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Neanderthals are us: genes and culture

Archaeologist **João Zilhão** has been challenging the orthodoxy of the Recent African Origins model for the past 15 years. He discusses fresh revelations on the Neanderthal genome and Middle Palaeolithic symbolic artefacts with *Radical Anthropology*.

Radical Anthropology: What first led you to contest the current orthodoxy of the modern ‘human revolution’ of the Upper Palaeolithic sweeping in from Africa?

João Zilhão: Until the mid-1990s, I accepted that the orthodox Recent African Origin (RAO) model of modern human emergence best fitted the available archaeological, palaeontological and genetic evidence. I began to have second thoughts after reading a paper in May 1996 by Hublin *et al.*¹ showing that the human remains from the Châtelperronian levels of the Grotte du Renne, at Arcy-sur-Cure, France, were of Neanderthals. From this evidence, the authors concluded that the cultural advances typical of the Châtelperronian, such as use of personal ornaments, resulted from a ‘high degree of acculturation’ of late Neanderthals by immigrating modern humans of the Aurignacian culture. They rejected the only other hypothesis considered: that the Grotte du Renne’s Châtelperronian ornaments represented ‘imitation without understanding’. This was the view of Chris Stringer and Clive Gamble² who argued that Neanderthals lacked the cognitive capacity for symbolic culture.

However, there was another possible interpretation of Hublin *et al.*’s results: given the continuity in lithic technology between the Châtelperronian and the preceding Mousterian, establishing a Neanderthal authorship for the Châtelperronian could imply that (1) the Châtelperronian stood for an indigenous ‘Upper Palaeolithic’

revolution, and (2) views of the Neanderthals as somehow cognitively handicapped were inconsistent with the empirical evidence.

Later that year, I had the chance to discuss Hublin *et al.*’s conclusions with my colleague Francesco d’Errico, from the University of Bordeaux. He too had been struck by this conundrum: Why did the paper not even consider the most parsimonious interpretation of the results? Could it be that paradigmatic biases were blinding researchers to accept the obvious? Was there something fundamentally wrong with the RAO model that prevented us applying to the Neanderthals and the Middle-to-Upper Palaeolithic transition interpretations that would be straightforward in any other archaeological context?

We sent a comment to *Nature*, but thanks to it being rejected, we decided to do the right thing: to examine the contentious artefacts ourselves. We asked our colleague Michèle Julien, at the University of Paris I (Sorbonne), who at the time curated and studied the ornaments and bone tools from the Grotte du Renne, to see the material in mid-December 1996.

This brief examination convinced

both of us that neither acculturation nor imitation were viable explanations for the Châtelperronian material: it was technologically and typologically distinct from its putative Aurignacian sources and,



Author (on right) helps with bear skull removal

at the Grotte du Renne, there was clear evidence of on-site production (e.g., manufacture debris). So we teamed up with Michèle and two other French colleagues, Dominique Baffier and Jacques Pelegrin, to write a review of the Grotte du Renne and of the stratigraphy, chronology and material culture of the Châtelperronian.

In a special issue of *Current Anthropology* dedicated to all things Neanderthal, our review³ laid out

the case that Francesco and I have been making for nearly fifteen years now: (1) stratigraphically (and chronometrically⁴) the Châtelperronian precedes the Aurignacian; (2) in these circumstances, ‘acculturation’ is an oxymoron (you cannot imitate or be influenced by something that does not even exist to begin with); (3) the association of diagnostic skeletal remains with the Châtelperronian at two different sites implies authorship, and a Neanderthal one at that, and (4) Neanderthals not only had the capacity for symbolic culture, they materialised it too (e.g., in the production of the personal ornaments and the decorated bone tools of the Châtelperronian).

RA: What is your view of the current evidence on genetic differences of the two populations?

genetic lineages whose geographic distribution encompassed the entire Old World and, therefore, may have been ‘early modern’ as much as ‘Neanderthal!’

These problems are compounded by the fact that archaeologists, anthropologists and media people (and even many geneticists) often mistakenly equate genetic ‘lineages’ (namely, mtDNA ones) with biological species. Take the recent realisation that the mtDNA extracted from a human phalange recovered in the cave site of Denisova, Siberia, belonged to a lineage that was even more distant from extant humans than the Neanderthals⁵: this finding was hailed as evidence for yet another ‘species’ of human living some 40,000 years ago! However, the levels whence the Denisova

1-4% and significantly higher in Eurasians than in Africans. These findings confirm that Neanderthals were not a separate biological species and, in retrospect, make it clear that the last 150 years of controversies surrounding their taxonomic status are a good example of the so-called ‘species problem in palaeontology’: the apparent contradiction noted by the late Stephen Jay Gould between Darwinian anagenetic evolution and the Linnaean concept of species, which arose under a fixist paradigm⁸. This is a problem in palaeontology, where morphology, not reproductive behaviour, underlies classification, but extant mammals that have been considered as different species, if not different genera, including primates (e.g., baboons), are now known to freely interbreed in the wild, producing fertile, viable offspring.

Could it be that paradigmatic biases were blinding researchers to accept the obvious?

Was there something fundamentally wrong with the RAO model?

JZ: Contamination is a major issue in palaeogenetics, and one that prevents us from fully understanding the genetic variation that existed in the Old World during the critical period between 35,000 and 60,000 years ago. Another major problem with ancient genomics is preservation. In tropical and temperate Mediterranean environments, DNA does not survive for the tens of millennia necessary for retrieval in early modern human fossils of Africa and the Near East, the regions of earliest appearance of the corresponding diagnostic anatomical traits, so we do not and cannot have any DNA from them. This fact has an implication that is seldom, if at all considered by palaeogeneticists: that what we are calling ‘Neanderthal’ mtDNA may in fact correspond to a group of extinct

phalanx came are so disturbed⁶ that the chances of that phalanx being 20,000 (or even 10,000) years old are as large as its being 40,000; until it is directly dated, we can’t tell. In any case, the fossil simply goes to show the extent to which past human genetic variation was much higher than at present, something for which many clues exist even among the genes of extant humans.

In a *Science* paper published last May, Green *et al.*⁷ released a draft of the Neanderthal genome, based on nuclear DNA extracted from three bones recovered in the Croatian cave site of Vindija. Their study significantly clarified the issues, as it found in the five present-day humans with whom the Vindija sequence was compared solid evidence of a Neanderthal contribution – estimated to be of

The 1-4% estimate doesn’t look that much, but, if you consider the environmentally driven imbalance in population size that existed during the Ice Ages between low-latitude Africa, representing the core of the human range, and high-latitude Eurasia, where the Neanderthals lived at low population densities and in overall small numbers, it is in fact a lot. If, for the sake of the argument, you assume, under a simple model of panmixia and unstructured post-contact populations, that, 50,000 years ago, there were 50,000 ‘Neanderthals’ in Eurasia and 500,000 ‘moderns’ in Africa, you would then not expect the Neanderthal contribution to those post-contact humans to be greater than 10% anyway. If, on top of this, you consider selection and continued evolution since 40,000 years ago, including the contingencies of population history, it is amazing that as much as a 1-4% contribution is still apparent today.

We also need to bear in mind that Green *et al.*’s estimate of

the percentage of Neanderthal contribution applies to the genome of extant humans and that we cannot extrapolate from their results that such was also the Neanderthal contribution to the genome of the Europeans of 40,000 years ago. The assumption of such an extrapolation would be total population continuity, which is unwarranted. In fact, most extant Europeans descend NOT from the mixed Neanderthal/modern people of 40,000 years ago but from the successive waves of migrants that came to our continent over the last ten millennia, namely as part of the process whereby farming spread from the Near East.

The contingencies of demographic history (namely, the demic underpinnings of the spread of farming) also impact the issue of where and when interbreeding occurred. Green *et al.* argued that it was right after the African exodus, some 50,000 years ago, and in the Near East, whence stem populations of 'moderns-cum-Neanderthal' genes would then have spread into Europe and the rest of Asia to become the ancestors of all extant Eurasians. Their argument is based on the fact that west Europeans come out in the comparisons as no closer to the Neanderthals than Papuans or Chinese, and many commentators hastily inferred from this that no interbreeding after initial contact in the Near East, namely as moderns spread deep into Eurasia, was one of Green *et al.*'s findings.

In fact, however, these authors did not exclude later interbreeding processes in western Europe precisely because, as explicitly acknowledged (p. 721), the pattern apparent in their study could be explained by the subsequent history of migrations connected to the spread of agriculture obscuring gene-flow.

So, where interbreeding in Europe

is concerned, all that Green *et al.* said was that they were unable to detect the corresponding signal in the samples, not that none occurred. I would only add that, if 'Neanderthals' and 'moderns' were not different biological species, then the null hypothesis for what

behavioural modernity related not to a speciation event but instead to a process of uneven and combined development affecting structured populations of humans — each perhaps worthy of subspecies status but, biologically, belonging to a single anagenetically evolving

The situation now is the exact reverse of what existed 20 years ago. Every single one of the sufficiently complete European modern human individuals dated to within 5,000 years of the time of contact feature anatomical archaisms

happened at the time of contact anywhere must be extensive (albeit variable) interbreeding, as indeed shown by the fossils themselves. Therefore, my prediction is: since the frequency of 'archaic' skeletal traits in European early moderns is higher than in present-day Europeans, European early moderns should exhibit a Neanderthal-derived percentage of their genomes higher than 1-4%; i.e., when compared to the Neanderthals, they should come out closer to them than do present-day Papuans or Chinese. Unfortunately, it would seem that we will have to wait some time until the prediction can be tested because we still have no genomes of immediately post-contact Europeans.

RA: Tell us about the fossil specimens you have been involved with which you think show evidence of interbreeding.

JZ: At the time of the 1998 *Current Anthropology* paper, our findings were consistent with two alternative non-RAO models for the emergence of symbolism: that it emerged among different lineages, even different species of humans, as a result of convergent evolution; or that Neanderthals had not been a different species at all. In that case, the emergence of anatomical and

species of which *Homo erectus*, *Homo heidelbergensis* and *Homo sapiens* would be but chrono- or palaeo-taxa.

Eventually, I went on to argue the latter alternative as a result of my involvement in the excavation and publication of three important early modern human fossils: in 1998-99, the child skeleton from the Lagar Velho site, in Portugal; and, in 2003-05, the mandible and cranium from the Oase cave, in Romania. The human palaeontological study of these fossils, led by Erik Trinkaus⁹, from Washington University (St.-Louis), concluded that all three presented a series of genetically inherited, archaic, if not diagnostically Neanderthal anatomical features that implied significant admixture at the time of contact.

This recognition coincided with the realisation, as a result of direct radiocarbon dating, that all the other purported early moderns lacking in such features, and upon which rested the notion that the Middle-to-Upper Palaeolithic transition in Europe featured total discontinuity in the realm of physical anthropology, were in fact of recent Holocene age. That was the case, in particular, of the supposedly Aurignacian-associated remains from the

south-west German cave site of Vogelherd.

So, thanks to the Lagar Velho and Oase finds, Erik's subsequent study of other long-forgotten Romanian fossils (from the caves of Cioclovina and Muierii), and the extensive analysis and monographic publication by Maria Teschler-Nicola *et al.*¹⁰, in 2006, of the early modern human sample from Mladeč (Czech Republic), the situation now is the exact reverse of what existed 20 years ago. Every single one of the currently known, sufficiently complete European modern human individuals (eleven in total) that have been dated to within some five millennia of the time of contact feature a similar, albeit variable mosaic of anatomical archaisms.

The robustness of the fossil pattern

RA: Genes apart, the most interesting aspect of your work is the theory and supporting data on cultural interaction between the populations, with influences travelling both ways. Can you give us an overview of this evidence?

JZ: In theory, one could argue that it would have been precisely because Neanderthals and moderns were both fully human that interbreeding might have been impossible—not as a result of (non-existent) biological barriers but because of cultural ones, e.g., prohibitions or taboos. But the archaeological record patterns against such expectations.

As I said, my involvement with these issues began with an argument on how acculturation did not work as an explanation for the ornaments and decorated bone tools

colleagues, were able to show that an early modern human-associated tradition of personal ornamentation existed in South Africa, the Maghreb and the Near East since the last interglacial, >70,000 years ago, perhaps as early as 100,000 years ago¹¹. This tradition consistently and exclusively manufactured composite beadworks made with perforated shells from the different regional species of *Nassarius*, a small marine gastropod, or of morphologically very similar genera. Although no such evidence is currently known for the intervening period, by 45,000 years ago the tradition resurfaced again in the Initial Upper Palaeolithic (IUP or Ehmiran) of the Near East, which is widely accepted as the stem culture for the subsequent Ahmarian and the related Protoaurignacian of Europe.



Oase excavation, Romania, 2004

is such as to make it clear that interbreeding between the latest Eurasian Neanderthals and the first early modern humans who began to disperse into their territories around 42,000 calendar years ago did occur. In short, the fossil evidence accumulated over the last decade indicated that no biological barrier to interbreeding between Neanderthals and moderns ever existed, and that conclusion is now corroborated by genetics.

of the Châtelperronian. It's ironic that subsequent developments showed that acculturation (in the sense of cultural influence) in the reverse direction best explains the composition of the assemblages of personal ornaments of the earliest European modern human societies.

Between 2004 and 2006, Francesco d'Errico and his former student Marian Vanhaeren, together with Chris Henshilwood and other

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This pattern is important because the Protoaurignacian is the earliest cultural manifestation reliably associated with the dispersal of modern human groups into our continent (its radiocarbon dating overlaps with that of the Oase fossils). Given this, it can hardly come as a surprise that small, basket-shaped shell-beads similar to those of the Ahmarian and the IUP feature prominently in Protoaurignacian ornament assemblages. These

assemblages, however, also include items that are unknown in its Near Eastern sister-culture (the Ahmarian), in the preceding IUP, or anywhere in Africa prior to 40,000 years ago: namely, large, perforated and grooved teeth, bones or fossil shells that in all likelihood were used individually as pendants hanging around the neck, not as parts of composite beadworks.

Where or who did the Proto-aurignacians get the idea from? Given the long-term stability of the African/Near Eastern tradition, and the fact that the novelties in its repertoire correspond to the range of ornaments seen in the Châtelperronian and the coeval, also Neanderthal-associated, so-called ‘transitional’ cultures of Europe (Lincombian/Ranisian, Szeletian, Bachokirian, etc.), the parsimonious explanation is that they got it from the locals — i.e., from the Neanderthals. Put another way, that they interacted with them, and, in such a scenario, one can hardly see how any putative sex prohibition could have been 100%

significant for Neanderthals as the Blombos materials for moderns?

JZ: The Spanish evidence¹² consists of four types of finds:

1. perforated shells of large marine bivalves of the genera *Acanthocardia*, *Glycymeris* and *Pecten*, some of which were painted;

2. unperforated shells of the Mediterranean spiny oyster, *Spondylus gaederopus*. As all other species of this genus, this features upper valves with exuberant sculpture and vivid red or violet colour that inspired collection for ritual purposes in a large number of archaeological and ethnographic contexts worldwide. One specimen was used as a container for the storage or preparation of a complex cosmetic recipe where shiny bits of freshly ground haematite and pyrite (black) were added to a base of lepidocrocite (red);

3. lumps of iron pigments of different mineral species (haematite,

the perforated shells in personal ornamentation, probably as neck pendants. For instance, that is exactly how Daniela Bar-Yosef *et al.*¹³ interpreted an assemblage of perforated and ochre-stained *Glycymeris* from the last interglacial, early modern human-associated site of Qafzeh, in the Near East. To question a similar interpretation for similar material in the Spanish case just because Neanderthals, not moderns, were involved, would therefore imply tons of special pleading — so much so that, in fact, to my knowledge, no one has so far ventured down that avenue of argumentation.

In the context of the Châtelperronian debate, this evidence is also particularly relevant in that the material from Cueva de los Aviones dates to 50,000 years ago, thus predating by ten millennia the Oase fossils, the earliest European modern humans currently known. The implication is inescapable: no matter what you or I or anybody else may think of the Châtelperronian, there can be no doubt that, in the

In any other archaeological context, the straightforward interpretation of this material would be that the pigments were used in bodily, most likely facial decoration, and the perforated shells in personal ornamentation, probably as neck pendants

effective 100% of the time. So, both the cultural and the physical anthropological evidence agree that encounter situations resulted in the transmission to immigrating modern human groups of both Neanderthal memes and Neanderthal genes.

RA: Tell us about the latest evidence from Cueva Antón and Cueva de los Aviones in S.E. Spain, dating back to 50,000 years ago, and spell out the implications of this material for Neanderthal cognition and symbolic behaviour. Is it as

goethite, siderite), but mostly of yellow natrojarosite (whose only known use is in cosmetics);

4. and a kind of stiletto made of an unmodified pointed bone bearing pigment residues on the broken tip, suggesting use in the preparation or application of colorants.

In any other archaeological context, the straightforward interpretation of this material would be that the pigments were used in bodily, most likely facial decoration, and

Spanish case, neither imitation nor acculturation explains the observed facts.

In light of the Qafzeh finds, the Spanish evidence also raises an intriguing possibility, one that neither my colleagues nor I have formally presented in writing yet, for consistency, I will advance it here. The presence, in the Near East of last interglacial times, of the African tradition of *Nassarius* beads so far rests on a single find from Skhul. Marian Vanhaeren¹⁴ and

her colleagues made a good case for that bead to come from the level that contained the burials of early modern humans. However, the true age of these remains is controversial (for instance, uranium series dates obtained on animal teeth suggest that an important component of that level dates to only 40,000-45,000 years ago). People like Chris Stringer and Milford Wolpoff have argued that two chronologically distinct populations, one anatomically less 'modern' than the other, could well be represented in the Skhul sample.

The possibility exists, therefore, that the Skhul *Nassarius* bead relates to a later period of occupation, i.e., that it relates to the modern humans who returned to the Near East after 45,000 years ago (those of the IUP), not to those who lived there some 90,000 years ago. If so, then the presence of painted/perforated *Glycymeris* shells in both Qafzeh and Aviones, coupled with the absence of *Nassarius* in either Qafzeh or Skhul prior to 50,000 BP, would allow the formulation of the following hypothesis: that the Aviones shells represent the survival in Europe, among Neanderthal societies, of traditions of personal ornamentation going back to the last interglacial, at which time they would have been spread around the shores of at least the whole of the north Mediterranean sea, regardless of (real or perceived) biological boundaries. Put another way, the possibility exists that, some 90,000 years ago, two different ornament traditions were already in existence: one in Africa and modern human-associated — the *Nassarius* beads tradition of the Still Bay culture of South Africa and the Aterian

culture of the Maghreb; another in Mediterranean Europe and the Near East and associated with both modern humans and Neanderthals — the perforated bivalve tradition of the Tabun C-type Mousterian of Qafzeh and the Middle Palaeolithic of Iberia.

RA: How does the Spanish data and a multispecies/population origin of symbolic behaviour impact on

this, I believe that language is too complex to be anything but evolutionarily ancient. To my mind, the chain of neurological, physiological, cognitive and palaeontological arguments supporting this notion that Terence Deacon¹⁵ put together in his 1997 book, *The Symbolic Species*, is extremely convincing.

On the other hand, considering how metabolically expensive the brain is¹⁶, why, if not to use it, would a particular lineage of great apes need to have a significantly expanded brain, with that expansion principally affecting the prefrontal cortex, the area that is involved in most advanced cognition tasks? Although on average smaller until 0.5 million years ago, *Homo* brain sizes overlap with the modern range of variation since at least one million years ago; therefore, I would expect the key hardware developments concerning language and cognition to have occurred at that time, not with the advent of anatomical modernity.

In my view, therefore, the right question to ask is why material manifestations of symbolism do not appear in the archaeological record until much later than one million years ago. Perhaps the problem lies in the operational definitions of symbolic material culture currently agreed upon by archaeologists and palaeoanthropologists; or perhaps no need existed for such material symbols until certain demographic and social thresholds were crossed. If that crossing eventually occurred around 100,000 years ago and not before, then that may well be the reason why we first see the



Perforated scallop shell from Cueva Antón, natural colouring on inside (left half), orangey pigment applied to outside (right).

a Noam Chomsky/Richard Klein position on major genetic mutation as the trigger of modern behaviour?

JZ: I don't think that multispecies views of human evolution are valid to begin with. However, if we accept them for the sake of the argument, the implication of the Neanderthal evidence is that a genetic 'flick-of-the-switch', triggering the emergence of symbolic behaviour, would have to have occurred independently, more than once, in different times and places, which is hardly consistent with parsimony. Therefore, a corollary of our findings is that the genetic mutation position can now be sustained only from within single-species models of human evolution. Having said

decoration of persons and objects at that time too.

RA: Comparing the overall records of possible early symbolic materials in Eurasia (Neanderthal ancestry) vs. Africa (modern ancestry), do you think there are still grounds for arguing for strategic, behavioural differences between the populations?

JZ: One of the aspects of the 'Human Revolution' paradigm that most hindered the last 20 years of research into Neanderthals and early modern humans was the notion that, in line with textbook definitions, each of these two 'species' would have been characterised by its own 'species-specific' behaviour. However, all attempts at defining a specifically 'modern human' behaviour as opposed to a specifically 'Neanderthal' behaviour have met a similar failure: When applied to the archaeological and the ethnographic records, such definitions always end up with some modern humans being behaviourally Neanderthal and some Neanderthals being behaviourally modern!

In the 1860s, when William King gave birth to *Homo neanderthalensis*, human fossils were used as ancillary evidence in mainstream ethnological views of the racial ladder, to which they added time depth. Today, ranking human 'races' in terms of cognition is no longer acceptable but, in western culture, the philosophical or religious need to place 'us' at the top of the ladder of life (or, for some, of creation) still prevails, and explains the continued search for images of what 'we' are not (or not anymore) that, by contrast, enhance the basics of what 'we' are. Such is the place occupied by Neanderthals in the Human Revolution paradigm, and that is how, explicitly or implicitly, species-specific perspectives of their behaviour treat them — the out-group against which 'modernity' or

'humanity' is defined.

Depending on different perceptions, going back to the eighteenth and nineteenth centuries, of the fundamental basis for the triumph of civilised society and industrial capitalism, so (1) do Neanderthals tend to be represented as lacking in the corresponding behavioural feature and (2) do early moderns tend to be portrayed as benefiting from a 'selective advantage' consisting in its possession. To give but a few examples, the Enlightenment emphasised the power of reason, Adam Smith stressed the importance of the division of labour, and David Ricardo highlighted the role of international trade and comparative advantage. Not surprisingly, explanations for the demise of the Neanderthals have correspondingly postulated competitive inferiority caused by their lacking in symbolic cognition, in labour specialisation by sex and age class, in long-distance circulation of raw materials, or in logistical organisation of the subsistence base... And, not surprisingly either, if Neanderthals are found to conform to the opposite

but also a diverse range of cultures and adaptations, ones whose intra-'Neanderthal' and intra-'modern human' variability along latitudinal and longitudinal clines encompassed almost the entire gamut of ethnographically documented settlement-subsistence strategies. In the realm of subsistence, for instance, Neanderthals were logistically organized hunters 50,000 years ago at Salzgitter-Lebenstedt, in northern Germany, where they exploited reindeer in exactly the same manner as the Ahrensbourghians who recolonised the area 40,000 years later. In the Levant, however, they had a broad-spectrum economy, including significant exploitation of small mammals and plant foods. And, in areas of Iberia where the present-day coastline is close to theirs, late Neanderthals left sites featuring shell-midden accumulations that differ from Upper Palaeolithic and Mesolithic ones only in that their artefact component is Mousterian.

Where the social and sexual division of labour is concerned, Kuhn and Stiner have argued¹⁷ that nowhere

To question a similar interpretation for similar material in the Spanish case just because Neanderthals, not moderns, were involved, would therefore imply tons of special pleading

of these expectations, then the argument is turned upside down! Recent formulations, for instance, have been that it was their extreme focus on large mammal hunting that allowed modern humans, with greater behavioural flexibility and a broader subsistence base, to outcompete them.

In truth, the archaeological record shows that, on the ground, the Middle-to-Upper Palaeolithic transition in Eurasia was about people featuring not only somewhat different arrays of anatomical traits

in the Neanderthal record do we see any evidence that, as in all known ethnographic hunter-gatherer societies living in cold-temperate or subarctic environments, females had taken on the role of technology specialists. They pointed out that bone needles and awls, the types of artefacts commonly used to make tailored, weather-resistant clothing and well-insulated artificial shelters, which are female-associated tasks in most subarctic hunter-gatherer societies, do not appear until the Upper Palaeolithic. This is undisputedly true, but the early

Upper Palaeolithic culture where such evidence does appear for the first time is... the Neanderthal-associated Châtelperronian! Functional analysis and experimental replication by Francesco d'Errico and colleagues showed that the awls from the Grotte du Renne had been subjected to an intensive use — a minimum of 20,000 perforations on 2.5 mm

analysis showed it to be an extract of oak bark macerated in water, of a kind used until recent historical times in the tanning of hides for the manufacture of water-proof clothing and shoe wear. Danish environmental researcher Bent Sørensen¹⁸ argues that even during the interglacial, Neanderthals faced a considerable heat-loss

structure in most if not all known African MSA sites as the modern standard!

More importantly, any such comparisons need to be put into historical perspective: the average campsite of the late Upper Palaeolithic is indeed more complex than the average campsite

In my view, therefore, the right question to ask is why material manifestations of symbolism do not appear in the archaeological record until much later than one million years ago

thick leather, with many, given their fineness, having probably been used on lesser resistant materials, such as furs, bird hides or intestines. One can hardly think of what such intensive use might have been for if not the making of tailored clothes; thus,

problem, and tailored clothes would have been necessary for survival. So, even considering the differences in body mass and other anatomical details, for a human — Neanderthal or modern — the simple fact of successful settlement of cold-temperate and subarctic environments implies technologies and modes of social organisation without which survival would have been impossible. In Ice Age Europe, therefore, the difference between the Middle and the Upper Palaeolithic archaeological records is primarily one of visibility, not one of cognition or biologically based behaviour.

A further problem with the 'biologisation' of the variation observed in the culture of Upper Pleistocene humans is that it is frequently framed by anachronistic comparisons. For instance, the argument that 'Neanderthal' camp sites are 'less elaborated and structured' than 'modern' ones is predicated on the use of European Upper Palaeolithic camp sites as the standard for a modern camp site and of European Middle Palaeolithic camp sites for a Neanderthal camp site. But the conclusion would have to be reversed if the habitation features apparent in the Grotte du Renne's Châtelperronian level X were used as the Neanderthal standard and the lack of any

of the Middle Palaeolithic. Does this relate primarily to the anatomy of the human populations involved or to intensification over time, i.e., to the higher levels of knowledge of and control over the environment acquired across the tens of millennia involved, as generation after generation people innovated, experimented, failed, tried again and passed on the learning so accumulated to their descendants? This would bring about an increase in numbers as a side effect of adaptive success and trigger a feedback mechanism promoting further intensification as hitherto untapped niches had to be exploited and the technologies to do that had to be invented. Since no one tries to explain the Industrial Revolution in terms of biologically based behavioural variables, why should we think the approach is valid for the Upper Palaeolithic Revolution?

This does not mean that important biological factors were not at work throughout. Erik Trinkaus, in particular, has suggested that many anatomical changes observed at this time, namely the trend to overall skeletal and dental gracilisation, were probably triggered by technological developments. The point is, such changes are observed among both moderns and Neanderthals (as in, e.g., the post-crania of Saint-Césaire). Understanding them



Team on excavation in Murcia

if, in subarctic environments, such tasks are primarily female ones, then the earliest real evidence for the existence of an institutionalised sexual division of labour is in fact found among Neanderthal, not modern human societies.

In actual fact, tailoring and shoemaking are also intimated by results from the analysis of the residue found on a flint flake from the German site of Neumark-Nord, dated to >100,000 years ago. The

therefore requires units of analysis that go way beyond the simplistic opposition between Neanderthals on one hand and modern humans on the other. In my opinion, these examples show that the problem lies in the Human Revolution straitjacket. From within such a frame of mind, scholars are inevitably led to treat Neanderthal-modern human interaction as an abstract, totally ahistorical game played between two reified entities with little (if any) relation to actual empirical realities, as if a Neanderthal of 100,000 years ago was the same thing as a Neanderthal of 50,000 years ago, and as if a modern human of today or of 20,000 years ago was the same thing as a modern human of 200,000 years ago.

So, to me, the way forward is to treat what happened in the late Middle and early Upper Pleistocene from the perspective of (palaeo-)history and (palaeo-)ethnography. We will never understand this critical period of our past if we reduce the biological and cultural variation that existed at the time to the two anatomically defined categories of 'Neanderthals' and 'modern humans'.

RA: If we now all agree that Neanderthals were not stupid, and showed similar if culturally distinctive abilities, what then is your view on the fate of the Neanderthals? Why are we here and not them?

JZ: Although it is unquestionably true that, as a population/subspecies displaying a consistent set of anatomical traits, Neanderthals disappeared some time between 35,000 and 40,000 years ago, that does not mean that they went extinct without descent. Given the fossil and genetic evidence for interbreeding at the time of contact, I think the question that you ask should in fact be rephrased. The problem is not one of who won the

'us' versus 'them' confrontation. Instead, the problem is: Why is it that the anatomical *gestalt* that prevailed in the mixed populations resulting from the process of interbreeding was the 'modern' and not the 'Neanderthal' one?

As with all complex problems, it is vain to look for single-cause explanations for the observed outcome. People often overlook that explaining historical processes implies looking at different scales, in both time and space, and that general explanations valid in the long-term or on a transcontinental scale may well be irrelevant to explain what happened in the short-term or on a regional scale. In short, framing the issue of the fate of the Neanderthals in terms of simple dichotomies (us versus them, smart versus stupid, adaptive versus maladaptive,

mix, the smaller population (in our case, the Eurasian Neanderthals) will always be absorbed by the larger (in our case, the African moderns). Of course, the other things never all remain equal, so we also have to



Measuring ESR, Oase excavation, Romania

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etc.) is easy, convenient and readily understandable; it is also fundamentally wrong.

To me, the starting point is the general biogeographical law that, all other things remaining equal, if the barriers (environmental, climatic, geographical, behavioural or other) between two populations that evolved in isolation for a significant amount of time disappear and the two genetic reservoirs effectively

include issues of selection (natural, sexual or cultural) and contingency in the equation.

Perhaps facial gracility was somehow selectively advantageous in the environment of accelerated technological innovation that characterises the period of contact in Europe. And catastrophic events, such as the major volcanic explosion that occurred near Naples 39,000 years ago (which probably wiped

out the mixed populations of south-eastern Europe soon after contact), may also have contributed to dilute the strength of the Neanderthal genetic signal. Or possibly social and economic practices and strategies gave rise to a differential in fertility favouring the peoples of the Protoaurignacian.

The problem is that, so far, no evidence has been found that the Protoaurignacian was indeed characterised by greater extractive efficiency and cultural complexity. Its possession of figurative art is often advanced as proof, but the widespread notion that Europe's earliest modern humans were 'astonishingly precocious' artists misrepresents the facts. The earliest such art anywhere in the world are the ivory sculptures of the German

the Châtelperronian was one of individually worn ornaments, then quantity cannot be automatically translated into quality, as it may well have taken 20, 50 or 100 shell beads to produce the functional equivalent of a single perforated carnivore tooth.

Finally, the last major problem with the 'us-versus-them' approach is that it frames the actual historical process in terms of competition only, and one that confronted two monolithic, reified entities. 'Modern' and 'Neanderthal' are 19th-21st century AD categories, to my mind very useful in some scientific contexts and very useless in others. But can we realistically assume that, at the time of contact anywhere in Europe, a 'modern human' would have known that he/she was ... a 'modern human' (and ditto for Neanderthals)? Although it simplifies things to talk about the spread of 'modern humans' into Europe, what the record actually shows is a spread of the Protoaurignacian culture. There is good reason to think that the modern human *gestalt* hitchhiked the spread of the Protoaurignacian, but this does not have to have been as a result of the 'victory' of a monolithic biocultural entity. In fact, it is much easier to explain the process as a result of the widespread adoption of cultural innovations via

contact, exchange, co-operation and interbreeding. As is always the case in such situations, competition and conflict inevitably must have entered the equation, but reducing the process to a confrontation between two peoples/armies battling for living space is what I would call the videogame view of the Transition: fine for Hollywood, not so for palaeoanthropology.

RA: Do you feel the archaeological and palaeoanthropological community has responded in a spirit of dispassionate enquiry towards

your work? Or do you think such sharp and polarised controversy is part of the process of science when cherished myths are challenged? At what point does politics interfere with science?

JZ: Of course the palaeo-anthropological community hasn't responded dispassionately! And I wouldn't have expected it to in the first place, because scientists are also human beings; although trained to be much more open-minded than the average street man, scientists are nonetheless influenced by widely shared cultural values, by academic environments, and by personal interests. Also, science is in many ways inherently conservative, and will resist paradigm change until and unless it cannot be avoided; and for good reason, as it too follows the old common sense principle that 'if it isn't broken, don't fix it!' Until about five years ago my Neanderthal/modern human papers submitted for publication systematically faced more than 50% hostile (often very hostile) reviews. Still, in my experience, journal editors were more often than not inclined to listen to my rebuttals, and as a result the papers eventually all got published, read and discussed.

So, I have no complaints: the scientific process worked. It was not easy, but then again it never is, and that's how it should be: science can live with harsh and unfair criticism, but not with complacency.

I don't think 'politics' are involved in these controversies, although they are often permeated, especially in the media, by 'political correctness' issues. For instance, the notion was promoted that, by showing that we all shared a very recent common ancestry, RAO and the Mitochondrial Eve hypothesis provided a scientific weapon against racism. I always found this to be a very dangerous argument, as it implied that perhaps racism would be scientifically justified if




Author on excavation in Murcia

Aurignacian and the Chauvet cave paintings. But, in good agreement with the nature of the associated stone tools, the range of dates obtained for these manifestations falls entirely within the Aurignacian II, i.e., they postdate by some five millennia the time of contact in Europe. At that time, the only archaeologically visible difference is that the Protoaurignacian features a lot more objects of personal ornamentation. But, if the Protoaurignacian was a culture of composite beadworks whereas

the opposite ‘candelabra’ model of a very distant common ancestor and largely separate evolutionary trajectories in Africa, Asia and Europe were to have been shown correct.

Awareness of the influence of politics, culture and intellectual traditions in interpretations of human evolution is needed. But

political attitudes and choices should be dictated by the ethical and social issues of the present, to which knowing what exactly happened to the Neanderthals 40,000 years ago is not, I’m afraid, of much relevance. Finding it out helps us in understanding ourselves as a biological species, and in learning more about our place in the natural world and about cultural process.

Also, as Svante Pääbo rightly pointed out in the initial stages of the Neanderthal genome project, we may even eventually learn from the Neanderthals things about our genes that will have medical and therapeutical applications. This is good enough for me as ‘political’ justification for doing ‘Neanderthal’ science (read the adjective as you wish!). 

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