ARTICLES

# The Invisible Frontier. A Multiple Species Model for the Origin of Behavioral Modernity

FRANCESCO D'ERRICO

Two contradictory theories of human cognitive evolution have been developed to model how, when, and among what hominid groups behavioral modernity emerged. The first model, which has long been the dominant paradigm, links these behavioral innovations to a cultural "revolution" by anatomically modern humans in Europe at around 40,000 years ago, coinciding with the first arrival of our species in this region.[1–4] According to this model, the sudden and explosive character of this change is demonstrated by the appearance in the archeological record of previously unseen carvings, personal ornaments, musical instruments, depictions on cave walls, and new stone and bone technology. A variant of this model sees behavioral modernity resulting from a rapid biological change, a brain mutation producing no apparent change in skull anatomy, which occurred in Europe or, more probably, in Africa at ca. 50,000 years ago.[5,6]

The alternative scenario considers behavioral modernity to be the outcome of a gradual process in Africa where anatomically modern humans originated. This process is seen as corresponding to the technological changes observed through the African Middle Stone Age.[8–10] These changes started around 250,000 years ago, at the very end of the Acheulean, and proceeded until the transition from the Middle Stone Age to the Later Stone Age, conventionally placed at 40,000 years ago.

Francesco d'Errico is a researcher at the Centre National de la Recherche Scientifique. His main research interest is the evolution of human cognitive abilities. He has published numerous papers on the early use of bone tools, the origin of symbolism, the emergence of behavioral modernity, the Middle-Upper Paleolithic transition, grave goods associated with Paleolithic burials, Paleolithic systems of notation, bone taphonomy, and the application of new techniques of analysis to the study of Paleolithic art objects. He leads a multidisciplinary research project funded by the Centre National de la Recherche Scientifique on the origin of modern humans and language and participates in research projects with colleagues from France, the United States, England, South Africa, Spain, and Belgium. E-mail: f.derrico@iquat.u-bordeaux.fr

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## BLOMBOS AND THE AFRICAN EVIDENCE

Several recent discoveries seem to reinforce the second model. The most striking is the recent publication of two ochre fragments (Fig. 1) from the Middle Stone Age levels of Blombos, Cape Province, which bear similar engraved geometric patterns;[11] they have been dated by two different methods to ca. 77,000 years ago. These objects were found associated with a Still Bay industry with shaped bone awls and bifacial spear points[9,12–13] (Fig. 2), a possible engraving on bone,[14] and with more than 8,000 fragments of ochre, most of which bear clear traces of use. The presence of symbolic engravings on artifactual pigment makes it unlikely that the thousands of pigment fragments found at Middle Stone Age sites were strictly functional and suggests instead that they were used for symbolic purposes. Other engravings or notched pieces are reported from Middle Stone Age contexts at southern African sites such as Klasies River, Apollo 11, Hollow Rock Shelter, Border Cave, and Diepkloof.[7,14]

In other words, Blombos engravings and bone tools may suggest that southern African human populations had already acquired behavioral modernity 30,000 years before the appearance of these innovations in Europe. In this context, it is very tempting to consider this discovery, together with the increasing corpus of artifactual ochre, bone tools, and evidence of diverse food sources, not only as the final tolling of the bell for the revolution model but also as a formal demonstration of the gradual "Out-of-Africa" theory. Such remote evidence of symbolic culture in southern Africa would conclusively correlate the origin of cultural modernity and modern language with the origin of anatomically modern humans.

It is possible, however, that accepting this view might provide only a part of the picture. Both these scenarios share the assumption that behavioral modernity arose only in a single species. They differ in that the first model sees cultural modernity as resulting from a sudden change within this species, and in a relatively small area. Also, the first model postulates a humanity that was biologically modern but not culturally modern until the "revolution" brought both modernities together. According to the second model, biological and behavioral modernity were inextricably linked, ad-

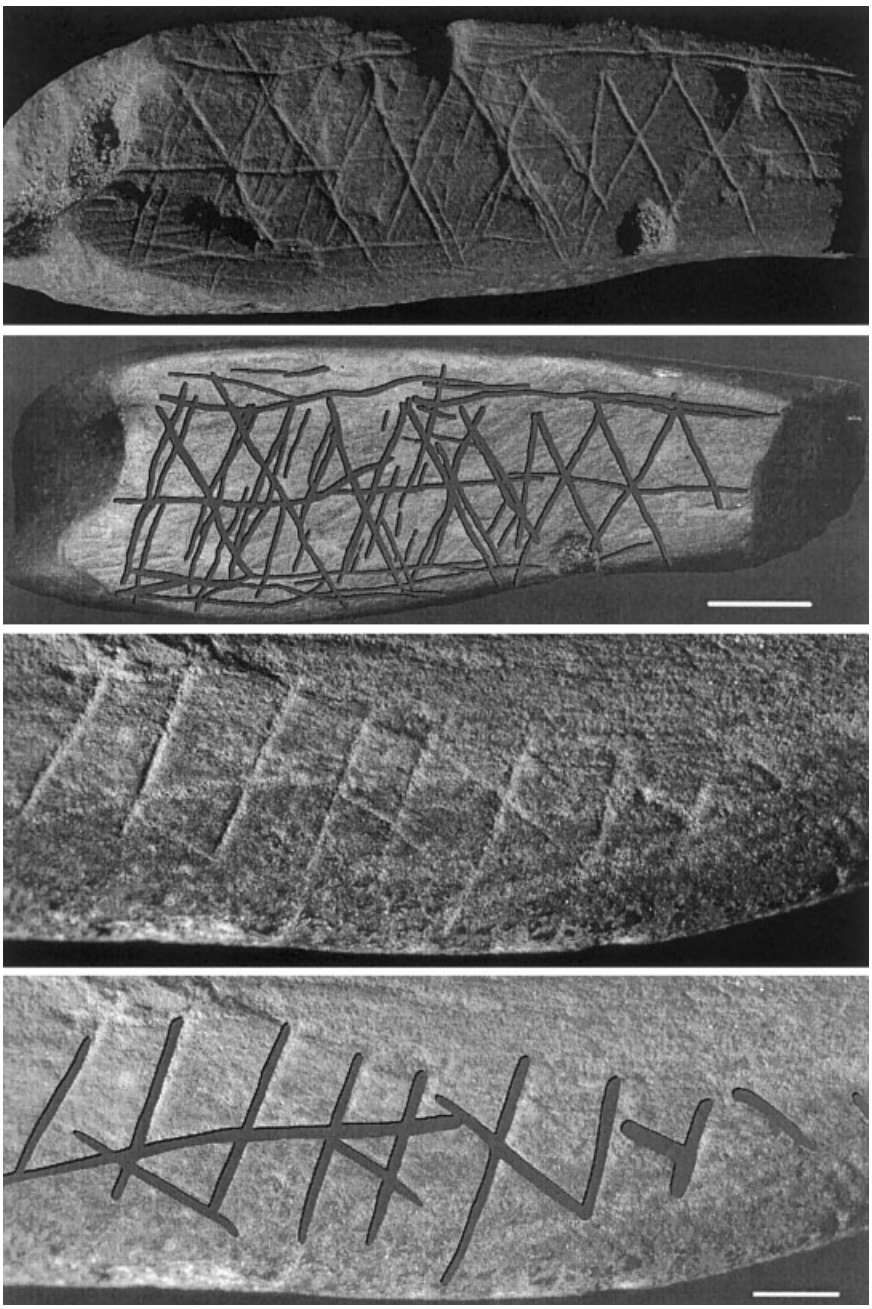

Figure 1. Engraved ochres from the Middle Stone Age levels of Blombos Cave with the tracings of the incised pattern (modified from Henshilwood and coworkers[11]). Top: scale = 1 cm; bottom, scale = 5 mm.

vancing together in a long and slow dialectic. In fact, both models are dependent on—I would say engendered by—the "Out-of-Africa" model for the biological origin of our species.[15–17] However, if we see archeology as an independent discipline, we should be able to assess issues that deal with cultural change on purely archeological grounds rather than through models shaped by current hypotheses of human biological evolution. This is a special danger if we trust archeological evidence that is ambiguous or inconsistent with suppositions as to which human species might have been involved. Because archeological remains are numerous and ubiquitous, while human remains are few and rare, it is easy in this way accidentally to prejudge the relationship between cultural and biological traits.

This is why, from an archeological perspective, the equation of biological modernity with cultural modernity should be considered as no more than a working hypothesis that needs to be tested against the archeological record. Following this approach, we may find that a fourth scenario is more consistent with the empirical data.[18–20] In this scenario, the traits that define behavioral modernity are not peculiar to our species and arose over a long period among different human types, including Neandertals.

## HOW TO IDENTIFY BEHAVIORAL MODERNITY

What features define behavioral modernity and how do we see them in the archeological record? McBrearty and Brooks[7] (Fig. 3) argue that modern behavior is characterized by four traits concerning both adaptation and cognition. They also provide a list of archeological signatures that demonstrate the acquisition of these traits (Fig. 4).

This approach would be valuable if, in a sense, the "criteria to find the criteria" were made explicit. One can expect, for example, that a list of traits might result from a cross-cultural comparative analysis[21] of various human societies and that the universality of a selected trait would be the criterion for its inclusion in the list. Otherwise one should accept that other researchers having a different cultural affiliation could propose features that *they* consider to define the modern experience, features which we should grant an equivalent weight.

Instead of following this path, the authors have been inspired by Middle Stone Age material culture and, to a lesser degree, the European Upper Paleolithic, to create a list of traits that would demonstrate the acquisition of behavioral modernity. The danger of creating a theory that fits one's expectation seems evident to me in this case. Also, if we model the traits suggesting the modern character of a cultural system on the archeological record of a specific region or a particular human type, what heuristic value will those traits have when they are

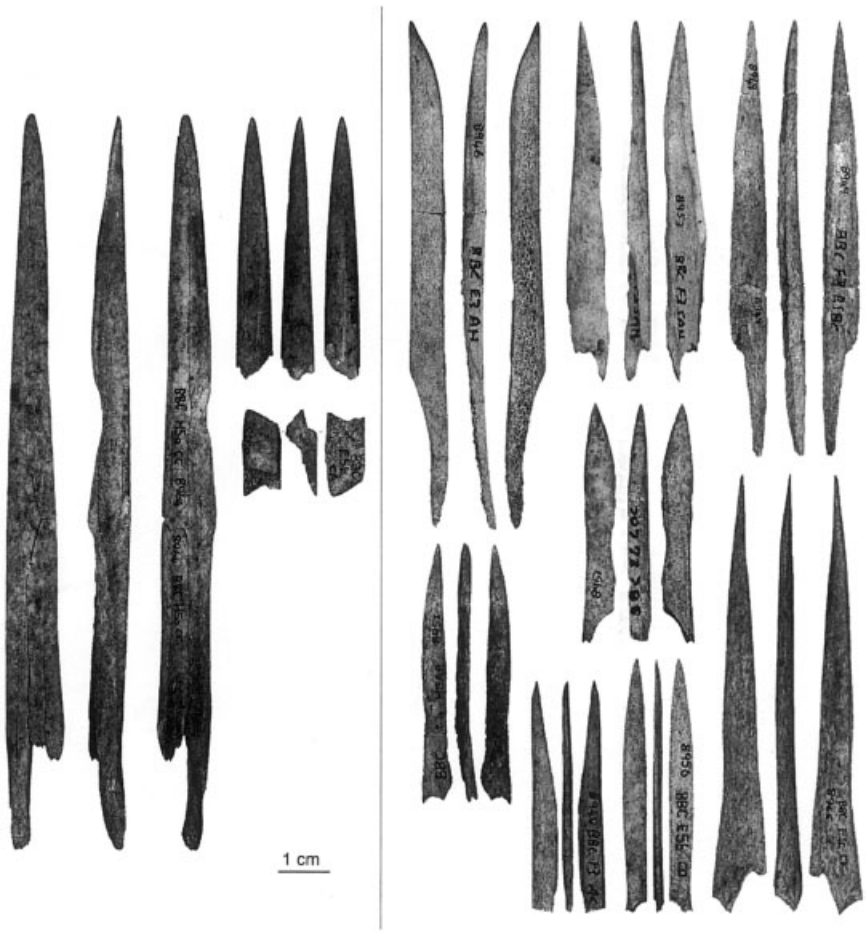


Figure 2. Bone spear points (left) and bone awls (right) from the Middle Stone Age levels of Blombos cave (modified from Henshilwood and coworkers).

used to test the modern *versus* nonmodern characters of human populations living in different environments and developing different evolutionary trajectories? As I will show, when I use these criteria, questionable though they are, to compare the African Middle Stone Age, where all these modern traits are supposed to have arisen, and the contemporary material culture left by Neandertals in Europe and the Near East, no dramatic differences appear between the two records.

## ECOLOGY AND SUBSISTENCE STRATEGIES

There is no reason to believe that Neandertals were less well adapted to their environment than were Middle Stone Age populations. This is demonstrated not only by their widespread geographical distribution over Europe and the Near East, covering, from north to south, several different ecological and biogeographical zones, but also by the fact that between 300,000 and 30,000 years ago they were able to pass successfully through three main glacial and three interglacial periods (OIS 9-3).[22,23]

Binford[24] has argued that Neandertals and Middle Stone Age hominids were obligate scavengers who lacked the ability to hunt large mammals. Stiner and Kuhn[25] have argued instead that Neandertals were able to hunt but that they practiced opportunistic scavenging more regularly than has been documented for modern humans and that the balance between these two foraging strategies was probably determined by ecological and climatic constraints. According to this reasoning, Italian Neandertals were primarily scavengers at sites dated before ca. 50,000 years ago and primarily hunters at younger sites. However, zooarcheological studies done in the last decade have shown that scavenging played little or no role in Neandertal subsistence strategies. It has also become increasingly clear that Neandertals were expert hunters who could hunt a wide range of large mammals, including dangerous animals such as bison, rhinos, and bear, and could concentrate, if necessary, on selected species. Marean and coworkers[26–28] have shown that the "head-and-foot"-dominated faunal assemblages, interpreted as evidence of scavenging at key sites from Europe and southern Africa, are due to the fact that the excavators either kept only the most easily identified bones or if they collected all of them, ignored some during the study of the faunal material. Although Stiner[29] has debated this point, Marean's observation probably remains valid for a large number of sites. Chase[30] had already argued that Neandertals were fully capable of hunting and that there was no evidence that they scavenged. A growing body of evidence now indicates that at sites dating between 125,000 to 55,000 years ago, Neandertal subsistence strategies were based on hunting. At the ca. 200,000-year-old site of Biache-Saint-Vaast, Neandertals focused on adult bovids (70%

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- **Abstract thinking**, the ability to act with reference to abstract concepts not limited in time or space.
- **Planning depth,** the ability to formulate strategies based on past experience and to act upon them in a group context.
- **Behavioral, economic and technological innovativeness.**
- **Symbolic behavior**,the ability to represent objects, people, and abstract concepts with arbitrary symbols, vocal or visual, and to reify such symbols in cultural practice.

Figure 3. Traits defining behavioral modernity according to McBrearty & Brooks.[7]

of the minimum number of individuals), but also hunted large bears, probably as they hibernated.[31] At the site of Mauran, the Neandertals killed hundreds of bisons, and processed the carcasses on site.[32] A similar preference for bovids is seen at sites such as La Borde, Champlost, Coudoulous, and Wallertheim. At the open-air site of Salzgitter-Lebenstedt, dated to ca. 58,000 to 54,000 years ago,[33] Neandertals systematically hunted reindeer; they also killed many animals simultaneously in a type of hunting that seems not to differ from that observed at later Upper Paleolithic sites or among sub-Arctic Inuit groups. A recent study also has shown that Early Upper Paleolithic hunting did not differ from Middle Paleolithic hunting in its degree of specialization.[34] Studies that have tried to contrast the adaptations of Neandertals and anatomically modern humans in the Near East have reached similar conclusions: these populations possessed broadly comparable organizational abilities.[35] The two main subsistence strategies they seem to have adopted, a "collector" land-use strategy involving lower residential mobility for the former and encounter-based hunting for the latter, both occur among historically observed hunter-gatherers.

Coastal Middle Stone Age sites show an intense exploitation of marine resources, which has been used to suggest the varied and modern character of these societies.[7] Only a few examples of the use of marine resources exist at Middle Paleolithic sites in Europe. The late Mousterian levels of Figuiera Brava, Portugal, have yielded evidence of systematic collection of seashells, particularly *Mytilus* and *Patella*.[36] Another case of Neandertal shellfish use, and probably seal-hunting, comes from Vanguard Cave, Gibraltar.[37]

It is a fact, however, that evidence of the exploitation of marine resources, with the exception of the use of sea shells for beads, is as scant in the Upper Paleolithic as it is in the Middle Paleolithic of Europe. Still, nobody has used this to argue against the modern character of Upper Paleolithic societies.

What about other inland resources? Stiner[38] has shown that Neandertals were able to diversify their diet and,

**Ecology**
- Range extension of previously unoccupied regions
- Increased diet breadth

**Technology**
- New lithic technologies: blades, microblades, backing
- Standardization within formal tool categories
- Hafting and composite tools
- Tools in novel materials, e.g., bone, antler
- Special-purpose tools, e.g., projectiles, geometrics
- Increased numbers of tool categories
- Geographic variation in formal categories
- Temporal variation in formal categories
- Greater control of fire

**Economy and social organization**
- Long-distance procurement and exchange of raw materials
- Curation of exotic raw materials
- Specialized hunting of large, dangerous animals
- Scheduling and seasonality in resource exploitation
- Site reoccupation
- Intensification of resource extraction ( aquatic and vegetable)
- Long-distance exchange networks
- Group and individual self-identification through artefact style
- Structured use of domestic space

**Symbolic behavior**
- Regional artefact styles
- Self-adornment, e.g., beads and ornaments
- Use of pigment
- Notched and incised objects (bone, egg shell, ocher, stone)
- Image and representation
- Burials with grave goods, ochre, ritual objects

Figure 4. Archeological signatures of behavioral modernity according to McBrearty & Brooks.[7]

particularly after 50,000 years ago, paid more attention to sources of foods such as lagomorphs and tortoises. Fowling has been suggested for Mousterian sites in Portugal, Spain, and Italy, among them Figueira Brava, Cova Negra, Gorham's Cave, Archi, Mochi, Fumane, and Castelcivita. This interpretation is based on the birds' large size and habitat rather than on the occurrence of cut marks and burning, which means we cannot eliminate the possibility that they were rock-nesting, cliff-roosting birds that died naturally or were accumulated by owls and mammalian carnivores. However, micro-residues of feather and other avian tissues have recently been found on stone tools from the Late Mousterian levels of Staroselie and the Streletskayan-like stone tools from Buran Kaya level C, a level underlying a Kiik-Koba Micoquian.[39]

In sum, while zooarcheological and isotopic analyses indicate that Neandertals derived most of their dietary protein from animal sources, they do not demonstrate that Neandertals were *obligate* large mammal hunters.[40,41] This takes us to the contradictory nature of the criteria used to assess behavioral modernity from subsistence strategies. Once the *obligate*[24] and *opportunistic*[25] scavenger scenarios for Neandertal economies are abandoned, little remains to distinguish the subsistence strategies of Neandertals and anatomically modern humans. The same features are used for and against the modern character of an economy depending on which actor is under scrutiny. The exploitation of a wide range of resources is used to suggest increased diet breadth when sub-Saharan hominids are concerned while, in a clear contradiction, the hunting of many mammalian species is taken to demonstrate the opportunistic character of Neandertal economies. The focus on one or a few species of large dangerous animals is at once interpreted as attesting to the "modern" organization of anatomically modern hunters, capable of "specialized" hunting, and as demonstrating the biologically handicapped cognition of Neandertals, who could not incorporate more resources into their diet.

## LITHIC TECHNOLOGY

Laminar technologies often have been considered to characterize the Upper Paleolithic, behavioral modernity, and higher cognitive abilities, while Levallois or Mode III technology is taken to indicate a lack of planning capacities.[1,3,42,43] However, it has now become clear that blades were systematically produced at several Middle Paleolithic sites in Europe and the Near East, as well as at African Middle Stone Age sites.[40]

**Because "blades" may result from very different reduction sequences, in which different types of raw materials are chosen and different sequences of motions are applied, the occurrence of blade production in the archeological record is better explained as the expression of local tradition than as a reflection of cognitive evolution. Certainly blades are not a simple diagnostic marker.**

In my view, three observations emerge from the temporal and geographic dispersion of blade technology. Blade production appears as a punctuated phenomenon in both the Eurasian Middle Paleolithic and the Middle Stone Age. After these periods, the production of blades did not become fixed in either continent, since other forms of débitage continued in both areas. The flake-based assemblages of the ethnographic Australian Aborigines, whose approach to stoneworking was characterized by little or no blade production, flourished into very recent times.[45] New World Paleo-Indians abandoned prismatic blade technology as soon as they left the Arctic.[46] Detailed technological analysis of blade assemblages indicates that "blade" is quite vague as an analytical concept: in terms of raw-material choice, preparation, and apprenticeship, the making of standardized bladelets by pressure-flaking has little to do with the production of Aurignacian blades, which are thick, elongated, and trapezoidal in section, and which differ from the short, thin blades produced by the late Neandertals to manufacture Châtelperronian points. Because "blades" may result from very different reduction sequences, in which different types of raw material are chosen and different sequences of motions are applied, the occurrence of blade production in the archeological record is better explained as the expression of local tradition than as a reflection of cognitive evolution. Certainly blades are not a simple diagnostic marker.

Partisans of the "Out-of-Africa" and "modern-behavior" model make much of the production of standardized formal tool categories (Fig. 5) at the end of the Middle Stone Age and of geographical and temporal variations in those categories.[7,47] This modern trend would be mainly exemplified by Still Bay bifacial points and by Howieson's Poort segments. Similar standardized tool categories and similar technological variation in time and space are common in the Mousterian world. This is the case for Levallois points and for Mousterian of Acheulean Tradition bifaces. During the last forty years, many attempts have been made to explain technological and typological variability in the Mousterian in terms of differential function of sites, chronological differences between assemblages, resharpening of tools, and raw-material availability, but these have all failed.[2] Also, in both Europe and the Near East at the end of the Mousterian we observe the same trends visible in the Middle Stone Age toward increased production of standardized tool categories. Segments very similar to those associated with the Howieson's Poort in southern Africa[7,8,47] were produced by Châtelperronian

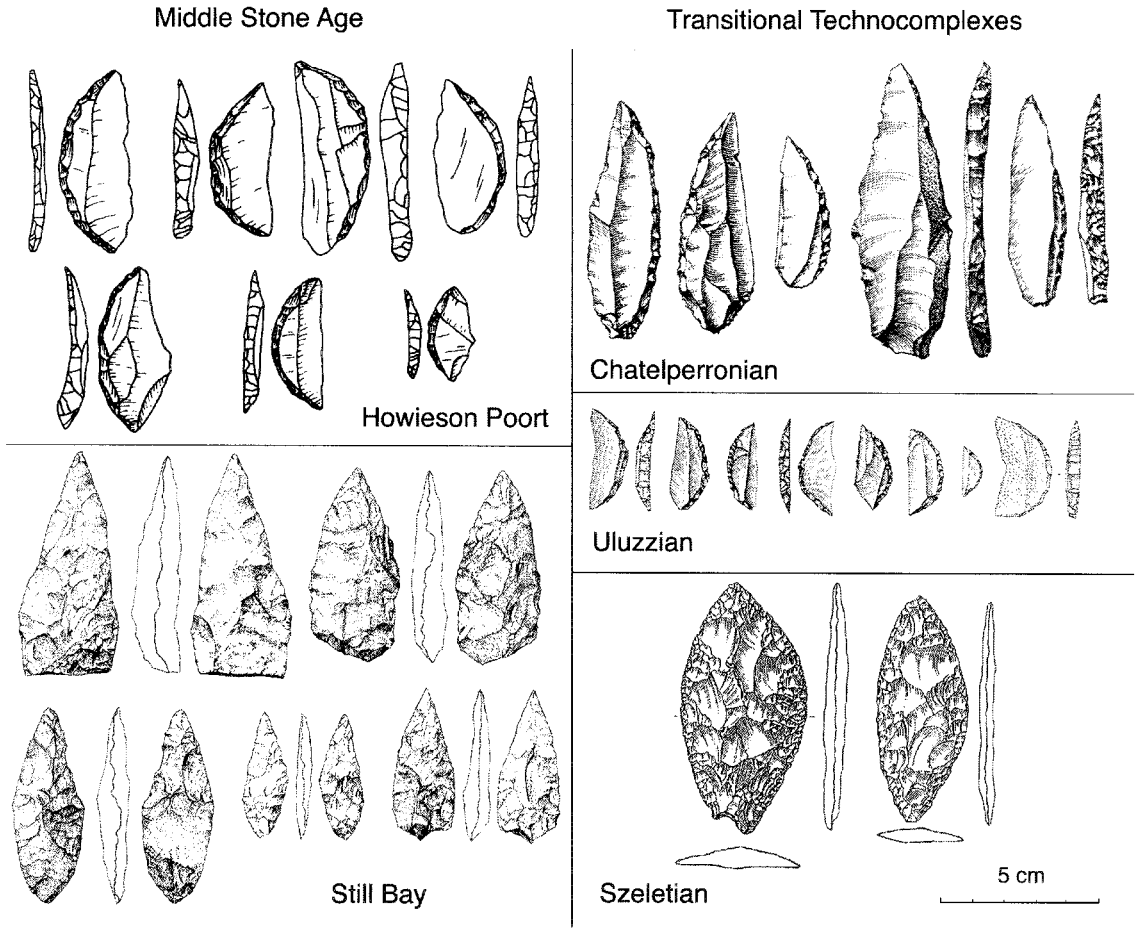


Figure 5. Backed pieces and foliates associated with the late Southern African Middle Stone Age and transitional technocomplexes in Europe.

Neandertals in France and Spain (Fig. 5) and by Uluzzian Neandertals in Italy and Greece.[18,48] The Szeletian and other east European late Middle Paleolithic technocomplexes, which developed locally from regional Mousterian traditions,[49] are characterized by thin bifacial points that recall those found at South African Still Bay sites (Fig. 5). Again, we see no clear difference between supposedly modern Middle Stone Age behavior and the behavior of the Neandertals.

## HAFTING AND RELATED CRAFT SKILLS

It has been argued that the Mousterian was an immediate technology involving a low degree of conceptualization.[1,3,42] However, the discovery of six wooden spears at the Lower Paleolithic site of Schöningen, Germany, dated to ca. 400,000 years ago, confirms what was already known from Clacton and Lehringen: Middle Pleistocene hominids shaped wood with specific techniques and produced spears for hunting.[50,51] The finding of four wooden hafts in another part of Schöningen also shows that composite tools were used in the middle part of the Middle Pleistocene (OIS 11).

We know that hafting technology was practiced in the Middle Paleolithic of Eurasia. A convergent scraper, three Levallois flakes, and a cortical flake with traces of bitumen adhesive used for hafting have been found in Mousterian levels dated to about 60,000 years ago at the site of Umm El Tlel, in the El Kowm Basin, Syria.[52] A blade from the Hummalian (Middle Paleolithic) levels at Hummal, in the same region, bears similar traces. Direct evidence of stone-tipped spears also comes from Umm El Tlel, which produced a Levallois point embedded in the third cervical vertebra of a wild ass.[53] Two birch-bark pitches have recently been found at the Middle Paleolithic site of Königsaue, Germany. These pieces came from two different layers dated to 43,800 and 48,400 years ago. One shows the imprint of a wooden haft, the other a bifacial tool.[54] A probable bone handle made of a horse metapodial has also been found in level C of Buran Kaya III, in Crimea.[55] The pre-Aurignacian industry from this level consists of clusters of chips and small flakes derived from bifacial shaping and thinning, associated with preforms and bifacial points recalling those of the Streletskaya culture.[56] The maker of these objects is still unknown, but it is noteworthy that level C underlies level B1, which contains a

Kiik-Koba Mousterian dated to 28,600 B.P. The handle has been directly dated by C14 AMS to 32,350 ± 650 (OxA-6869), which is well before the oldest C14 dates for the Crimean Aurignacian.

In sum, the available evidence provides no reason to believe that hafting and the use of composite tools was developed *only* in the Middle Stone Age. Consistent, if not more evidence of this technology is found in Mousterian sites from Europe and the Near East.

## BONE AND IVORY WORKING

Evidence of worked and, in some cases, decorated bone awls comes from Châtelperronian and Uluzzian sites in France and Italy.[18] But did Neandertals produce an organic spear technology before these late stages? Villa and d'Errico,[57] in an analysis of Torralba and Ambrona ivory points formerly interpreted as shaped or used tools,[58] found that these tusk fragments are the result of natural phenomena. These authors also have shown that a natural explanation must be favored for other bone and antler points reported from Mousterian sites such as Vaufrey, Combe Grenal, Camiac, and Pech-de-L'Azé I, and probably for those from other sites the authors were unable to study. On the other hand, a recent experimental study by Schmitt, Churchill, and Hylander,[59] indicates that the thrusting spear was one of the principal sources of strength asymmetry in both Neandertal and Early Upper Paleolithic modern human male humeri. Why, then, did Neanderthals use wooden spears and stone-tipped spears but not organic spear tips? The reason may lie in the different type of predatory tactics used by Middle and Upper Paleolithic hunters.[57,60]

Upper Paleolithic bone and stone spear-tips are different from Middle Paleolithic stone points in their aerodynamic properties and in the amount of kinetic energy they carry at impact. Even when carefully shaped by retouch, Middle Paleolithic stone spear-tips have a large, thick base, implying a large, heavy shaft. This kind of javelin has a low velocity but high penetration power at short distances. Similar organic points could not penetrate deeply into the flesh of large animals because of the softer nature of the bone material. In contrast, stone and bone spear-tips used by Upper Paleolithic hunters are similar in that both types are thin, straight, and light: they are made to travel at high speed and to be cast from afar. This allows them to penetrate the animal body and injure vital organs. Thus, while both Neandertals and anatomically modern humans relied on thrusting spears before the appearance of long-range projectile weapons, (spear-throwers) during the early part of the Late Upper Paleolithic, Neandertals may have preferred more robust and heavy weapons for closer-range hunting.

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What impact did the production of formal bone tools by Middle Stone Age people have on their way of life? Analysis of the twenty-eight bone tools from Blombos Middle Stone Age layers indicates that 90% of these objects are awls that were made on different types of long-bone shaft fragments, shaped by scraping, and then used at the site to pierce soft material such as leather.[12] Three points shaped by scraping and then completely finished by careful polishing probably were projectile points made for hafting. These points might have been polished to increase their penetration power and to give them a distinctive appearance—an "added value"—to reflect the distinct contexts of use of the two tool categories and the different social roles of their users.

However, one may argue that bone tools are a possible, but not obligatory outcome of the acquisition of modern traits. Relatively few Middle Stone Age sites have been excavated by modern standards in comparison with the many Middle and Upper Paleolithic sites in Europe. But does this difference fully explain why only a handful of bone tools has been found in southern Africa? There are bone harpoons from Katanda[61–63] for which the minimum date of 90,000 years ago remains controversial;[6] one quite doubtful point from Mumbwa cave;[64] a few notched and marked objects[7,14,65] from Klasies River and Apollo 11; and one clear point from Peers cave. Singer and Wymer[65] described a bone point from a disturbed context at Klasies River. Its shape is very similar to that of Later Stone Age points, and it probably should be attributed to a more recent period.[12,57] In sum, while we have at Blombos clear evidence of bone tools produced by a varied repertoire of techniques and designed for different purposes, we cannot use this evidence to support either the hypothesis that the Middle Stone Age *as a whole* was characterized by systematic production of formal bone tools or, because little is known about the evolutionary significance of bone tool shaping the notion that the production of formal tools gives Middle Stone Age material culture a modern appearance.

## THE COGNITIVE ABILITIES OF NEANDERTALS AND THEIR RELATIONSHIP TO MODERN HUMANS IN EUROPE

In the last few years, studies have begun to cast new light on the intellectual abilities of these predecessors and the chronology of their contact

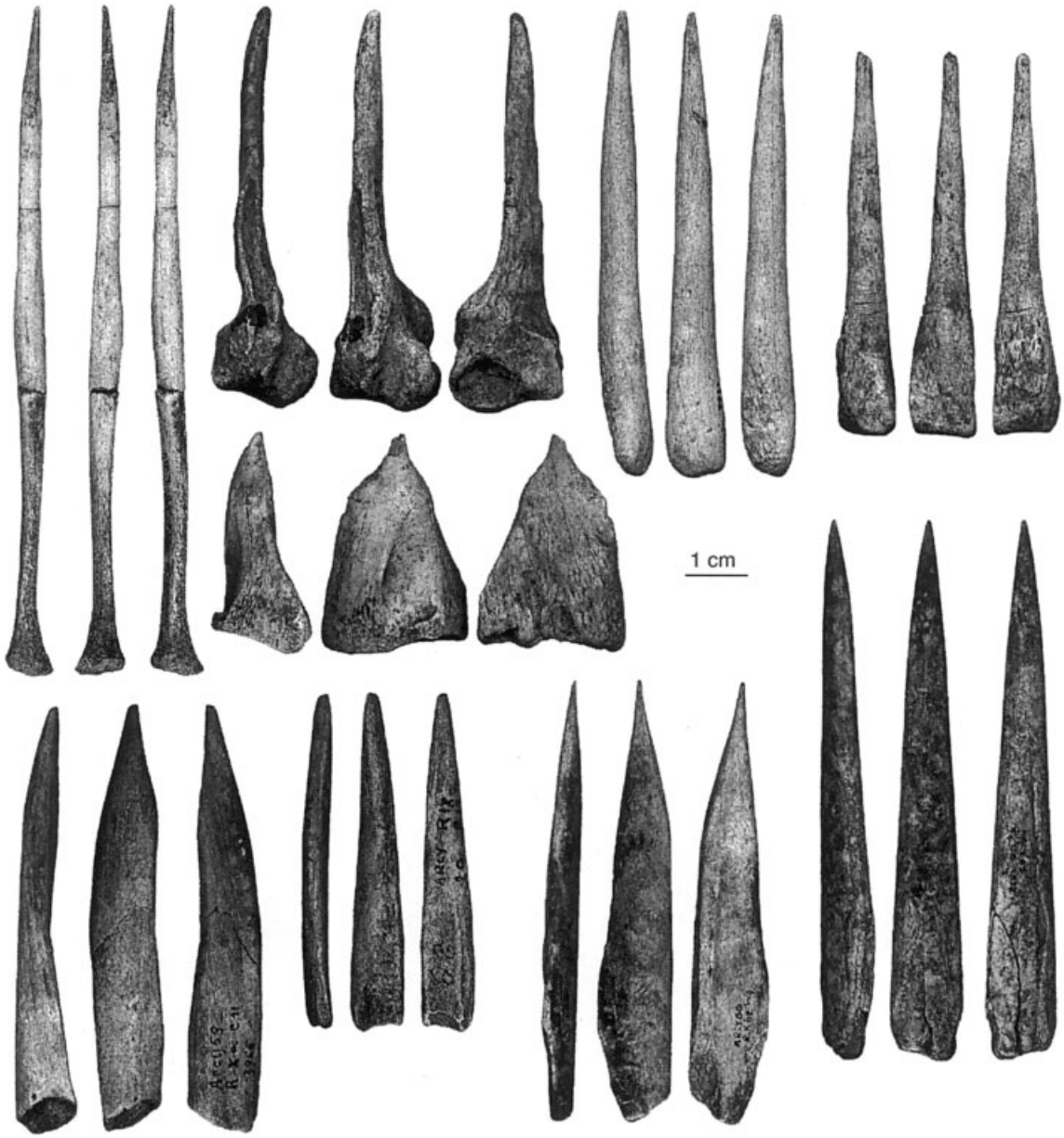


Figure 6. Bone awls from the Chatelperronian layers of the Grotte du Renne at Arcy-sur-Cure, France (modified after d'Errico et al. in press).

with the first anatomically modern humans to colonize Europe. Debate on this issue has generally taken for granted that people like us arrived in the far west of Europe from the east about 40,000 years ago. According to that assumption, Cro-Magnon populations, carrying a lithic and bone technology called Aurignacian, would have triggered, through acculturation, the appearance of a new lithic technology, ornaments, decorated objects, and bone tools among some late Neandertal groups such as the Châtelperronians in France and Spain or the Uluzzians in Italy.[1,2,4] The manufacture of personal ornaments and bone tools by Neandertals has been a controversial issue; many researchers preferred to attribute the presence of such objects in the Châtelperronian layers of sites like the Grotte du Renne, France, to a reworking of archeological layers incorporating Aurignacian artifacts, the Neandertal collection of objects manufactured by modern neighbors, or an actual transfer of objects to Neandertals through trade. Recent reassessments of the evidence have shown that Châtelperronian Neandertals themselves made the personal ornaments and bone tools from the Grotte du Renne, as demonstrated by the presence, in the same layers, of refittings and manufacturing by-products.[18,19] This finding is reinforced by a new study of the fifty Châtelperronian and nine Aurignacian bone awls (Fig. 6) found in the Châtelperronian and Aurignacian levels of the Grotte du Renne.[60] If the bone tools found in the Châtelperro-

nian layers had originated in the overlying Aurignacian level, we would expect their number to decline with depth, but the opposite is true. The lowest of the three Châtelperronian layers yielded four times the number of awls found in the Aurignacian horizons of the site. The tools from the two cultural horizons also show a different spatial distribution: in the Châtelperronian layers the bone tools are concentrated inside a circle of stone located in the northwestern part of the excavated area, while the few Aurignacian awls were found in the southeastern part. The Châtelperronian tools also vary more in blank types, methods of blank production, and degrees of shaping. Nine Châtelperronian tools are marked with sets of notches or v-shaped motifs. Only one Aurignacian piece bears a decoration, a set of crosses. The presence of deliberate decorations suggests that symbolism, rather than restricted to a few objects obtained through exchange, played a role in the domestic aspects of group life. Bone tools are not isolated occurrences. Awls also come from the Châtelperronian level of Quincay, Charente (Lévèque, personal communication) and from several Uluzzian sites from Italy such as Cavallo and Castelcivita.[18]

The lithics tell the same story.[18] While revealing the use of new knapping techniques and tool types, late Neandertal technologies from different European regions show *no* affinities with the technology that modern humans introduced into Europe; instead they appear as independent developments from local traditions. The chronological precedence of the Aurignacian over these regional Neandertal entities, which is fundamental to their interpretation as the outcome of prolonged contact, is also called into question. Wherever archeological layers of both cultures are represented at the same site, the Châtelperronian *always* underlies the Aurignacian, suggesting its priority. The only exceptions are two instances of interstratification between Aurignacian, and Châtelperronian, which now have been formally rejected by reappraisal of these sites.[67] Similarly, analysis of all the radiometric dating shows that the earliest occurrences of a diagnostic Aurignacian in Western Europe is no older than ca. 36,500 BP. The available evidence suggests that at that time late Neandertals were already developing their *own* transition to the Upper Paleolithic, the Châtelperronian, and that this, like other late Neandertal cultures, emerged *before* any modern humans became established in the same areas. This indigenous development may have included the manufacture and use of symbolic objects created for visual display on the body. The alternative hypothesis, which I and others have proposed, is that it was precisely the new situation involving contact between anatomically modern people and Neandertals and the consequent problems of cultural and biological identity that stimulated an explosion in the production of symbolic objects on *both* sides.[18,19]

**. . . that the earliest occurrences of a diagnostic Aurignacian in Western Europe is no older than ca. 36,500 BP. The available evidence suggests that at that time late Neandertals were already developing their *own* transition to the Upper Paleolithic, the Châtelperronian, and that this, like other late Neandertal cultures, emerged *before* any modern humans became established in the same areas.**

## BURIALS

Thirty-five of the fifty-eight known Middle Paleolithic putative burials from Europe and the Near East belong to Neandertals.[68,69] Contesting the opinion[1,70,71] that they must be interpreted as accidental depositions of dead bodies would require a detailed discussion of each case, and that is beyond the scope of this review. However, while I can easily accept that most of these human remains, all excavated long ago, lack the information required today to assess the human origin of the inhumations, there is a growing consensus on the existence of Neandertal burials. This depends in part on the observation[72] that complete animal skeletons are so rare in Near Eastern and, one may add, European caves, as to make it unlikely that interments were produced by causes other than cultural processes. Also, field observations (for example, at Kebara) on the more recently found burials help confirm the reality of this phenomenon.[73,74] In sum, many would agree that there is enough evidence to believe that both anatomically modern humans and Neandertals buried their dead well before the Later Stone Age or Upper Paleolithic.

Should the Neandertal burials be seen as symbolic in nature? The only difference we see between the burials of these populations is that the use of grave goods is apparently well established for anatomically modern people but remains controversial with respect to the Neandertals. Also, the recent rediscovery of the Neandertal neonate from Le Moustier, the remains of which were previously assigned to La Ferrassie LF4, eliminates from the literature the only known example of a Neandertal double burial.[75] Although for these reasons the funerary practices of anatomically modern humans may appear to be more complex than those of contemporary Neandertals, this cannot be used to suggest that the latter invested less consciously in symbolism. Many fully symbolic ethnographic and even modern societies bury their dead in single tombs with few or no durable grave goods. The idea that these differences result from "incomplete learning" of this behavior by Neanderthals who obtained it through contact with anatomically modern humans in the Near East, supported by the dating of ca. 100,000 for the Qafzeh buri-

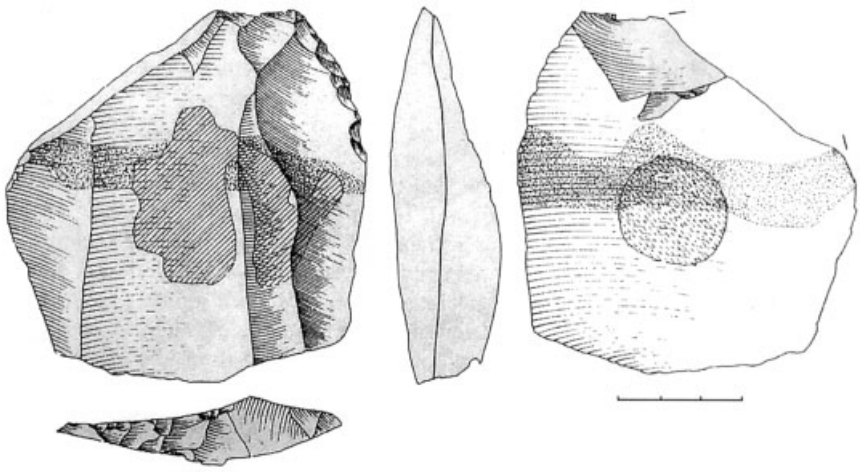

Figure 7. Levallois flake from the Middle Palaeolithic level 4 at Wadi Soldmein Cave showing an ochre band on both faces. Hatched pattern on dorsal face indicates a calcite crust. On the ventral face, note a circular inclusion of different color in the chert (after Van Peer, Vermeersch[82]).

als, is now contradicted by the thermoluminescence dating of Tabun layer C to 160,000.[76] This could make the Neandertal burial therein the oldest known burial in the world or, if one takes a minimalist view of the evidence, a burial as old as the oldest anatomically modern burials found in the region.[77]

Again, we see no clear-cut indications that anatomically modern humans were culturally more "advanced" than Neandertals. In fact, burials produced by both human types appear to resemble each other more than they do burials dated to the Upper Paleolithic of Europe because of the virtual absence of ochre, bone tools, and personal ornaments. Many fragments of ochre bearing traces of use and ochre-stained stone tools come from the Qafzeh layers that yielded the burials,[78] but none of them were found in clear association with the skeletons.

## COLOR

There is no traditional modern society in which the production and use of colorant is merely functional. Recent excavations at Kapthurin in Kenya[79] and Twin Rivers in Zambia[10,80] have yielded convincing proof that colorants were systematically used as far back as the Acheulean to the Middle Stone Age transition, ca. 200,000 years ago. At GnJh-15 in the Kapthurin Formation, more than seventy pieces of red pigment weighing more than 5 kg altogether are associated with an early Middle Stone Age assemblage dated to 285,000 years ago. Field work at Twin Rivers produced 176 colorant fragments in layers dated between 260,000 and 400,000 years ago. Five different colors and traces of their use are attested. Layers dated to 200,000 years ago yielded 132 pieces of colorants. The discoveries at these two sites confirm isolated occurrences of red pigments signaled in the past from sites such as Nooitgedacht in South Africa, Kabwe in Zambia, and Charama in Zimbabwe. Watts[81] has shown that the use of red pigments increased during the Middle Stone Age and became a consistent feature of MSA2b/Still Bay, Howieson's Poort, and Late Stone Age sites. Middle Stone Age people preferred strong red colorant even when yellowish or yellowish-brown material of similar chemical composition was available. This choice argues against a purely functional interpretation of pigment use. Many Middle Stone Age colorants are shaped like crayons, suggesting that they were used to trace lines on soft material like leather or to paint the body. Additional evidence indicating that the spread of pigment use was not limited to sub-Saharan regions comes from the Wadi Sodmein cave in Egypt, where Van Peer and Vermeersch[82] have reported a Middle Paleolithic assemblage with Levallois debitage dated to ca. 115,000 years ago in which there is a Levallois flake marked on both sides by a continuous red line perpendicular to the main flake axis (Fig. 7).

Is pigment use exclusively a Middle Stone Age attribute? Neandertals, too, used colorants. Black pigments, mostly manganese dioxides, and to a lesser extent fragments of ochre, come from at least seventy layers excavated at forty Neandertal sites in Europe.[83,84] While most of the sites with pigments represent the Charentian Mousterian and Mousterian of Acheulean Tradition and date from OIS 3 (60,000 to 35,000 years ago), evidence of pigment use in Europe extends back to the Acheulean. The richest collection, comprising 451 colorant fragments and grinding stones, comes from the Mousterian of Acheulian Tradition levels of Pech-de-l'Azé I, dated to ca. 60,000 to 50,000 years ago.[84,85] Most of these pigments show traces of use in the form of abrasion facets like those visible on Middle Stone Age colorants; some also show evidence of use as crayons. There is no conspicuous difference between pigment use at Pech-de-l'Azé I and at Middle Stone Age sites in terms of the weight, number, and proportion of pigments used. Moreover, Pech-de-l'Aze I provides evidence of more intensive use of pigment than does any Middle Stone Age site except Blombos. Evidence of systematic use of pigment by Neandertals has recently been reported from the Cioarei cave in Romania, where eight subcircular ochre containers made of stalagmite fragments, associated with fifty-five ochre fragments, were found in a Mousterian layer older than 50,000 BP.[86]

In sum, while the widespread occurrence of pigments at Upper Pleistocene Middle Stone Age sites is an important phenomenon that, following the discovery of Blombos engravings, probably reflects the growing role of symbolic activities in these communities, evidence from European Middle Paleolithic sites gives no reason to believe that Neandertals were not using pigments in compara-

ble activities. The chronological attribution of the older pigments from Africa (Kapthurin, Twin Rivers) and their association with Lupemban stone tools seem to indicate that the use of pigments originated with *Homo heidelbergensis* or archaic *Homo sapiens*. If colorant use is taken as an archeological indication of symbolic behavior, then the origin of these abilities, traditionally attributed to anatomically modern humans, has to be considered more ancient. This is clearly consistent with the hypothesis I offer here: these abilities did not necessarily emerge in a single species; a model for their origin must be primarily archeological and independent of biological scenarios for the origin of our species.

## ABSTRACT AND DEPICTIONAL REPRESENTATIONS; PERSONAL ORNAMENTS

Little evidence of abstract or depictional representations exists in the Middle Stone Age.[7] Apart from the objects I mentioned at the beginning of this paper, the only evidence of depictions are the painted slabs with animal figures from the Apollo 11 site, Namibia, found in a level overlying assemblages with Howieson's Poort affinities. The chronological attribution of this level, however, is unclear. The young age suggested by radiocarbon dating, 26 to 28,000 years ago, seems to contradict the cultural attribution of the assemblage. No personal ornaments are known at Middle Stone Age sites. The oldest traces of their manufacture come from the Kenyan site of Enkapune ya Muto, dated to 40,000 years ago,[87] and from the site of Ntuka River 3, GvJh11, associated with a 29,975 year old Late Stone Age microblade industry (Ambrose, personal communication). Perforated and ochre-stained *Glycymeris* shells apparently were found at Qafzeh in association with early modern human burials dating to 90,000 to 100,000 years ago; the Mousterian levels of Skhul may have yielded similar shells.[88] However, as long as no detailed publication of this material is available it is difficult to evaluate the evidence. In fact, the oldest evidence of the production of personal ornaments comes from the Early Upper Paleolithic levels of Uçagizli, Turkey, and perhaps from the contemporary layers at Ksar' Akil, Lebanon. Recent excavation at the former site by Kuhn and colleagues[89] has yielded a large number of perforated marine shells of different species from levels dated to ca. 39 to 41,000 years ago. The stone-tool assemblage associated with the beads is characterized by pointed blades and small end-scrapers; it shows no Aurignacian affinities. The makers of these shell beads are still unknown and, considering the age of the layers, might well have been Neandertals. A morphologically modern child was found in the Aurignacian layers of Ksar' Akil, but the layer from which the modern remains come is dated to ca. 29,000 years ago[90] and overlies the Ahamarian layers in which the oldest beads occur.

It is difficult to establish whether or when Neandertals or earlier hominids produced deliberate engravings or used personal ornaments because many objects that have been described as such are actually the result of natural phenomena.[91] This is the case with the Pech-de-l' Aze II rib and several purported engraved bones from Cueva Morin, Stranska Skala, and other sites. It is also true of perforated bones from Pech-de-l'Azé, Bois Roche, Kulna, Bocksteinschmide, and Repolusthöhle, as well as putative musical instruments like the "flute" from the Slovenian site of Divje Babe. The putative engravings are blood-vessel impressions, the putative pendants are actually bone fragments regurgitated by hyenas, and the perforations on the so-called flute are punctures produced by cave bears.[92]

Although no reports have been published regarding some of them, a limited number of bone and stone objects from Acheulean and Mousterian sites in Europe and the Near East *do* seem to bear deliberate engravings in the form of sequences of more or less parallel incisions. These include the well-known mammoth shaft fragment from Bilzingsleben, which has an engraved fan-like motif; the Tata "engraved" nummulite and polished mammoth dental plate; the parallel lines on the Temnata slab; parallel incisions on bone or antler from Ermitage, Ferrassie, Vergisson IV, and Vaufrey; shaft fragments with dozens of parallel lines from the late Mousterian levels of the French sites of Unikote, La Chapelle-aux-Saints, and Marillac; and shaft fragments with criss-cross patterns from Peyrère.

We also have seen an increase in the number of sites dated to ca. 35,000 to 40,000 years ago and located in periarctic regions that have yielded Middle Paleolithic or "transitional" stone-tool industries associated with sequentially notched bone and ivory working.[93] At the moment, nothing demonstrates that these assemblages were not produced by Neandertals. In spite of the consistent, albeit discontinuous, presence of anatomically modern humans, near Eastern Mousterian sites are as spare as those from Europe in potentially symbolic objects. The only two examples are, so far, a flint cortex engraved with a set of concentric lines, which was found at Quneitra[94] in a level dated to ca. 60,000 years ago, and another cortex with a set of parallel incisions, which was found at Qafzeh in the same levels as the burials.[95] The only evidence from the Near East that might offer symbolic expressions from periods comparable with the most ancient African evidence of systematic use of pigments is the so-called Berekhat Ram figurine.[7,79–81] This piece comes from an Acheulean layer sandwiched between two well-dated volcanic deposits, indicating that the human presence at the site is older than 230,000 years and probably lies between 250,000 and 280,000 years ago.[96–97] A recent microscopic analysis has shown that the object was purposely modified by humans, but this, of course, does not demonstrate its symbolic nature.[98]

It is noteworthy that most of the more convincing "representations" found in Europe come from relatively late Neandertal sites, indicating an increase in the production of possible symbolic objects more or less at the same time as the increase in the production of engravings and pigment use in the southern African Middle Stone Age. We see no difference in the frequency and nature of such objects between Europe and the Near East, where anatomically modern humans

were present since at least 100,000 years ago. As with the Middle Stone Age, very little evidence exists for the use of personal ornaments by Neandertals at sites before the end of the Mousterian. At the end of the Neandertal period, however, Neandertals did produce different types of personal ornaments and decorated bone tools with sets of notches. This appears clearly at the Grotte du Renne.[18] Personal ornaments also come from the Châtelperronian level of Quincay in the Charente.[99] Shell beads have also been reported from several Uluzzian sites in Italy such as Cavallo and Castelcivita.[18] Several small rods made of hare and wolf long bones that bear no trace of use as tools and that might well have been used as pendants come from the level C of Buran Kaya III in the Crimea.[55] (See the section on hafting and related craft skills for the context and dating of these objects). This review of the evidence makes it clear that, with the possible exception of the shell beads from Qafzeh, there is no convincing proof of the use of personal ornaments before 40,000 years ago and no dramatic difference in the amount and nature of depictional and abstract representations between the archeological records produced by the two human types.

## SINGLE-SPECIES OR MULTIPLE-SPECIES ORIGIN OF BEHAVIORAL MODERNITY

The application of the criteria used so far to identify behavioral modernity in the material culture of Neandertals and contemporary anatomically modern humans does *not* seem to support the single-species or single-population model for the origin of these modern traits. Neandertal subsistence strategies and technological and symbolic traditions do *not* significantly differ from those of contemporary human populations in Africa and in the Near East. Submitted to close scrutiny, comparable evolutionary trends common to the two geographical areas may be detected in a number of domains (Fig. 8). It may be argued that it is not the mere presence of "advanced" behaviors that matters, but rather the frequency, consistency, and association of those behaviors. Considering, for example, that relatively few southern African Middle Stone Age sites have been excavated as compared with the number of Mousterian sites in southwestern France, the association at Blombos of bone tools, engravings, and a large quantity of pigments can be interpreted as highly significant. One can counter, however, that none of the other eleven South African Middle Stone Age sites with fauna have provided bone tools like those found at Blombos. And if we accept that the relevant comparison is between the whole Mousterian in Europe and the whole Middle Stone Age in Africa, there are at least sixty Middle Stone Age sites throughout Africa that could be expected to show what Blombos does, and none do. Although there are many more excavated sites in Europe, there are enough in Africa to show that "modern" markers are no more common in the Middle Stone Age than they are in the Mousterian of Europe.

Also, it is dangerous to equate the frequency of a type of archeological material with its ancient social significance. The amount of pigment recovered in an excavation depends on taphonomic factors, including the technique used to prepare the pigment, the media on which the pigment was applied, and the frequency of the activities in which pigments were used. The presence of used pigment indicates that other colorants may also have been used but did not survive archeologically. Thus, can the presence of pigment at "only" forty Mousterian sites be used to suggest that symbolic activities were less important in Europe than in Africa? The same applies to most of the other modern traits. We can note only that some of them, such as burials, "formal" tools, hafting, blade technology, and even pigments, are clearly present in the two records, and well before the appearance of transitional technocomplexes such as the Châtelperronian. Other traits such as deliberate markings are rare in both records. Still others, such as personal ornaments and geometric stone tools, seem to appear only at a relatively late stage in both records, while depictional images are virtually absent from both. Some behavioral innovations, such as a bone-tool technology, seem to appear in the Middle Stone Age of Africa before they do in the Mousterian of Europe, but their use does not seem to have been widespread. Also, the chronology of the cultural entities associated with these new behaviors on both continents is still uncertain. Some "transitional technocomplexes" from Europe, traditionally considered to postdate the beginning of the Aurignacian, are now considered to be older and so are closer in age to some Middle Stone Age assemblages.[19] And even if a more precise chronology does demonstrate that Middle Stone Age people had priority in some of these innovations, should this be taken as supporting a single-species model for the origin of behavioral modernity? It is possible that the more precocious appearance of some of these traits in Africa was fundamentally a question of that continent's greater size and larger human population,[100] which created greater opportunities for innovations to develop and survive.[101]

On the other hand, the traits used to identify behavioral modernity are no more than a list of the major archeological features that characterize the Upper Paleolithic in Europe. The problem is that this behavior is highly derived within *Homo sapiens*. It does not consistently characterize the behavior of the earliest *Homo sapiens* populations nor does it appear in many parts of the world (much of Africa, most of Asia, all of Australia) until long after its appearance in Europe ca. 40,000 years ago. Rather than accept that this complex of behaviors reflects adaptive strategies that were unique to the problem of colonizing Europe, many archeologists cling to the notion that the course of human behavioral evolution can be modeled in terms of a simple progression from archaic to modern behavior.

We might reconstruct the concept of modernity encompassing behavioral universals among ethnohistoric humans and excluding behavioral convergences revealed by primate ethology. However, this would result in the exclusion from "modernity" of many recent *Homo sapiens* archeological populations and, as I have shown

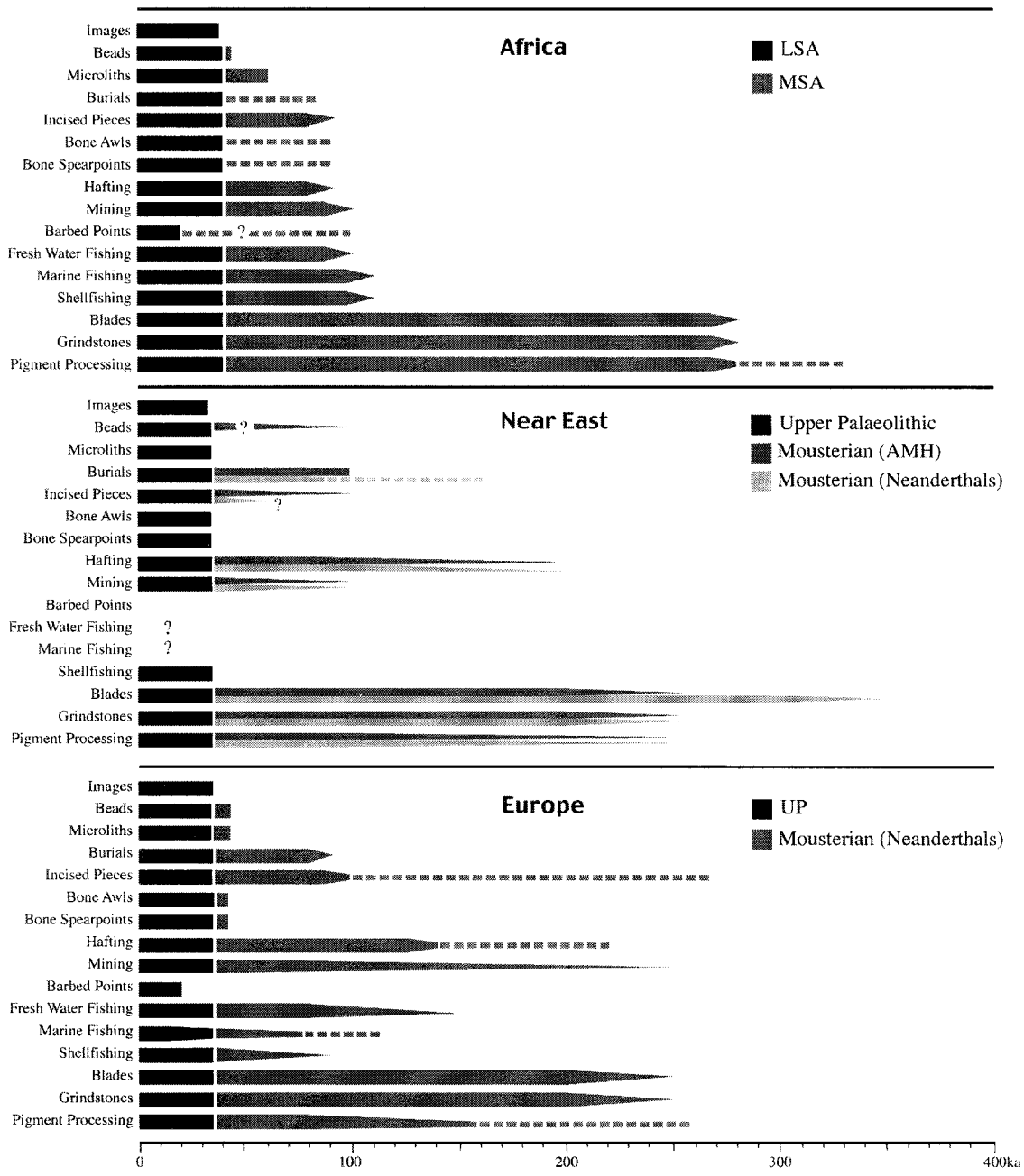


Figure 8. Occurrence of "modern" traits in the African, Near Eastern, and European archeological records. Interrupted lines indicate discontinuous presence.

here, the inclusion of various Neandertal or earlier hominid populations. After that, could we continue to use modernity as a metaphor for the human condition? Behavioral modernity has been a useful concept to highlight the inconsistencies of the revolution model, but we now need to go further.

"Modern" traits may have appeared in different regions and among different groups of humans, much as happened later in history with the inventions of agriculture, writing, and state society. Two hypotheses, which are not mutually exclusive, may explain both convergences and differences between the two populations on which I have focused here. The first is that the two populations reacted in comparable ways to comparable ecological pressures. The other is that, as their similar lithic technology in the Near East suggests, cultural barriers, and perhaps biological ones, between these populations were permeable. The limited amount of fossil DNA available seems to indicate[17,101] that differences between Neanderthals and recent humans were of the order of two or three times those found within recent humans. But even in this case, the data can be used to support the placement of Neandertals and recent

humans either in the same species or in different ones, given the recent origin of common ancestry. And Europe was, at all times, a cul de sac. Handaxes arrived there one million years after their invention in Africa, and agriculture, in some areas of Europe, 7,000 years after its invention in the Near East. This demonstrates that we do not need to assume different cognitive abilities to explain gaps in the appearance of some behaviors in the two populations.

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