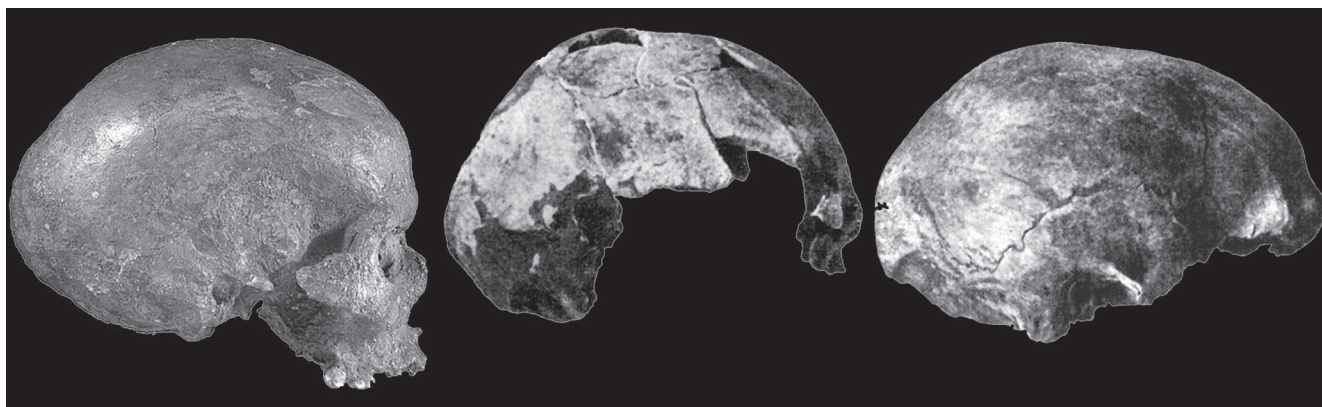
FIGURE 1. Mladeč 1, 6 and 5, Czech Republic, showing the striking morphological differences between the two females on the left and the male on the right. (To facilitate comparison, all specimens are shown facing the same direction.)

behaviour and cultural potential. Since the period from 45 ka to 28 ka BP has produced dozens of "Neanderthal" remains in Europe, but no securely dated, unambiguously fully modern human remains (in the anatomical sense), it follows that these Neanderthals were of "entirely modern" cognition, behaviour and cultural potential, according to the replacement advocates. The onus is now on these scholars to present evidence that there were anatomically fully modern humans, free of any robust or "Neanderthaloid" features, in Europe during the entire first half of their "Upper Paleolithic." Until they do this, their contentions about human evolution over this period in the European theatre are contradicted by all available skeletal evidence. Similarly, we cannot assign any stone tool tradition of the entire first half of the so-called Upper Paleolithic – including the entire Aurignacian – to anatomically modern people. Moreover, all contemporary humans in Africa, Asia and Australia are also descended from archaic *Homo sapiens* types. That has been obvious for a century; therefore the European replacement hypothesis is merely a local aberration of archaeological hypothesis building. If we are to consider the origins of human modernity – especially in the relatively unimportant anatomical sense – in a scientific format we would need to disregard the mythologies of the replacement hypothesis.

We could begin with the currently available data, some of which I have listed above, and then pose the apparently most important question to be asked in this context: what could have caused the inherent laws of biological evolution to be suspended for humans during the last fifty millennia or so?

Around 250 or 200 ka ago, *Homo heidelbergensis* graded into the "Neanderthals" in Europe, a local form with a brain size (1400 to 1750 cm^3) exceeding that of modern humans on average. *H. sapiens neanderthalensis* is the best-known human fossil, because the habit of burying the dead occasionally in limestone caves, which offered the best preservation conditions, has greatly facilitated the survival of skeletal remains of the sub-species. Those of hundreds of individuals have been recovered, from Iberia to Uzbekistan.

Anatomically, Neanderthals were very similar to modern humans, except that they were far more robust and muscular, and perhaps up to twice our physical strength. There were considerable differences among them, some specimens of the later period in western Europe being typically more robust than others, while the most recent fossils are very gracile. Minor differences between them and anatomically more modern humans concern the structures of the shoulder blade and the pubic bone. Their brain casts are so similar to ours that no evolutionary change is indicated by them, their hyoid bone (which is essential for speech) was similar, and their anatomical capacity of speech probably resembled ours (notwithstanding Lieberman's 2007 speculations). Neanderthaloids underwent considerable technological changes, starting off with a Lower Paleolithic tool kit and developing the distinctive Mousterian lithic typology that is seen as their hallmark. Four basic forms of the Mousterian are recognized, indicating a growing cultural differentiation. Beginning 45 ka ago, "Neanderthals" gradually developed Upper Paleolithic traditions in most parts of occupied Europe, from Spain to Russia, with many local traditions appearing.

The CI event and subsequent sharp climatic decline 40 ka ago may have precipitated demographic and cultural adjustments. Although this bottleneck could have also effected genetic or anatomical changes in some parts of Europe, the universal human gracilization over the last 40 ka or so, apparently in all parts of the world then settled by hominins, demands a universal explanation and precludes a local one. Occurring concurrently in the course of the second half of the Late Pleistocene, in all four continents occupied, this process needs to be explained if we are to understand our origins. In Europe, it is best documented by human remains from the central region, particularly in the Czech Republic from the crucial period of about 31 ka to 26 ka, which witnessed distinctive sexual dimorphism. Despite the lack of credible stratigraphic evidence from the Mladeč site, the recent attempt to provide direct dates from some of its human remains suggests that they represent precisely this interval (Wild *et al.* 2005). A series of dates

derived from Mladeč 1, 2, 8, 9a and 25c ranges from about 26,330 BP (the ulna of 25c) to 31,500 BP. Male crania are characterized by thick projecting supraorbital tori, Neanderthaloid posterior flattening, low brain cases and very thick cranial vaults – all typical robust features (Smith 1982, 1985, Frayer 1986, Trinkaus, Le May 1982, Jelínek 1987, Jelínek *et al.* 2005). As in Neanderthals, cranial capacities exceed those of "anatomically modern humans" (1650 cm^3 for Mladeč 5), but there is a reduction in the difference between male and female brain size relative to Neanderthal data. The sexual dimorphism is also expressed in the more inclined forehead in the males, their more angled occipital areas with lambdoidal flattening, broad superior nuchal planes and more prominent inion (*Figure 1*). The female specimens show similarities with, as well as differences from, accepted Neanderthal females, such as larger cranial vaults, greater prognathism, lack of maxillary notch, a very narrow nose and distinct canine fossa. However, the females are far more gracile than the males, while still being more robust than males of later Pleistocene periods. The Mladeč population thus seems to occupy an intermediate position between late Neanderthaloid *Homo sapiens* and *H. sapiens sapiens*, a position it shares with numerous human remains from other Czech sites. The material from Pavlov is among the most robust available from the European Upper Paleolithic, sharing its age of between 26 and 27 ka with yet another Moravian site of the Gravettian, Předmostí. The more gracile finds from Dolní Věstonice are around 25 ka old and still feature some archaic characteristics (particularly the Neanderthaloid specimen DV16).

Thus gracilization begins typically in females, with males lagging many millennia behind *(Figure 2)*. The process has continued to the Holocene, and reduction in both dimorphism and robusticity is also still active in human evolution today. The face, jaw and teeth of European humans 10 ka ago are in general 10% more robust than those of today's Europeans (and Asians), and those of 30 ka ago are 20–30% more robust. Some modern humans (e.g. Aborigines) have retained tooth sizes typical of archaic *H. sapiens*. In the Mesolithic period, individual heights averaged 1.67 m and 1.56 m respectively for male and female Europeans, while 20 ka earlier, heights were 1.74 m and 1.59 m respectively. Neanderthaloid specimens occur in the Mesolithic, such as the Hahnöfersand specimen already mentioned, or the equally robust Mesolithic skull fragment from Drigge, also from northern Germany, which is about 6250 years old (Terberger 1998). Numerous other late specimens of Robusts occur, ranging in age from the Magdalenian through to the Neolithic, and younger.

Holocene gracilization could conceivably be explained as a response to changing food-processing techniques or less physically demanding lives. The smallest tooth sizes are found in those areas where food-processing techniques have been used for the longest time. However, this explanation cannot be extended to universal gracilization during the Late Pleistocene. The life style of people 15 ka ago is not thought to have been significantly different from that of 35
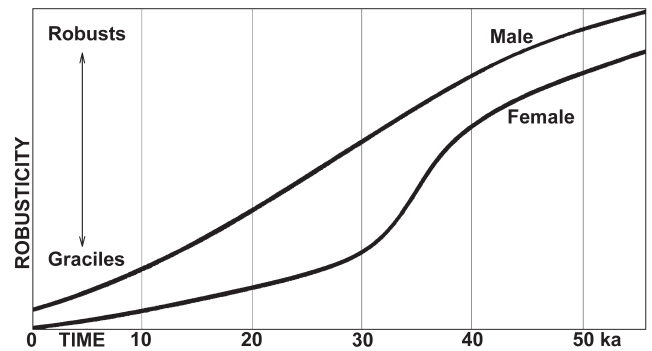

FIGURE 2. Schematic depiction of male and female relative cranial gracility in Europe through time, showing that the decline in robusticity is gradual in males, but accelerated in females between 40 and 30 ka BP.

ka ago, yet the overall rate of gracilization appears to have been reasonably uniform over the past 40 ka (*Figure 2*). As a universal phenomenon it has not been explained, and indeed has been ignored due to the dominance of the replacement model.

Natural selection simply cannot account for a significant reduction in robusticity and reversal of encephalization without any apparent trade-off in evolutionary benefits for the organism in question. No such benefits are apparent, and yet this process seems to have been universal wherever humans existed during the Final Pleistocene. It is proposed here that the dimorphism observed during the crucial period of the last twenty or thirty millennia of the Pleistocene presents the key to the most parsimonious explanation. Dimorphism in mammals generally reflects one or both of two selection pressures: competition between males for access to females, or male-female differences in food procuring strategies, with males provisioning females (Aiello, Wheeler 1995, Biesele 1993, Deacon 1997). In the case of late hominins it has been suggested that physical competition among males may have been diminished radically with the introduction of accurate projectile weapons acting as "equalizers" (Boehm 1993, 1999). This is, however, not a satisfactory explanation: effective distance weapons were in use long before the Upper Paleolithic (spears of the Lower Paleolithic were found at seven European sites), together with large game hunting. Thus the "equalizers" had long been in use and they do not explain the gender-specific pattern of later gracilization, nor the extensive foetalization that took place in the Final Pleistocene (see below).

The explanation proposed here is radically different from any other so far offered for the phenomena discussed in this paper. Human evolution, particularly in the latter part of the Pleistocene, simply cannot be assumed to have been a purely biological process (Dobzhansky 1962: 18); it must have been increasingly moderated by culture, as predicted by gene-culture co-evolutionary models. It is suggested here that around 40 ka ago, cultural practice had become such a determining force in human society that breeding mate selection became increasingly moderated

by cultural factors, i.e. by factors attributable to learned behaviour. These could have included the application of a variety of cultural constructs in such choices, such as social standing, communication skills, body decoration (which becomes notably prominent 40 ka ago), and most especially culturally negotiated constructs of physical attractiveness.

In all animals, including all hominins, reproductive success determines phylogenetic direction. It is obvious that today, the processes of natural evolution are largely suspended in our species' development, having been widely replaced by cultural mating imperatives. Inescapably, this development must have been phased in at some time in our past. If we were to look for evidence of its timing, two strategies spring to mind. We could look for signs that attributes of natural fitness were decisively replaced by attributes that confer no Darwinian survival benefits, or we could look for indications of a culturally mediated preoccupation with female sexuality. We would note that, firstly, gracility of females develops strongly during the Aurignacian, and secondly, that this very same period is marked by a distinctive preoccupation with female sexual attributes. The latter is found in the common depictions of (mostly) isolated vulvae or pubic triangles; at Abris Blanchard, Castanet, Cellier and du Poisson, La Ferrassie, Laussel (Delluc, Delluc 1978) and in Chauvet Cave; and the creation of naturalistic female statuettes beginning with the Aurignacian. Therefore the question to be asked is: what cultural preferences could possibly have led to the gracilization of female humans during the second half of the Würm glacial in Europe?

Mating preferences and their genetic results in respect of personality and anatomical traits (Laland 1994), which could become cultural selection variables, can be modelled by methods of the gene-culture co-evolutionary model (Cavalli-Sforza, Feldman 1973, Feldman, Cavalli-Sforza 1989, Aoki, Feldman 1991, Durham 1991). It has been noted that traits selected for can include large female breasts, small feet or male macho behaviour, and most certainly physical "attractiveness" – informed no doubt by cultural constructs of attractiveness.

If the foetalization of humans accounts for their recent gracilization, what are its anatomical consequences?

Humans resemble chimpanzees anatomically most closely in the latters' foetal stage. Both the foetal chimpanzee and the adult human have hair on the top of the head and on the chin, but are otherwise largely naked. In apes, this changes rapidly upon birth, in humans it remains for life. All male adult apes have a penis bone, but it is categorically absent in both foetal chimpanzees and all male humans, from the foetal stage and throughout life. In female chimpanzees, the *labia majora* are an infantile feature, in humans they are retained for life. The hymen, too, is present only in the neonate ape, but is retained for life in human females in the absence of sexual penetration. The organs of the lower abdomen, such as rectum, urethra and vagina, are typically aligned with the spine in most adult

mammals, including apes, only in foetal apes and humans do they point forward relative to the spine (upright walking appears irrelevant, because foetal apes do not walk). The human ovary reaches full size at the age of five, which is the age of sexual maturity of the apes. Human hands and feet resemble those of embryonic apes, and the same applies even to their heads. Most importantly, the skull of an unborn ape is thin-walled, globular and lacks the prominent tori of the adult ape, thus resembling the cranium of a modern human. Upon birth its robust features develop rapidly. The face of the ape embryo forms an almost vertical plane, as it does in the modern human all the way through adulthood. Even the brains of foetal apes and adult humans are much more similar to each other, in terms of proportion and morphology, than they are to those of adult apes. These many features define the anatomical relationship between ape and man as the latter's *neoteny*.

In neoteny, sexual maturity is attained before full somatic development, and juvenile characteristics are retained for life. In an evolutionary perspective, it refers to species whose adults retain juvenile ancestral features. This has also been called foetalization, because in such phylogenic development, foetal characteristics remain into adult life, and specific processes of anatomical maturation are retarded (de Beer 1940). Indeed, the modern human has undergone so much selection in favour of neoteny that this retardation should be seen as just as important distinguishing anatomical characteristic such as his oversized brain. It therefore needs to be considered here. "But neoteny does not only contribute to the production of large structural change; it is also the cause of the retention of plasticity" ("morphological evolvability") (de Beer 1930: 93). Adaptively useful novelties supposedly become available as maturation genes are freed by pedomorphosis.

Encephalization and neoteny in hominin evolution are quite probably related, perhaps through supervenience. It is self-evident that, relative to the neonate ape, the newborn human is not remotely as far developed. For instance, it would find it impossible, for many months after birth, to cling to the fur of a mother for transport. Of course this is related to its excessive brain size, which has caused it to be expelled at a much earlier stage of foetal development. It can be regarded as highly probable that human mothers always had to carry their infants. Indeed, one of the first kinds of artifacts used by early humans were probably some kind of slings or baby carrying bags. The long period during which the human infant was entirely dependent upon the mother, not just for sustenance but also to move with the horde as well as for protection, extended the period for learning very significantly. This, obviously, coincided with the continued growth of the brain after birth, which in fact exceeds that of the foetus in man. In the first year after our birth, our brain more than doubles in volume and weight. It continues to grow, approaching adult size by the age of three, but goes on expanding slightly more up to adolescence and even beyond. If we compare this extraordinary development, unheard of in the rest of the

animal kingdom, with that of other primates, we see that in simians such as the rhesus monkey and gibbon, 70% of adult brain size is achieved at the time of birth, the remaining 30% in the subsequent six months. In the apes, the size of the brain approaches adult size after the first year of life. These are very significant differences, and they are all connected with our neoteny.

Another marked difference between humans and other animals is the abolition of estrus, or periodicity of libido in the female. This uniquely human feature has not been explained satisfactorily, but there is a good probability that it is also related to these factors. The excessively long period of infant dependency would have been mirrored in a similar dependency of mothers on the horde, most especially for the meat protein needed for brain tissue (Aiello, Wheeler 1995, Leonard 2002, Leonard, Robertson 1992, 1994, 1997). It is thought very probable that there was strong selection favouring female mutations allowing long periods of sexual receptivity, leading to the abandonment of estrus altogether: those females who were longer or always receptive were favoured in the distribution of meat from kills, in a feedback system facilitating encephalization through better access to animal protein (Biesele 1993, Deacon 1997). It has been noted that on occasion, female chimpanzees are only given meat after they have copulated with a successful hunter, and it is logical that such a behaviour trait would select in favour of continuously receptive females.

CONCLUSION

Be that as it may, the numerous physiological features of human neoteny should suffice to demonstrate that humans are anatomically best defined as a foetalized form of ape. Although the process of selecting in favour of infantile physiology appears to mark much of human history, during the Final Pleistocene it suddenly accelerated to an unprecedented rate and resulted in markedly unfavourable mutations, from the perspective of natural selection. The brain of all higher species is hardwired to react in a nurturing fashion to neonate features, but this does not seem to result in foetalization unless moderated by culture. Worldwide, wherever humans existed 40 or 50 ka ago, possessing as they did an essentially "Middle Paleolithic" technological tradition, they shed all of their robust features in just a few tens of millennia. Their brain size decreased, despite the rapidly growing demands made on their brains. Their muscle bulk waned until their physical strength was perhaps halved, in tandem with significant reductions in bone strength and thickness. The decrease in skull thickness is particularly prominent, as well as rapid reduction in cranial robusticity. This process occurred so fast that it can be tracked through the millennia. At about 35 ka ago, we encounter partially gracile specimens from Europe to Australia. The subsequent skeletal evidence presents a distinctive sexual dimorphism: the female crania, though still much more robust than male crania were towards the end of the Pleistocene, show distinctive gracilization (development of globular crania, reduction or absence of supraorbital tori and occipital projection, significant loss in bone thickness, and several other features). The males, however, remain almost as robust as typical "Neanderthals." Ten thousand years later, the females have become markedly more gracile, and the robust features of the males have also begun to wane. Towards the end of the Pleistocene, the males begin to catch up with the females, and from there on the loss of robusticity continues right to the present time.

There is one mechanism that defies the laws of Darwinism: Mendel's theory of inheritance (1866). In all sexually reproducing species, all characteristics of individuals are inherited through genes. It is energetically cheaper to code information in DNA than in nervous tissue. The principles and mechanisms of genetics apply to the molecular structure of cells and tissues, the development of individuals and the evolution of whole populations. Selective breeding defies natural evolution in the sense that it can rapidly change the characteristics of a population without any natural selection in the Darwinian sense.

This demands a revolutionary change in the way we view hominin development in the last part of the Pleistocene. "Conscious" human choice, evident in various other areas, began to influence breeding patterns, and aesthetic constructs starkly evident in paleoart production began to be applied in the choice of mating partners. The skeletal evidence from central Europe suggests that this process began with males developing a reproductive preference for females of slightly more juvenile characteristics, whose genetic success only needed to be very marginally greater to achieve the changes the skeletal record documents. As ideas of a sexual desirability that was unrelated to mere reproduction apparently became reified (and perhaps expressed in paleoart), their effect on breeding patterns would easily account for the progressive female gracilization we observe. This is then a case of cultural selection for specific phenotypes of juvenile features. Eventually, it also affected the male genotypes, resulting in the reduction of male robusticity that becomes marked during the Gravettian and continues to the present time. In short, this model attributes the process to selective breeding patterns, it defines it as a form of *domestication*: humans "domesticated" themselves, unintentionally, well before they did the same with other species. This process of human self-domestication can account for the foetalized features that distinguish us from our ancestors of 40 or 50 ka ago.

To appreciate the effectiveness of such a process we only need to recall the dramatic example of the effects of domestication provided by the dog, bred to far more radical skeletal extremes in just 15 ka. Domestication demonstrates that the continuous selection of a single trait does not necessarily evolve a population of better-adapted organisms, as Darwinism would predict. Rather, it shows that selection for a single trait results in changes in numerous traits, changes that are usually deleterious.

The study of domestication has also shown that change can occur rapidly rather than gradually, given the right selective factors.

Domestication in general describes the selective breeding of specific mutations, as well shown by the examples of wheat domestication and the experiments of Dmitry Belyaev with the silver fox (*Vulpes vulpes*). The characteristics selected for are diverse, but they can include physical appearance. In the case of recent humans, we can assume that a preference for features implying youth, reproductive fertility, reproductive potential and good health presented reproductive advantages. Other primates exhibit no preferences of youth or specific body ratios, facial features, skin tone or hair, yet in present humans these are deeply entrenched, perhaps hardwired. Facial symmetry, seen to imply high immunocompetence (Grammer, Thornhill 1994, Shackelford, Larsen 1997), is also of importance, and in female humans neotenous facial features are strongly preferred by males (Jones 1995, 1996). This applies today, and it needs to be asked how long ago this preference was introduced. The paleoanthropological record worldwide suggests its gradual introduction between 40 and 30 ka BP. It is therefore reasonable to assume that much of what constitutes sexual attractiveness is attributable to cultural constructs, although there may well be biological bases for these (such as immunocompetence, or the greater reproductive potential of young females because they offer more fertile years). Once these affect "conscious" mating choices, breeding patterns favour their perpetuation, and the population should be considered to experience domestication.

We would be hard pressed to deny that cultural determinants are powerful in the choices we make *today*; therefore there must be a point in time when these began to override Darwinian selection. One could argue that this "evolutionary luxury" perhaps occurred when humans developed the ability of producing staple food surpluses, through the advent of agriculture. Alternatively, we could look at the hard evidence and search for signs of phylogenic developments that defy natural evolution. I have chosen the latter here, and propose that the apparent reduction in evolutionary fitness evident in the recent neotenous gracilization of *Homo sapiens* marks the time when physical appearance became a cultural construct affecting mate choice. It began with a sexual preference of females with mutations presenting juvenile physical characteristics, i.e. it was pioneered by the females. The decline of robusticity in males lagged many millennia behind the gracilization of females. Individuals considered attractive simply had more offspring, *and it is they who "replaced" the robust genes*.

We have three basic hypotheses to account for the universal change from Robusts to Graciles: replacement by an invading population in four continents (for which we lack any evidence, be it skeletal, cultural or genetic); gene flow and introgression without any mass movement of population (which is somewhat more plausible, but fails to explain the apparent suspension of evolutionary canons); or cultural moderation of breeding patterns (i.e. domestication). Only the last-named option can account for all the hard evidence as it currently stands. With breeding mate selection becoming increasingly moderated by cultural factors (such as cultural constructs of attractiveness or social position), we have a far more effective explanation for the worldwide change from robust to gracile types from roughly 40 ka to 10 ka BP than what has been offered so far. This is certainly not a development unique to Europe, it is found in Australia, Asia and Africa as well. There is no natural evolutionary explanation for this universal change, it did not involve any increase in brain size or other improvement in evolutionary fitness. The cranial gracility of modern humans confers no evolutionary benefit on them, and yet physical anthropologists have uniformly failed to ask the obvious: why did *Homo sapiens* so rapidly and uniformly change to gracile skull architecture and other inferior skeletal features? It is incumbent upon us to explain why a species should suddenly, in evolutionary terms, develop such regressive features as thinner skulls, significantly reduced bone and muscle strength, and perhaps even hair loss in a cold region. Nature does not select for such plainly disadvantageous variables, but culture might. The most logical explanation is that cultural factors had begun to dominate breeding patterns to the extent that modern humans are the outcome of their own domestication.

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