
The Neanderthals: a Social Synthesis

Robert Davies & Simon Underdown

The Neanderthals have long fascinated archaeologists and anthropologists alike. Similarity to us coupled with clear differences has produced endless theorizing. This article reviews the background to such ideas. It examines the current lines of thought about Neanderthals and explores the validity of the conclusions. The ultimate aim is the construction of a social synthesis, a solid foundation upon which the validity of inferences regarding Neanderthal cognitive ability and behavioural complexity may be examined.

The 1856 discovery of hominin remains in the Feldhofer Cave of the Neander Valley was significant for two reasons. Although these were not the first remains of *Homo neanderthalensis* to be found¹ they were the first to be recognized as belonging to ancient humans and the likely product of evolutionary processes. Additionally, their discovery marks both the genesis of palaeoanthropology as a scientific investigation and the initiation of the still unresolved debate over what it meant to be a Neanderthal. From the beginning, the emphasis centred upon the three most pertinent and observable differences, those of skeletal morphology, lithic technology and material culture. Significances drawn regarding the behavioural complexity and cognitive ability, from the comparative examination of the Neanderthal remains with those of modern humans, built the foundation upon which the conceptual opposition of humans and Neanderthals, as 'self' or 'other' and as 'human' or 'primitive', has been constructed.

It is arguably a foundation from whose constraints researchers have failed to escape; and which has seen Neanderthals ostracized by some as different, whilst simultaneously embraced as a brother in the shaving mirrors of others and by multitudes of early morning subway commuters² (see Drell 2000 for a history of the interpretation). It is the generations of archaeologists and palaeoanthropologists, with their individualistic paradigms, that are to be credited with constructing the latter pseudo-realist images of Neanderthals.

It is further argued that the evidence used in constructing these images is so flimsy and untestable that, 'vows of wedlock to either position are at best

premature' (Speth 2004, 523). For instance, researchers continue to analyze a few elements of Neanderthal behaviour in isolation, especially symbolic expression and language ability. It is the intention of this article to depart from such reductionist analysis and assess whether the differences in physical characteristics, technology and social organization, as evident in the archaeological record, really do reflect inferior cognitive ability and behavioural complexity in Neanderthals when compared to contemporaneous anatomically modern *Homo sapiens*. The ultimate aim is construction of a social synthesis, a solid foundation upon which the validity of inferences regarding Neanderthal cognitive ability and behavioural complexity may be examined.

This holistic analysis will only use data from between 120,000–28,000 years ago as it is arguably the case that, from this point onwards, we can be certain we are dealing with the last surviving member of an adaptive radiation of hominin species within Europe (Foley 2002). Although we have no direct means of verification, both genetic analysis and the autapomorphic (i.e. unique) nature of Neanderthal morphology illustrate that it is becoming increasingly likely that Neanderthals and anatomically modern humans (AMH) represent two distinct species. This article is written with this assumption in mind (see Sere *et al.* 2004; Caramelli *et al.* 2003; Harvati 2003; Harvati *et al.* 2004).

In addition, owing to the relatively limited amount of information to be gained from studying archaeological sites in isolation, an attempt is made to investigate the life of the 'average' Neanderthal. Although, as Gamble (1999) states, they were unlikely to have

been a homogeneous group of people, with identical behaviour, Neanderthals were homogeneous enough that comparisons are permissible between two distinct groups, the European immigrants characterized by AMH and the resident Neanderthal populations.

Neanderthal morphology and developmental rate

What follows is an investigation of exactly what can be reliably and validly inferred, in terms of behavioural complexity and cognitive ability, from a comparative investigation of Neanderthal physical characteristics alone. Naturally, it is not intended to herald a new era of unbiased interpretation. Rather, two points will be emphasized. Firstly, despite the great differences between Neanderthals and AMH in terms of morphology, difference in terms of behavioural or cognitive complexity remains largely unfathomable without a complete understanding of the average daily social life and organization of a Neanderthal. Secondly, when considering the importance of both physical characters and social behaviour, dichotomization of Neanderthals from their phylogenetic primate history and the ecological environment in which they existed is probably unjustifiable.

To begin with, it is necessary to define what this article means by the term Neanderthal. The long-standing Eurocentric bias means that Neanderthals are easier to characterize than other earlier hominins because of their relative abundance and variety of skeletal remains. As in modern humans, variation in form occurs. Although the Krapina and Vindija Neanderthals have been described as 'transitional', recent genetic studies by Sere *et al.* (2004) have emphasized that intra-group morphological variation — perhaps resulting from localized environmental stochastic pressures — is the most parsimonious explanation for the observed skeletal differences (Wolpoff & Caspari 1997; Pearson 2000). Combined with the fact that the Near Eastern Neanderthals show close morphological affinities to the Western European sample, this means that creating a picture of an 'average' Neanderthal morphology based upon autapomorphic traits is feasible (Tillier 1989).

With regards to AMH, direct morphological comparisons are hindered by the inherent problems of stratigraphy, in that most of the AMH specimens were uncovered early on in Europe by over-zealous antiquarians using poor excavation techniques. Thus, the stratigraphy and age of most AMH finds are so uncertain that the specimens must be excluded from discussion (Gambier 1989). This study is ultimately concerned with contemporaneous interactions, where

'contemporaneous' is defined as within 40 to 28,000 years in Europe. Consequently, the autapomorphic traits of the contemporaneous AMH to be compared to Neanderthals are assumed to be on average the same as those of modern humans.³

Some researchers have claimed to be able to infer a great deal about cognitive abilities and behavioural complexity from differences in skeletal morphology alone (see Table 1 for comparisons). For example, Solecki (1973) argued that in the lateral view of Shanidar One, the occipital bone appears to be flattened and rises steeply to the crown of the head, quite unlike the shape seen in 'classic' Neanderthals. He suggests this may be evidence for the kind of artificial deformation observed in modern human groups and thus of modern ritual behaviour. This kind of conjecturing from skeletal remains alone has strong parallels with the erroneous theories of Broca and Binet and is acknowledged to be fraught with pitfalls, yet inferences of a similar nature continue to be made (Hothersall 1995).

For instance, Niewoehner argued that subtle alterations in joint shape and orientation, combined with greater pronation of the metacarpal 2 in AMH, would have allowed dramatic mechanical advantages in the mid-carpometacarpal region. Such differences are then postulated to relate not only to greater ability to haft stone tools in AMH but also to the finer movements required for engraving and incising of bone and antler artefacts, 'regardless of the archaeological evidence to the contrary' indicating that Neanderthals and AMH in the Levant had almost identical typological and technological tool kits (Niewoehner 2001, 2983).

Are we then to assume that Neanderthals, although cognitively capable of producing such fine crafted artefacts, were prevented from doing so by morphological differences alone? Niewoehner (Niewoehner *et al.* 2003) has revised his position and now maintains that Neanderthals would have had almost identical manipulatory capabilities to modern humans. Although he should be credited for his ability to reassess his arguments, his stance helps to show that some researchers, perhaps as a result of ideologies, are too quick to draw damning conclusions regarding Neanderthal behavioural complexity from physical characteristics alone and from a social context as inferred from the archaeological record. Table 1 illustrates the clear skeletal distinctions that divide the two groups, but the most interesting and relevant elements (for investigating behavioural and cognitive variance) concern the adaptive significance of differences in robusticity and muscular hypertrophy,⁴ incidence of

Table 1. Morphological and physical characteristics of an average Neanderthal and Anatomically Modern Human.

	Neanderthals	Anatomically Modern Humans
Cranial		
Average cranial capacity	1520 ml	1340 ml
Braincase	Long low, thin-walled; oval when viewed from behind	Long, narrow and high
Maximum breadth	At mid-parietal level	At top
Forehead	Low forward (flatter frontal bone)	Higher (domed frontal bone)
Brow ridge	Pronounced double-arched supraorbital torus	Rarely forms continuous supraorbital torus
Brow ridge dimorphism	Equally developed in both sexes	More greatly developed in males
Orbits	High rounded	Low square
Nasal cavity	High, wide and voluminous	Lower narrower nose
Maxillary bone	Inflated, no depression (Canine fossa)	Canine fossa
Zygomatic arch	Receding, swept back	Angled
Supra inniac fossa	Usually present	Absent
Occipital bone	Shorter bulging occipital	Longer curved occipital
Lamboid region	Bone flattened at lamboid & sagittal suture	No flattening
Juxtamastoid process	Larger eminence	Smaller eminence
Mastoid process	Small	Larger (especially for males)
Inner ear	Small anterior & posterior semicircular canals Uniquely low position for posterior canal	Larger anterior/posterior canals Higher position of posterior canal
Level of basicranial flexion	Equivalent to 6- to 11-year-old modern child	
Hyoid bone	Present	Present
Hyerglossal canal	Large	Large
Mandibles	Asymmetric sigmoid notch (large coronoid process)	Symmetric signoid notch (small coronoid process)
Prognathism	Large prominent nose and mid-facial projection	Nose may be prominent, but not whole mid-face
Retro molar gap	Present	Absent
Anterior teeth	Small	Small
Tauradont molars	Present	Absent
Incisors	Significantly larger than modern size	
Maxillary incisors	Shovel-shaped	Not shovelled
Cheek teeth	Less worn than incisors and canines	Anterior and posterior teeth equally worn
Mental foramen	Usually under 1st molar	Usually under premolars
Mental symphysis (chin)	Usually absent	Present
Post-cranial		
Shafts of radius & femur	Usually bowed	
Average weight	Male: 77 kg; Female: 66 kg	Male: 65 kg; Female: 54 kg
Average height (males)	Male: 166 cm; Female 154 cm	Male: 178 cm; Female 161 cm
Muscular hypertrophy	Extremely large, well-developed muscle & ligament attachment areas	Less robust muscle attachments
Femoral shaft	Rounded	Not rounded — pilaster on dorsal surface
Femoral heads	Large, robust surface	Smaller, less robust
Ribs	Thick and weakly curved	Thin, flat and curved
Pubic bone	Lengthened and thinned	Shorter
Scapula	Very broad, commonly with deep groove or sulcus on outer edge of dorsal surface	Shallow groove, usually on ventral or rib surface
Tips of phalanges	Large, rounded apical tufts	Narrower, hemiamygdaloid tufts
Infant development	Possible reduced adolescent stage	Presumed secondary altricial development
Age at death	8.6% chance of survival above 35 years	50% chance of survival above 35 years

pathology and serious injury, infant development and elements of morphology relating to language abilities. Some researchers argue that the greater robusticity and muscular hypertrophy observed in Neanderthals as compared to AMH is illustrative of their limited

ability to adapt culturally (Klein 1999; 2003; Stringer & Gamble 1993; Trinkaus 1993).

For instance, Trinkaus *et al.* (1998) argue that the scaling of cortical thickness against probable body mass for the Western Asian AMH at Qafzeh and

Skhul shows them to have arms less robust than, but legs as robust as the contemporaneous Neanderthals from this region. The inference, as they state, may be that Neanderthals relied less on tools and technology for undertaking daily tasks than AMH. However, although gracile in comparison to the Neanderthals, the skeletal robusticity and muscular hypertrophy (including that of the humeri) of both the early and late Upper Palaeolithic AMH in Europe is significantly greater when compared to that of modern humans. Additionally, work by Stock & Pfeiffer (2004) on the long bone robusticity of Late Stone Age hunters (8000 to 2000 BP) in South Africa clearly illustrates that the relative levels of bilateral asymmetry in upper-limb robusticity can vary greatly within AMH populations, depending upon the selective pressures and attributes of the ecological environment exploited.

As the Upper Palaeolithic AMH are considered to be cognitively and behaviourally modern, this suggests that variations in climate can induce physical adaptation irrespective of the complexity of the technology to hand (Churchill & Vincenzo 1997; Lahr & Foley 1998; Shackelford & Trinkaus 2002). As 'climate has clear correlations with physique and skeletal proportions' (Pearson 2000)⁵ and hence lifestyle (cultural adaptation) is only one of many influences on morphology, arguments suggesting that Neanderthal robusticity indicates cultural inferiority may be undermined.

Nor, however, does a climatic explanation of robusticity directly imply inability to pursue cognitively complex survival strategies. Klein (1999) has contended that the great trunk breadth and short limb length, indicative of Neanderthal adaptation to a cold climate, equalled or exceeded that of modern Inuit peoples despite the more extreme cold tolerated by these latter groups. Neanderthals therefore have been characterized as relying more upon 'brawn' than 'brains' in their day-to-day survival strategies (Stringer & Gamble 1993). Yet, such arguments do not unambiguously imply behavioural simplicity in Neanderthals. The direct ancestors of modern-day Inuit groups only reached the Arctic approximately 5000 years ago, and in this short time they have developed remarkable biological mechanisms, including reduced overall vasodilation and increased flow to vulnerable areas such as hands (Schurr 2004; Lazenby & Smashnuk 1999). Theoretically, another 100,000 years of isolation could quite probably result in further physical adaptation.

Many of the differences in robusticity between Neanderthals and early modern humans could be related to a greater period of exposure and thus time for

adaptation to cold conditions in the former. There is no simple correlation to be made between (perceived lack of) cognitive ability and this adaptive robusticity as a survival strategy.

Pearson (2000) has argued that, when relying on robusticity to infer behavioural differences, the method by which the measure is obtained is crucial, in that some recent Australian aboriginal remains have levels of 'residual' robusticity as high as those of Neanderthals. Furthermore, investigations of Neanderthal ecology and environment by Stewart (2005) indicate that they do not conform as well to the adaptive scenario posited by the Bergman and Allen rules as is usually presumed. Consequently, the climatic analogies employed by Klein (1999) may have no theoretical basis in the light of Stewart's findings that the environment of the Neanderthals may have no modern analogue.

Presentation of these polarized opinions is not intended to deny the importance of increased hyper-robusticity when examining Neanderthal cognitive and behavioural complexity. Rather, such abundant disagreement illustrates the problem that inferences based solely on physical characteristics, without a thorough understanding of social organization, may be ineffectual for determining the precise nature of this complexity.

Similar conclusions may be drawn from a review of the incidence and frequency of pathology and serious injuries amongst Neanderthals (see Berger & Trinkaus 1995). Indeed, the work of Trinkaus & Thompson (1987) it made clear that the life of the average Neanderthal was short, with fewer than 8.6 per cent of individuals surviving beyond the age of 35 years. The characteristically high rate of trauma and short lifespan observed in Neanderthals is presumed to result from inferior subsistence strategies. Low levels of Neanderthal organizational complexity and information processing, together with the reduced opportunity for transgenerational communication of knowledge, is inferred (Trinkaus 1993).

However, a number of points need to be considered. The age estimates are based on the assumption that Neanderthals had similar rates of maturation and osteon remodelling; and the actual lifespan of the contemporaneous AMH is unknown (Klein 1999). Although the incidence of disease and trauma was relatively high, it is widely accepted that so too was the survival of some afflicted individuals (Trinkaus & Shipman 1994; Klein 1999; Dettwyler 1991). Therefore, it is equally valid to argue that the extensive intra-group care needed to sustain such infirm members is surprising unless they provided some valuable service

such as transgenerational communication within the group.⁶ Furthermore, a demographic study of an Iron Age population in the Western Mediterranean, using far more comprehensive data, estimated a life expectancy at birth of approximately 23 years, suggesting that, for these modern humans at least, life was 'nasty, brutish and short', which highlights that to a certain extent any assumptions regarding the longevity and living conditions of AMH Palaeolithic groups remain just assumptions (Alesan *et al.* 1999).

A more recent study of long-bone trauma incidence by Underdown (2004) found that whereas 28.5 per cent of the Neanderthals suffered serious trauma, a selection of modern and historically recent human hunter-gatherer groups, living in broadly similar climatic conditions, had an average rate of only 5.1 per cent. In an attempt to ascertain the causes of the high trauma levels, the foraging energetics of the Neanderthals was modelled and comparisons made with the patterns observed in the modern human populations. No broad correlations were found with the type of tools being used or subsistence strategy. Conversely, the high incidence of trauma may be a result of small groups existing in relative isolation with little inter-group support in times of crisis, under harsh and highly variable climatic conditions. Consequently, both these examples highlight that a thorough understanding of Neanderthal social organization is likely to be prerequisite for our understanding of the significance of contrasting physical characteristics.

Amongst the primates, the 'secondarily altricial' (i.e. underdeveloped) postnatal brain and body growth in modern humans is recognized as a key factor underlying our highly developed and culturally complex system of social interaction and behaviour (Key 2000). Therefore, it is assumed that the existence of a relatively precocial development in Neanderthals would provide an important insight into their level of social interactions. Generally, two methods of investigation have been employed to test theories of development, those of skeletal and dental analysis.

Trinkaus & Tompkins (1990) argue that the inferior locomotory anatomy, lithic technology and manipulative anatomy characteristic of Neanderthals, together with low levels of social organization, would deny them a strong developmental pattern. However, the argument is contradictory, in that their investigation into the rate of postnatal brain growth indicates that most Neanderthal rates fall within just one standard deviation of the modern human rate. With a similar degree of contradiction, one study by Ogilvie *et al.* (1989) suggested that the high rates of

enamel hypoplasia defects found in Neanderthals compared to modern humans indicate higher stress during infant development; whereas a recent study by Guatelli-Steinberg *et al.* (2004) argues that linear enamel hypoplasia does not indicate a significantly different level of stress during infant development.

Conclusions are sharply divided between those researchers who see significant differences and those who do not.⁷ As Ishinda & Kondo (2003) illustrate, a number of problems and contradictions exist. For instance, whereas femoral length as a growth indicator shows retarded growth, dental developmental rates indicate that the rate is advanced. They, together with a number of other researchers, are highly critical of the validity of inferring age of specimens by modern human standards, as assessments of relative developmental rates are thus perpetually flawed (Tillier 1989; Mann *et al.* 1991; Dean & Leakey 2001; Thompson *et al.* 2003).

Thompson *et al.*'s (2003) tentative summary of existing work states that Neanderthals are likely to have possessed the same five ontogenetic phases of growth and development as AMH although their adolescence stage probably encompassed a greater proportion of their total growth. Indeed, recent work by Ramirez *et al.* (2004) on the enamel extension rate appears to support this conclusion by suggesting that Neanderthals reached adulthood 15 per cent sooner than modern humans. However, Ramirez *et al.* have had to assume a modern human rate of enamel extension. Therefore, it appears that, despite objections to the contrary, researchers comparing physical characteristics alone are still unable to answer with any certainty when and how the modern human pattern of growth and development appeared (Thompson *et al.* 2003).

A substantial amount of research has been steadily accumulating for assessing Neanderthal linguistic ability from physical characteristics alone. Early studies assembled by Kochetkova (1978) suggested that Neanderthal brains, despite their large size, allowed markedly inferior cognitive ability compared to AMH. Yet, although the distinctively different cranial shape may indicate a different system of neurological structure, such differences do not and did not fossilize and thus present scientific methods do not support such 'palaeophrenological' conclusions (Holloway 1985; Klein 1999; Schepartz 1993).

Through their extensive work in recreating the supralaryngeal vocal tract anatomy from the level of fossil hominin basicranial flexion, Laitman *et al.* (1979) and Lieberman (1992) have concluded that Neanderthals would be incapable of modern speech. However, Houghton (1993) and Schepartz (1993) both argue that

the techniques employed by Lieberman and Laitman are flawed and their conclusion incorrect. Moreover, the presence of a relatively modern basicranial flexion in early humans such as Steinham, together with that found in the 120,000-year-old Saccopastore 1 Neanderthal, provides further problems for reconstruction of the Neanderthal upper respiratory system (Johanson & Edgar 2001).

Indeed, the evolution of the laryngeal anatomy required for speech in humans comes at a significant risk of suffocation, indicative of its extreme evolutionary importance: hence it is unlikely to have been 'lost' through time (Stringer & Gamble 1993; Houghton 1993; Strier 2003). In addition, Neanderthals possessed a hyoid bone that was both morphologically identical to our own and highly distinct from that of the higher apes (Arensburg 1989). Although it has been stated the Neanderthal hyoid bone also resembles that of a pig, Neanderthals evolved within the order primates, not Artiodactyla, so the significance concerns phylogenetic history not coincidental similarity (Lieberman 1992). Furthermore, research by Kay *et al.* (1998) and MacLarnon & Hewitt (1999; 2004) on the relative size of the hypoglossal canal and spinal cord, respectively, suggest that Neanderthals possessed a level of innervation comparable to that of modern humans and thus were capable, at least anatomically, of modern speech.

Establishing the existence of language in Neanderthals has been a matter of personal opinion and individual interpretation. This discussion is no different, but in the light of the existing evidence combined with recent research questioning the true nature of an 'explosion' of culture in the Upper Palaeolithic, together with the work of Aiello & Dunbar (1993), it favours the proposition that the process of language development in *Homo* has probably been slow and gradual (McBrearty & Brooks 2000; Bar-Yosef 2002). Thus, although it seems highly likely Neanderthals were 'anatomically capable' of speech, comparative study of physical characteristics is not enough on its own to determine whether they possessed the highly symbolic form of spoken language employed by modern humans.

In conclusion, the model of contrasting physical characteristics is useful in highlighting the differences that existed between Neanderthal morphology and that of AMH *Homo sapiens*. Yet, as we shall see in the next short discussion of Neanderthal technological ability, neither attribute in isolation fully justifies the immense weight of inference they are expected to carry. Divorced from an understanding of Neanderthal social organization and behavioural complexity,

they primarily provide us with questions, not unambiguous answers.

Sticks & stones

The inherent problems of preservation mean that apart from bones, stones (lithic technologies) are the primary evidence of past hominin behaviour. Naturally, this has been the medium via which archaeologists and palaeoanthropologists have attempted to understand the cognitive ability and behavioural complexity of Neanderthals. However, archaeological artefacts cannot speak for themselves; the thoughts, fears, concerns and social organization of the individual who created the artefact are not set in 'stone', unambiguously visible to us. Social organization is inferred and from this we conjecture within a framework of archaeological theory about cognitive and behavioural complexity (Gamble 1999).

Whilst this does not invalidate outright the interpretations which are drawn, such interpretations illustrate the current state of opinion and not a cemented reality of Neanderthal behaviour. Indeed, few researchers would still agree with François Bordes's view that the variation between tool types and techniques in Europe from different levels and sites reflected the existence of five distinct, coexisting Neanderthal 'tribes' (Stringer & Gamble 1993). Archaeologists are now suitably wary of applying such typological terms which imply a linear progression from primitive organization to civilized societies (Gamble 1999).

There is not room within the scope of this article to document the origin and development of lithic technologies in Europe; comprehensive and authoritative reviews can be found in Churchill & Smith (2000) and Mellars (1996). Rather, the intention here is to examine some of the ways in which technology has been used to infer Neanderthal cognitive and behavioural complexity, and to assess the validity of these inferences. For example, although many researchers are careful to state that 'simplicity in behaviour' does not reflect 'simplicity of mind' they have nevertheless been able to extract a great deal of information regarding the state of Neanderthal cognition and behaviour from stone tools alone (Mellars 1996). The validity of the conclusions is not self-evident.

It is widely acknowledged that the transition from the Middle to Upper Palaeolithic in Europe is not a simple switch between the less-advanced Mousterian lithic traditions and that of the later AMH Aurignacian industries (Stringer & Gamble 1993; Gamble 1999; Churchill & Smith 2000). Indeed, the

existence of lithic types such as 'blades' presumed to be exclusively associated with the Upper Palaeolithic has now been discredited by documenting such tools in Europe as early as 90,000 years ago (Hayden 1993; Gamble 1999). Furthermore, pre-Upper-Palaeolithic industries (PUP) such as the Szeletian and Jerzmanwician predate the arrival of the Aurignacian in Europe by several thousand years (Pettitt 1999; Churchill & Smith 2000). However, both Mellars (1996) and Gamble (1999) maintain there was a major change in the cognitive properties of tool manufacture between the two periods. The nature of the change is purported to be in the 'style' of the tools themselves.

Gamble (1999) argues that, although taxonomy of Mousterian tools is possible, there is no typology, no techno-complex. For the Neanderthals, lithics (and indeed any tools) were extensions of the body, inseparably tied to it, and thus whatever social meaning they held was regionally restricted. Conversely, he maintains that AMH had succeeded in separating form from function, so that objects could hold independent symbolic meaning. As a result, he argues that Neanderthals should be viewed as possessing a lower, 'practical' form of consciousness as opposed to the 'discursive' form found in modern humans.

Moreover, as Neanderthals had no separation between 'tool' and 'self', the possibilities for cultural evolution were precluded by the lack of rational, distanced thought towards the tools themselves. Spears could not 'become more accurate, huts warmer, nets tougher, and technology lighter and more portable' as Neanderthals were incapable of either directed problem solving or planning depth (Gamble 1999). Finally, the static nature of the Mousterian industry is neatly explained as directly resulting from these inabilities. Wynn & Coolidge (2004) reach a similar conclusion to Gamble's and suggest that not only is the low level of innovation indicative of inferior cognitive abilities but also the inability to think separately about tools and objects makes complex symbolic language unlikely in Neanderthals. In turn, Mellars (1996) argues that, if Neanderthals lacked words for tools, this would explain the homogeneity of styles and also highlight their cognitive inferiority. As Klein (1999, 420) states, all of this 'implies a very significant behavioural difference'.

Although some researchers believe that the study of lithic technology alone is enough to draw important conclusions about cognitive difference, the validity of such conjecture is questionable. For instance, Ingold (1993, 450) suggests that 'Western' researchers assume the meanings of the words tools, language and technology to be unproblematic, that 'intelligence is

the faculty of reason, language its vehicle, and technology the means by which a rational understanding of the external world is turned to account for human benefit'. However, in much the same ways as 'Western' researchers have erroneously dichotomized 'nature' from 'culture', believing these to be universal concepts, we should not assume that such categories as technological ability are aligned with intelligence or linguistic ability (Ingold 1996). Indeed, both Dibble (1989) and Hayden (1993) doubt whether 'tools' can in any way be used to infer linguistic abilities.

Hence, as Cosgrove & Pike-Tay (2004, 322) illustrate, if models of European stone typology are applied to Australia, Tasmanian aborigines would be characterized by 'flake stone tools, unmodified flakes, mostly scraper technology and the use of local raw materials'. This would merely be a 'Mousterian' industry with little clear progression and development of 'style' in over 20,000 years. Gamble contends that such examples are irrelevant given the rich artistic tradition of the Tasmanians. However, as he admits, most of their art is highly ephemeral, including body painting, scarification and the carving of symbols onto rocks and trees (Gamble 1993). In addition, the tool types of some Australian aboriginal groups are less standardized in terms of 'style' than those of Mousterian Neanderthals (Hayden 1993). Thus, it is argued that if a mutation within the brain of AMH at 50,000 years ago was responsible for the cultural 'explosion' in the European Upper Palaeolithic, the implications of such a change are not detectable amongst all human groups at this time (see Klein 2002 for discussion of this theory).

In addition, the discovery of the 400,000-year-old wooden spears in Schonigen, Germany, has revealed the extent to which our perception of technological development, which has been largely based on stone tools, underestimated the capabilities of archaic humans' (Finlayson 2004, 120; Thieme 1997). Microwear analysis indicates that European Neanderthals whittled wood and hafted stone tools in wooden mounts as they did in the Levant (Marshack 1990; Boëda *et al.* 1999; Lieberman & Shea 1994). This, together with the work of Underdown (2004), suggests that Neanderthals were not limited to thrusting spears, and their notable frequency of injury is thus unlikely to be the result of primitive technological ability. Indeed, Mesolithic hunter-gatherers from India both thrust and threw spears (Berger & Trinkaus 1995; Kennedy 2004). Moreover, the extensive evidence of wood-working suggests archaeologists are missing a substantial amount of information regarding technology and tools. Tools are also frequently made by contemporary

hunter-gatherers out of palm leaves and other plant materials (Madella *et al.* 2002).

In terms of other non-lithic technology, it is often easier to discuss what Neanderthals lacked in comparison to AMH than what they shared. The lack of utilization of bone, antler or ivory for tool production by Neanderthals has been cited as evidence of behavioural simplicity (Mithen 1996; Stringer & Gamble 1993; Gamble 1999). Tools of this type are not unknown for Neanderthals; however, they mostly comprise pointed ribs and fibula such as those at Salzgitter Lebenstedt or rare finds of antler 'points' like those at sites in the Ache valley, France (Gaudzinski & Roebroeks 2000; Munzel & Conard 2004). Tools of ivory are unknown and the only tools commonly found in Middle Palaeolithic contexts are largely unmodified bone or antler 'retouchers' (Patou-Mathis 2000).

In addition, evidence of 'structures' or 'dwellings' are rare in the Middle Palaeolithic, as is evidence of well built 'hearths' of the type seen in Upper Palaeolithic contexts (Lumley 1969; Patou-Mathis 2000; Gamble 1999). Also lacking in the archaeological record is evidence suggesting the storage of surplus resources (Stiner & Munro 2000; Marean & Assesfa 1999). Absence of such technological attributes has implications for site organization, settlement patterns and demography, and will be discussed later.

Mithen (1996) suggests that Neanderthals could not work natural materials like bone, antler, or ivory as they had once been part of 'nature'. Along with Wynn & Coolidge (2004), he infers that Neanderthal brains were organized in such a way that they thought separately about 'nature' and 'technology' and thus lacked the ability to view natural objects as tools. But, as discussed, the soft tissue of brains is not preserved and thus theories of this testable nature have little scientific merit.

Conversely, Hayden (1993) suggests Neanderthals lacked tools of natural materials for the same reason they lacked the tailored clothing associated with AMH. Using modern ethnographic examples, he argues that tailored clothing is energy-expensive and time-consuming to make and usually reserved for wealthy individuals in contemporary 'complex' hunter-gatherer communities. Therefore, if Neanderthals were 'generalized' hunter-gatherers, they would have no need for tailored clothing and the 'increased use of hides, hide-scrapers, bone needles, awls and spatulae may be viewed as products of the manufacture of status display garments' (Hayden 1993, 130). It is not the intention of this article to emancipate Neanderthals as cognitive and behavioural equals of AMH. Rather, the existence of such polarized opinions on

lithic and other forms of technology, together with the incomplete nature of the archaeological record, should serve to warn that, as a means of assessing behavioural complexity, technology alone does not support the weight of inference laid upon it by researchers.

In conclusion, an increasing number of palaeo-anthropologists argue that, as with robusticity, the surrounding environment has been an important influence in shaping human behaviour and morphology. Indeed, as Marean & Assesfa (1999) illustrate, historic hunter-gatherer groups living on the cold open plains of northern Europe built sophisticated corrals to trap large numbers of migrating animals, whereas contemporaneous groups on the African savannas, surrounded by abundant local fauna, did not. Finlayson (2004) suggests that AMH developed their greatly advanced technology on the homogeneous, open plains environment, where vast distances and low resource predictability and reliability necessarily drove technological innovation. This ecological approach arguably provides a much sounder scientific basis for investigating behavioural variability between Neanderthals and AMH and is a theme which will be returned to later.

Social synthesis: a review of current opinion

Like us, Neanderthals evolved from primate ancestry, so they undoubtedly relied upon advanced and complex social organization for their survival (Strier 2003). They are, however, extinct, which provides palaeoanthropologists with a serious difficulty in assessing the level of complexity inherent within their society. As we have seen, morphology and technology alone arguably provide little in the way of unambiguous answers for assessing this difficulty. Traditionally, Palaeolithic archaeologists studied the static residues of past action, from which inferences were drawn regarding social life and behaviour (Gamble 1999). Such an approach is crucial if we are to understand anything about the lives of extinct hominins.

A growing number of researchers, however, are adopting the approach of behavioural ecology in an attempt to gain a fuller understanding of Neanderthal social complexity (Finlayson 2004; Burke 2004; Foley 1987). It is an approach which has provided environmental stochasticity with an increasingly important role in the development of both Neanderthal and AMH behaviour and one which often derives markedly different conclusions from the same archaeological evidence.

Yet most of what we currently understand about Neanderthal behaviour is inferred directly from arte-

factual evidence alone. What follows is an attempt to provide a social synthesis for Neanderthals, bringing together some of the current evidence relating to the behaviour of this hominin. The validity of this evidence for determining Neanderthal cognitive and behavioural complexity will then be assessed. The following categorization form reflects the main avenues used by researchers to gauge Neanderthal social organization.

Symbolism, art, ritual and material culture

Mellars (1996) argues that differences between Neanderthals and AMH in terms of symbolic expression directly reflect a disparity in language ability, which has obvious connotations for social organization. Yet there is much disagreement as to the reality of this inequality in symbolic ability. For instance, whilst Chase & Nowell (1998) reject the idea of musical aptitude in Neanderthals, suggesting that taphonomic factors are at work, Otte (2000, 271) argues that 'the idea of Mousterian ineptitude is one of the deepest and ... most perverse because it reassures us about ourselves'. He suggests that the vast majority of modern flutes are made of wood; hence there is little direct evidence. However, as discussed, Gamble (1999) argues that structured music, as opposed to sound, requires the separation of form from function, an aesthetic ability he states was lacking in Neanderthals and which the absence of other material objects serves to highlight.

Although apparently rare, objects do occur in the Middle Palaeolithic record just as they do in the Middle Stone Age of Africa (McBrearty & Brooks 2000; Arsuga 2003). Indeed, Marshack (1990), Bahn & Vertut (1997), Mellars (1996) and Gamble (1999) provide examples of incised and pierced bone objects like those found at the 300,000-year-old site of Bilzingsleben, Germany. Furthermore, Neanderthals are known to have frequently collected non-utilitarian objects including 3-kg chunks of iron pyrite from as far as 30–90 km from their source (Hayden 1993). This is in addition to large quantities of haematite ochre, bearing marks of repeated use, which are commonly found at Neanderthal sites. Yet the significance and validity of these and other objects is fiercely debated.

The review by Harrold (1980) suggests that Neanderthal burials imply markedly different socio-cultural systems. There are some who argue that burials are ritualistic. For example, Patou-Mathis (2000), Arsuga (2003) and Pettitt (2000) argue that 'mortuary ritual ... was one of the most "cultural" activities in which Neanderthals indulged' (Pettitt 2000, 360). However, most researchers gravitate towards Harrold, suggesting that whilst bodies were deliberately

protected from decay, this act reflects only the 'existence of some kind of strong social or emotional bonds within Neanderthal societies' (Mellars 1996, 381; see also Tattersall 2004; Dibble & Chase 1993). Stringer & Gamble (1993) suggest that the absence of carnivore activity has erroneously led researchers to view burial as deliberate (see also Gamble 1999). Indeed, Gargett (1989) suggests that all Neanderthal 'burials' are better explained as the products of taphonomic processes.

Archaeological evidence for other forms of ritual is rare. Gamble (1999) states Neanderthals would have engaged in rituals of attaching to and separating from social gatherings but that these greetings and farewells likely characterized all hominins. Cannibalism at Krapina has been proposed by Patou-Mathis (2000), whilst this and other cases have been rejected by others (Defleur *et al.* 1999). Based upon the assumption of precocial growth and short lifespan, Pettitt (2000) suggests Neanderthals had a 'rite de passage'. However, as discussed, we are currently unable accurately to ascertain the nature of Neanderthal lifecycles.

Subsistence strategies

A huge amount of work has been done on Neanderthal subsistence behaviour, most of which views it as synonymous with hunting ability. This emphasis on hunting reflects the belief that it requires theoretical and practical knowledge, experience and teaching and that, 'it builds traditions, creates memory, and structures society by particularly increasing social cohesion and co-operation' (Patou-Mathis 2000, 394). Several reviews summarize the current state of knowledge and, although Neanderthals are no longer seen as obligate scavengers, much debate is centred on whether they were technically challenged or fully adept hunters (Bar-Yosef 2004; Marean & Assesfa 1999; Patou-Mathis 2000; Burke 2004; Speth & Tchernov 1998; Chase 1989; Klein 1999).

Specifically, the targeting of prime-age animals and specialization on a single group is believed to reflect increased cognitive ability, social organization and planning (Gamble 1999; Mellars 1996). Indeed, Gaudzinski & Roebroeks (2000) argue that Neanderthals at Salzgitter Lebenstedt did both, and isotopic studies by Richards *et al.* (2000) further strengthen the case that Neanderthals were efficient hunters of herbivorous mammals (see also Mithen 1996; Drucker & Bocherens 2004). In addition, for La Cotte de Saint-Brelade, Scott (1980) argues that Neanderthals may deliberately have driven herds of mammoth and rhinoceros over the cliff. However, Munson & Marean (2003) and Burke (2004) argue Neanderthals did not specialize, and others suggest that 'specialization'

itself may simply be a product of the ecological environment and not a purposeful decision (Madella *et al.* 2002; Finlayson 2004).

Some researchers argue that only AMH may be characterized as increasing their diet breadth and that Neanderthals were incapable of exploiting small fast moving fauna like rabbits (Richards *et al.* 2001; Marean & Assesfa 1999; Stiner & Munro 2000; Mithen 1996). However, at Terra Amata, a range from both large and small herbivores to birds, turtles, molluscs and possibly marine fish was exploited 300,000 years ago (Lumley 1969).⁸ Neanderthals at Grotta die Moscerini (Italy), Gibraltar and Hortus (France) are known to have exploited molluscs, sea mammals, and thousands of rabbits respectively (Binford 1992; Stringer 2002; Boyle 2000). Indeed, Finlayson (2004) argues we should view Palaeolithic hominins, within the framework of their phylogenetic history, as opportunistic omnivores who artificially raised the carrying capacity (K) of our environment by simultaneously exploiting foods from two trophic levels (Milton 1999). Both Madella *et al.* (2002) and Lev *et al.* (2005) state that Neanderthals relied heavily on plants. In addition, both Finlayson (2004) and Drucker & Bocherens (2004) are critical of the evidence suggesting only AMH increased their diet breadth.

There 'may be no best model of Middle Palaeolithic subsistence behaviour' (Marean & Assesfa 1999, 34), but Finlayson (2004) and Madella *et al.* (2002) suggest that local climatic stochasticity, and hetero/homogeneity greatly influences subsistence behaviours. Furthermore, Sørensen & Leonard (2001) state that Neanderthals could not have been both highly active and inefficient foragers. Contrary to the theory of Mithen (1996), Patou-Mathis (2000) argues that the setting up of camps on animal migration routes by Neanderthals indicates they possessed detailed knowledge of seasonal trends, planning and foresight and thus intra-group social organization and cooperation equal to that of AMH.

Settlement patterns

Changes in mobility and settlement within the landscape are known to, 'trigger dramatic changes in food storage, trade, territoriality, social and gender inequality, division of labour, subsistence and demography' (Finlayson 2004, 195). However, the vast majority of archaeological sites are characterized by palimpsests which means that the nature of mobility and settlement pattern is not easily discernible (Pettitt 1999; Farizy 1994). Nevertheless, Gaudzinski & Roebroeks (2000) argue that Neanderthals were able to remain at Salzgitter Lebenstedt and endure near Arctic conditions between Oxygen Isotope Stages (OIS) 5 and 3. In ad-

dition, Lev *et al.* (2005) infer that a wide diet breadth, together with the absence of commensal rodents (mice) at Kebara Cave indicates a semi-sedentary Neanderthal settlement pattern. However, Trinkaus (1993) states the presence of commensal rodents at Qafzeh indicates the same mobility pattern in AMH.

Yet most archaeologists state that Neanderthal mobility was characterized by frequent short stops whilst moving in a circulatory manner. The local resources at each temporary camp were exploited in a radial star, or 'starburst', within 5–10 km of the camp, and groups moved on after depleting the local resources (Patou-Mathis 2000; Lieberman & Shea 1994; Gamble 1999; Boyle 2000; Feblot-Augustins 1993; Lumley 1969). However, there is disagreement as to the distance travelled between these temporary camps. In the southwest of Europe, distances are believed to average 5–10 km, suggesting a seasonal territory of 10,000 km², which stands in contrast to the mean AMH distance of 50 km (Feblot-Augustins 1993; Gamble 1999; Blades 1999). Gamble (1999, 356) suggests that it implies that Neanderthals engaged in constant 'acquisition (lithic), reduction, use, re-sharpening, discard'. Conversely, he states AMH stocked locales with 'caches' of resources and thus had more time for social interaction. Yet Feblot-Augustins (1993) show that the mean distance travelled by Neanderthals on the North Central plains was about 45–50 km and that such planned 'residential' moves followed migrating herds.

Thus, the contrast between mobility in the South West and North Central regions highlights that the importance of local climatic conditions cannot be ignored. Indeed, Finlayson (2004) and Boyle (2000) state that Neanderthals abandoned the homogeneous central plains at the start of OIS 4 for the more heterogeneous fauna-rich Mediterranean environments which would favour such short duration, frequent movement patterns. Feblot-Augustins (1993) also suggests that the occasional occurrence of trans-Carpathian lithic transfers of almost 250 km may indicate that Neanderthals moved between 'visiting zones'. Furthermore, both she and Farizy (1994) note that Neanderthals appear to be repeatedly occupying some sites like Mauran and Champlost over many generations. There is much debate as to the significance of these and other findings concerning settlement patterns, which will be discussed below.

Site organization

The ability to adopt a more sedentary lifestyle in 'base camps' with clear spatial divisions is seen by many as an important development for increasing the social

complexity of AMH lives in comparison to the Neanderthal sites (Gamble 1999). Both Munzel & Conard (2004) and Pettitt (1997) consider Neanderthal sites to be characterized by limestone rubble in a silty matrix with low densities of artefacts. Pettitt (1997, 208) argues that this repetition in simple spatial organization indicates Neanderthal camps were 'not different from [those] of non-human carnivores'. The generally simple nature of hearths found on these sites is also taken to indicate that although Neanderthals engaged in social interaction it was marked by co-operation in routine acts within intimate and effective networks and there was no external principle of an extended symbolic network which established an overarching principle for the organization of Neanderthal sites (Mithen 1996; Gamble 1999).

Sites like Grotte du Renne, Grotte du Bison and Pech de l'Azé often display complex organization including well-built hearths and huts, stone walls, and areas paved with limestone slabs (Hayden 1993; Klein 1999), but the characterization of such sites as Neanderthal is problematic for a number of reasons. They all belong to the Châtelperronian industrial period and, although d'Errico *et al.* (1998) consider this industry to be a genuine Neanderthal innovation, Mellars (2005) prefers to view such advanced site organization as a product of imitation and acculturation: while they could emulate, they could not fully understand (Stringer & Gamble 1993). However, Neanderthal sites with complex organization exist at Le Lazaret and Grotte Vaufray (France), Vilas Ruivas (Molodova) and Kebara Cave (Israel) as early as 120,000 years ago. For instance, at Kebara the living space was regularly cleaned and ash deposited in a midden against the cave wall (Boyle 2000; Gamble 1999; Stringer & Gamble 1993; Speth & Tchernov 1998). Furthermore, at Terra Amata it is believed the group designated an area away from the camp for defecation.

Thus, whilst Stringer & Gamble (1993) see no evidence of 'base camps', Patou-Mathis (2000) does recognize them along with five other distinct types; and hence she and Farizy (1994) suggest that complex site organization can be found at Neanderthal sites. The significance of inferring the complexity of Neanderthal social organization from such strikingly different opinions will be discussed below along with a number of important points which must be considered before any conclusions are drawn regarding cognitive ability or behavioural complexity.

Trade and exchange

The trade and exchange of objects aids in the formation of intimate inter-group relationships, which arguably

stretches society beyond the immediate gathering of people and implies the cognitive capacity to maintain abstract relationships. Such extended networks can be crucial in ensuring group survival during localized resource shortages (Gamble 1999). Hayden (1993) argues both Middle and Upper Palaeolithic assemblages in the Dordogne Valley are generally made of local lithic materials. Conversely, Neanderthals on the North Central Plains appear to have regularly transferred stone up to 200 km. Feblot-Augustins (1993) suggests that this may indicate long-distance social interaction.

However, as she states, this was not typical. Thus whereas the archaeological record indicates that AMH are almost certain to have 'traded' items in an 'economic' fashion outside the immediate group, the use of such terms for Neanderthal lithic transportation seems both awkward and erroneous. From this evidence, Gamble (1999) infers that Neanderthals lived within localized 'task-scapes', were incapable of maintaining long-distance social relationships in extended networks, and thus lacked the symbolic language he argues to be necessary for the existence of such networks. This suggests grave behavioural disparities in social organization between Neanderthals and AMH, stemming from inferior cognitive and behavioural abilities.

Demography and day-to-day social life

Klein (1999) states there are 'no practical or theoretical grounds for estimating absolute population densities of the Neanderthals'. Estimates of group size range from 143 to only 30 men, women and children (Aiello & Dunbar 1993; Farizy 1994). Though we have no provable means of determining group size, most archaeologists believe that Neanderthals would have lived as small relatively localized populations (Gamble 1999). Bar-Yosef (2004) suggests that group mobility, the seasonal availability of food resources, and their spatial distribution would have been important factors. However, estimates of small groups are often based upon assumed foraging inefficiency and a lack of storage technology in Neanderthals (Klein 1999; Mithen 1996; Stiner *et al.* 1999). As discussed above, this inferred disparity is unlikely.

Data relating to age structure, gender ratio or developmental patterns within Neanderthal groups are based upon the analysis of skeletal remains which is ambiguous at best. Gamble (1999) theorizes that males and females would have lived in separate matrilocal and patrilocal groups, each maintaining their appropriate philopatric determinant, whereas AMH males would have dispersed from relatively seden-

tary matrilineal groups. His argument is based upon conclusions regarding the assumed lack of symbolic behaviour, low group density, and reconstructions of settlement patterns in Neanderthals but, as outlined above, these inferences are not unquestioned. Finally, Mithen (1996) and Pettitt (2000) argue that Neanderthals would not have shared food — but it is becoming increasingly likely that such behaviour would have been present as early as 1.5 million years ago in *Homo ergaster* (Bunn 2001).

In conclusion, by using the available literature relating to Neanderthal developmental rates, Pettitt (2000, 361) states there would have been ‘very little differences [in Neanderthal social organization] from other higher primates’. The next section will discuss the validity of this damning statement, and assess to what extent the information presented in this review allows us to make inferences regarding Neanderthal cognitive ability and behavioural complexity.

The significance of difference: a portrait of an ‘average’ Neanderthal

There is no direct way of observing Neanderthal social interaction. Consequently, the theoretical interpretations laid out in the previous section provide the only data we have for assessing Neanderthal social organization. By summarizing each of the categories at face value and adhering to the majority viewpoint in each, it is possible to create a picture of the ‘average’ Neanderthal, a representation of what daily life was like for Neanderthals drawn from the available evidence.

They lived in small groups where daily interaction with other members was obligatory and necessary for group cohesion. Yet both the interactions themselves and the language lacked any significant level of symbolic meaning. Strong emotional and social bonds between group members meant that the death of an individual caused disruption within the group and the body was deliberately protected from decay. These bonds also ensured that the economic needs of disabled members were met by the rest of the group. Life was dominated by the necessity of group survival and lacked a ritual framework. Individuals, probably male, had the ability to co-operate effectively in the hunting of herbivorous fauna, using spears. Yet, although females and infants probably exploited a wide range of plants and animals efficiently within the local environment for food, they were incapable of exploiting small fast-moving prey.

Groups were highly mobile within a small range, frequently set up temporary camps, exhausted the

local resources and moved on. This is reflected in undeveloped site organization and absence of well-built permanent structures. The small range of groups meant they frequently met and gathered, and thus trade or sites for ‘social occasions’ to strengthen bonds between groups were not required. Hence they lacked, or experienced no pressure to develop, the aesthetic appreciation necessary for such symbolic behaviour, and objects, art or music capable of communicating symbolic messages ‘in absentia’ were not created or traded.

Neanderthals and AMH probably constitute separate species divided by as much as 900,000 years of divergent evolution.⁹ Thus it would be rash to assume that differences did not exist between their respective behaviours. However, a careful examination of the social synthesis reveals a significant lack of consensus over what we may consider to be an ‘average’ Neanderthal. For instance, although a number of papers attempt to summarize the vast array of literature relating to Neanderthal subsistence, the only consistent similarity between these summaries is the subject matter; the conclusions, as we have seen, are often contradictory (see Patou-Mathis 2000; Bar-Yosef 2004; Burke 2004). It is worth considering how such disparate opinion can exist given that researchers claim to be able accurately to portray Neanderthal social organization, from which they make inferences regarding cognitive ability or behavioural complexity.

The answer may lie with the fact that ‘the severity of taphonomic distortion increases with age’ (Bahn & Vertut 1997, 25). So the archaeological record of the Middle Palaeolithic is sparse compared to the Upper, despite the greater duration of the earlier period. We know that open-air shelters in Europe were used for painting during the Palaeolithic, but their significance was not recognized until the 1980s owing to a combination of poor preservation and the presupposition of ideas of researchers. Indeed, as Bahn states, only ‘once a phenomenon is accepted as real, [does it start] to be looked for and to be found’ (Bahn & Vertut 1997, 26). Turning back to Middle Palaeolithic, one of the most obvious features of sparseness is the relative lack of evidence for symbolic expression. Although from time to time tantalizing glimpses are seen in the form of incised bone or objects of a seemingly non-utilitarian nature, they are rare. This makes their significance extremely difficult to determine. It may be that taphonomic considerations are important here, just as with paintings in rockshelters, but despite fertile debate, the majority of researchers prefer to equate rarity with irrelevance, ‘the products of eccentric individu-

als, rather than reflections of larger societies in which these individuals lived' (Tattersall 2004, 26).

This 'authentic' majority opinion is possible, as researchers attempt to compensate for the sparseness of the archaeological record by using interpretive models which are heavily influenced by external factors and individualistic preference. For instance, one of the most evident points about our species is that we live in a symbolic world of our own creation, which governs our social interactions (Geertz 1993). Thus the lack of symbolic expression in Neanderthals is equated with inferior social organization which, in turn, is seen as reflecting grave disparities between 'us' and 'them' in terms of cognitive ability and behavioural complexity. Yet, arguably, when looking for evidence of 'Art' or symbolic expression in the past, archaeologists are intrinsically pre-judgmental. For instance, capitalized 'art' is meant to highlight that archaeologists may be looking for symbolic expression in the past using our 'Western' idea of aesthetic understanding. This is not considered to be a cross-culturally applicable category amongst modern humans by anthropologists so how can we expect its relevance to extend into the Palaeolithic (Weiner 1994)? Moreover, we have discussed how Neanderthals appear to have had high mobility. The ethnographic evidence of equally mobile historic and recent hunter-gatherer peoples should serve to show that such a lifestyle precludes a cumbersome material culture for its own sake (Strehlow 1993).

Irrespective of these considerations, evidence of this unjustifiable imposition is seen frequently in archaeological interpretations. Whilst Mellars (1996) argues Neanderthal burials are at the very least indicative of a strong or emotive sense of attachment to the deceased, he states there is no evidence, indeed no need, to invoke symbolic or ritual explanations. The absence of obvious symbolic artefacts or of grave goods found with Neanderthals is thus seen as absence of a capacity for symbolic thought, and consequently of inferior cognitive ability. Accordingly, Neanderthals could be assumed to have no greater ability for symbolic expression than African elephants (*Loxodonta africana*). These animals have been observed to bury the bodies of both other elephants and human beings they unintentionally killed, with earth and vegetation, and then to stand over the burials for days in silence. The most common explanation for this behaviour is that they feel strong emotive or social attachment to the body. The reality, however, is that we do not understand, even through direct observation, the significance of this behaviour in elephants (see Poole 1996).

Therefore, we must consider that archaeological remains are 'usually an incomplete source of informa-

tion, since social structure is reflected in mortuary ritual which is only partly composed of disposal of the body' (Trinkaus 1984, 677). For example, the Wollunqua aboriginal tribe of central Australia accompanies totemic ceremonies with paintings drawn into wet sand which are normally obliterated the following day (Strehlow 1993). Furthermore, grave goods are discouraged and even prohibited amongst many human societies (Trinkaus 1984).

In Tibet, the extreme climatic fluctuations mean that both subterranean burials and cremations of the deceased are seldom practised owing to permafrost and lack of firewood. Any trace of the body is completely obliterated when the bones are crushed to powder and all organic material is devoured by vultures during the Buddhist 'sky burial' ceremony (Marsh 2000). Thus, archaeologists must be aware that the Judeo-Christian perspective of burial can influence their interpretation of the past.

'Compassion' for infirm group members, enabling them to survive with serious illnesses and disabilities, is frequently considered to be relatively unproblematic in Neanderthal societies. Yet, as Dettwyler (1991) stresses, not all modern societies automatically show 'compassion' for disabled individuals and even within the western world disabled people are not always considered as equal members of society. Indeed, equal rights for disabled individuals have only been won by hard fought campaigning. In addition, the vast majority of disabilities leave no osteological trace and thus theories of compassion in Neanderthals are based upon the analysis of a very limited amount of evidence relating to the survival of individuals with cranial and postcranial disabilities. We know nothing of how blind Neanderthals fared within their society.

The lack of evidence for long-distance transfer of material among Neanderthals is taken as evidence that they lacked the symbolic capacity, and thus cognitive ability, to envisage and maintain extended social networks (Gamble 1999). Significant evidence exists that AMH traded an impressive array of non-utilitarian objects such as sea shells. It may be argued, however, that, by comparing AMH to Neanderthals in this way, we already have a picture of what 'trade' should have been like among Neanderthals, and thus the absence of long-distance shell transport is taken as absence of inter-group connection. Yet again the model is weakened by ethnographic examples emphasizing the variability in modern human behaviour. Indeed, as Paton (1994) states, Mudburra- and Jingili-speaking aboriginal Australian groups are known to travel more than 300 km to exchange apparently identical stone blades.¹⁰ The archaeological evidence left at what

Gamble (1999) would term a 'social occasion' between these aboriginal groups is virtually non-existent. Yet the meaning inherent within the blades and the meetings themselves is crucially important for the social organization of the groups involved.

In terms of settlement patterns and site organization, it may again be argued that the model used to view the evidence significantly affects the conclusions. Middle Palaeolithic sites are palimpsests formed over hundreds of generations (Pettitt 1999). Thus, examining spatial patterning are a way of studying behaviour diachronically rather than the organization of and use of space synchronically (Farizy 1994). This leads us to focus solely upon repetitiveness of behaviour across generations 'rather than on the ways that people organized their space in any single occupation' (Farizy 1994, 160). Evidently, she believes that a social ethnography of Neanderthal behaviour is unlikely to be possible. Conversely, Conard (1994) argues that split second decisions in the minds of hominins can confidently be seen in the archaeological remains, and thus that the lives of extinct hominins can be accurately reconstructed. Thus, the conclusions drawn regarding social organization, symbolic expression and thus cognitive ability depend upon the school of thought a researcher aligns his or her self with, and not necessarily the archaeological evidence.

For instance, Pettitt (2000) provides us with an interpretive analysis of Neanderthal developmental and social lifecycle phases. Much like the work of Boule, the image it presents of the average Neanderthal is scientific in that based on the detailed analysis of skeletal morphology and in the case of Pettitt, archaeological evidence (Drell 2000). As has been discussed, there are clear differences in the physical characteristics of Neanderthals and AMH, but the significance of these differences is far from certain. Yet we are presented with an image of Neanderthal social organization which differs little from that of chimpanzees. He suggests that as the developmental rate of individuals was rapid, and life 'nasty, brutish, short', they lived in an undifferentiated society. Status was acquired through an individual's physical achievement or accumulated knowledge. However, he states that his work is largely interpretive, reflecting his own views on the subject.

Admittedly, it may be argued that Pettitt is only attempting to stimulate debate on what is a contentious issue because of the close temporal proximity of *Homo neanderthalensis* to our own species. As previously illustrated, however, palaeoanthropologists do not currently have enough evidence to know with any confidence the developmental rate of Neanderthals. Thus, despite the fact that the science behind

his interpretations is flawed, the reader, unaware of evidence to the contrary, is presented with an 'authoritative' portrait of Neanderthal life. Illustrative and provocative, such flagrantly interpretive work can be dangerous. Boule's largely erroneous image of Neanderthals as savage, primitive apes, lacking the ability for even competent habitual bipedalism, took decades to deconstruct.

It is not the intention of this article to deny the existence of 'negative evidence', to claim that the social organization of Neanderthals or their capacity for symbolic expression could have equalled that of AMH without leaving any evidence (see Dibble & Chase 1993 for a discussion). The aim is not to emancipate Neanderthals as 'human' but to point out that we must be aware that researchers model this 'negative evidence' within their own theoretical outlook. We are not able to comment upon an easily discernible archaeological reality from which one authentic or accurate portrait of Neanderthal behaviour can be drawn (Drell 2000). All too often a lack of evidence is interpreted as inferiority. Consequently, the validity of the conclusions drawn regarding cognitive ability and behavioural complexity is certainly questionable.

Conclusion

As the attempted social synthesis has clearly illustrated, we lack a significant 'chunk' of important data regarding day-to-day social interaction and demography. It is either uncertain or absent. This in no way invalidates the evidence we have; however, it illustrates the fact that when researchers construct images of the average Neanderthal, they are continuing to make inferences from a few, isolated and preferred lines of investigation, for example, symbolism, physical characteristics, the transportation of lithic material or inferred settlement patterns.

These available means of investigation can provide an archaeological 'window' into the past, an opportunity to accumulate evidence about the behaviour of extinct hominins. But we must be aware that the ideological stances of individual researchers can cause them to see markedly different vistas through the same 'window'. Rather than realizing the limitations of what the available evidence can tell us, some researchers attempt to use the data to compensate for and explain away the great deal we do not know about Neanderthal demographic behaviour and daily interaction.

This compensatory approach does not provide a satisfactory representation of Neanderthal social organization, and thus inferences regarding cogni-

tive ability or behavioural complexity are premature, invalid and potentially dangerous. Indeed, as Drell (2000) states, museums, televised documentaries and popular or scientific books are powerful media for disseminating ideas about Neanderthals. Thus 'casual' interpretations of the kind made by Pettitt (2000) have the potential to become lodged as reality in the collective memories of millions, reinforcing the division between a hypothetical 'them' and 'us'. A recent article in a British newspaper concerning the discovery of the *Homo floresiensis* highlights the extent to which this dangerous phenomenon still exists. Indeed, it states that the present inhabitants of the highlands on Flores, living simply off the land, are the direct descendents of *Homo floresiensis* and not of a *Homo sapiens* ancestor a clear case of the perpetuation of 'them' and 'us' (Shears 2005).

Such a brutally relativistic approach is in no way intended to show that we cannot or should not attempt to understand the life history or social organization of extinct hominins. Rather, new approaches should be sought not to replace but to augment and strengthen traditional means of investigation. Arguably, we need to emphasize our phylogenetic history as a primate, so that the study of anthropology does not irrevocably dichotomize social behaviour from the physical reality and our environment. One way to prevent such unprofitable divisions may be by providing evolutionary, ecological theory with a more important role in our understanding of hominin behaviour. It is a line of theory long championed by amongst others, Robert Foley, but its importance is only recently being understood by the wider anthropological community. Indeed, as he states, 'Fossils cannot tell their own story' (Foley 1987, 69; 1999; 2002; see also Martin 2002).

As discussed, environmental stochasticity can provide reasonable explanations for the observed variation in Neanderthal behaviour. For instance, Finlayson believes that AMH were initially prevented from occupying the heterogeneous, faunal-rich Mediterranean areas by the presence of Neanderthal populations. He theorizes that, forced out onto the open plains, they experienced intense selective pressures to develop and build upon hominin exaptations, and thus he states the evolution of modern behaviour 'could easily have gone the other way' (Finlayson 2004, 207). Additionally, ecological elements including population and community interaction could provide a framework upon which to test hypotheses in the future. Although we have no means of directly validating our theories owing to the distance between us and the past reality, ecological theories, could be tested by analogy through primatology.

Irrespective of whether this is a path taken by future researchers, this article has shown that we still lack a holistic understanding of Neanderthal social behaviour. By using primatological analogy, Neanderthal society, at an absolute minimum, can be characterized as comprising intelligent, self-aware individuals, engaging in political behaviour (de Waal 1988; Strier 2003; Gallup *et al.* 1995). However, we do not currently have a comprehensive understanding of Neanderthal society. We lack evidence of cultural elements including incest taboos and rites of passage which do not leave archaeological traces. Although we cannot be certain they existed, we cannot assume they did not. Hence, until new evidence is found, we should exercise more caution when drawing conclusions regarding the cognitive ability or behavioural complexity of Neanderthals.

Robert Davies
 Department of Anthropology
 Oxford Brookes University
 Headington
 Oxford
 OX3 0BP
 UK
 Email: r.davies@ucl.ac.uk

Simon Underdown
 Department of Anthropology
 Oxford Brookes University
 Headington
 Oxford
 OX3 0BP
 UK
 Email: sunderdown@brookes.ac.uk

Notes

1. The significance of earlier Neanderthal finds at Engis (Belgium) and Forbes Quarry (Gibraltar) went unnoticed due to inaccurate identification of the fossils (Stringer & Gamble 1993).
2. Milford Wolpoff (Wolpoff & Caspari 1997, 270) famously stated 'Every morning I see a Neanderthal in my shaving mirror', referring to his belief that Neanderthals made a significant contribution to the modern human gene pool. In 1939, Carleton Coon's attempted to dress a replica of the La Chapelle-Aux-Saints Neanderthal in modern clothes and a trilby hat, providing him with a hair cut and a shave, the intention being to illustrate how presented in such a way, he would go unnoticed as 'Other' by his fellow subway commuters. See Stringer & Gamble (1993) and Wolpoff & Caspari (1997) for details and images.
3. The presence of *Homo sapiens* in Australia at more than 50,000 kyr helps to support the position taken here.

4. See Pearson (2000) for a recent debate regarding the definition of robusticity.
 5. Johanson & Edgar (2001) provide a clear photographic illustration of the extent to which localized environmental pressures have resulted in the unusually robust nature and peculiar shape of the ancient *Homo sapiens* at Kow Swamp.
 6. This is in fact a view communicated by Trinkaus & Shipman (1994, 418) in their remarkably contradictory review.
 7. Opinion is divided between Godfrey & Sutherland (Williams *et al.* 2003), Smith (1991), Dean & Leakey (2001), Stringer *et al.* (1990), Majo & Tillier (2003), and Ishinda & Kondo (2003) who see no significant differences, and Ramirez *et al.* (2004), Trinkaus & Thompson (1987), and Trinkaus & Tompkins (1990) who conclude that a non-human pattern characterized Neanderthal development.
 8. The taxonomy of the hominins at Terra Amata is uncertain. They may have been a late surviving populations of *Homo heidelbergensis* or part of an adaptive radiation leading to Neanderthals (Lewin & Foley 2003).
 9. Recent finds have pushed back the origin of primates to at least 80 million years ago (Mya). Older methods of determining the length of separation between Neanderthals and modern humans were based upon the erroneous assumption that this order evolved 55 Mya. A recalibration yields an estimated divergence from a last common ancestor at as much as 900,000 years ago. See Martin (2002) for a discussion.
 10. Groups also exchange wooden boomerangs and bamboo spears. Both leave very little trace in the archaeological record but are saturated in meaning and significance (Paton 1994).
- References**
- Aiello, L.C. & R.I.M. Dunbar, 1993. Neocortex size, group size, and the evolution of language. *Current Anthropology* 34(2), 184–93.
- Alesan, A., A. Malgosa & C. Simo, 1999. Looking into the demography of an Iron Age population in the western Mediterranean. *American Journal of Physical Anthropology* 110, 285–301.
- Arensburg, B., 1989. New skeletal evidence concerning the anatomy of Middle Palaeolithic populations in the Middle East: the Kebara skeleton, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Human*, eds. C.B. Stringer & P. Mellars. Edinburgh: Edinburgh University Press, 165–71.
- Arsuga, J.-L. de, 2003. *The Neanderthal Necklace: in Search of the First Thinkers*. Chichester: Wiley.
- Bahn, P.G. & J. Vertut, 1997. *Journey Through the Ice Age*. London: Weidenfeld & Nicolson.
- Bar-Yosef, O., 2002. The Upper Palaeolithic revolution. *Annual Review of Anthropology* 31, 363–93.
- Bar-Yosef, O., 2004. Eat what is there: hunting and gathering in the world of Neanderthals and their neighbors. *International Journal of Osteoarchaeology* 14, 333–42.
- Berger, T.D. & E. Trinkaus. 1995. Patterns of trauma among the Neanderthals. *Journal of Archaeological Science* 22, 841–52.
- Binford, L., 1992. Subsistence — a key to the past, in *The Cambridge Encyclopaedia of Human Evolution*, eds. S. Jones, R. Martin & D. Pilbeam. Cambridge: Cambridge University Press, 68–9.
- Blades, B., 1999. Aurignacian settlement patterns. *Current Anthropology* 40, 712–18.
- Boëda, E., J.M. Geneste, C. Griggo, N. Mercier, S. Muhesen, J.L. Reyss, A. Taha & H. Valladas, 1999. A Levallois point embedded in the vertebrae of a wild ass (*Equus africanus*): hafting, projectiles and Mousterian hunting weapons. *Antiquity* 73, 394–402.
- Boyle, K.V., 2000. Reconstructing Middle Palaeolithic subsistence strategies in the south of France. *International Journal of Osteoarchaeology* 10, 336–56.
- Bunn, H., 2001. Hunting, power scavenging, and butchering by Hazda foragers and by Plio-Pleistocene *Homo*, in *Meat Eating & Human Evolution*, eds. C. Stanford & H.T. Bunn. Oxford: Oxford University Press, 199–217.
- Burke, A., 2004. The ecology of Neanderthals: preface. *International Journal of Osteoarchaeology* 14, 155–61.
- Caramelli, D., C. Lalueza-Fox, C. Vernesi, M. Lari, A. Casoli, F. Mallegni, B. Chiarelli, I. Dupanloup, J. Bertranpetit, G. Barbujani & G. Bertorelle, 2003. Evidence for genetic discontinuity between Neanderthals and 24,000-year-old anatomically modern humans. *Proceedings of the National Academy of Sciences of the USA* 100(11), 6593–7.
- Chase, P.G., 1989. How different was Middle Palaeolithic subsistence? A zooarchaeological perspective on the Middle to Upper Palaeolithic transition, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. C.B. Stringer & P. Mellars. Edinburgh: Edinburgh University Press, 321–37.
- Chase, P.G. & A. Nowell, 1998. Taphonomy of a suggested Middle Paleolithic bone flute from Slovenia. *Current Anthropology* 39(4), 549–53.
- Churchill, S.E. & F.H. Smith, 2000. Makers of the early Aurignacian of Europe. *Yearbook of Physical Anthropology* 43, 61–115.
- Churchill, S.E. & F. Vincenzo, 1997. A case of marked bilateral asymmetry in the upper limbs of an Upper Palaeolithic male from Barma Grande (Liguria, Italy). *International Journal of Osteoarchaeology* 7, 18–38.
- Conard, N.J., 1994. On the prospects for ethnography of extinct hominids. *Current Anthropology* 35, 281–2.
- Cosgrove, R. & A. Pike-Tay, 2004. The Middle Palaeolithic and Late Pleistocene Tasmania hunting behaviour: a reconsideration of the attributes of modern human behaviour. *International Journal of Osteoarchaeology* 14, 321–32.
- de Waal, F., 1988. Chimpanzee politics, in *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans*, eds. R.W. Byrne & A. Whiten. Oxford: Clarendon Press, 122–31.

- Dean, C. & M.G. Leakey, 2001. Growth processes in teeth distinguish modern humans from *Homo erectus* and earlier hominins. *Nature* 414, 628–32.
- Defleur, A., T. White, L.S. Valensi & E. Cregut-Bonnoure, 1999. Neanderthal cannibalism at Moula-Guppercy, Ardeche, France. *Science* 286, 128–31.
- d’Errico, F., J. Zilhão, M. Julien, D. Baffier & J. Pelegrin, 1998. Neanderthal acculturation in western Europe? *Current Anthropology* 39, 31–44.
- Dettwyler, K.A., 1991. Can paleopathology provide evidence for ‘compassion’? *American Journal of Physical Anthropology* 84, 375–84.
- Dibble, H.L., 1989. The implications of stone tool type for the presence of language during the Lower Middle Palaeolithic, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. C.B. Stringer & C. Gamble. Edinburgh: Edinburgh University Press, 415–32.
- Dibble, H.L. & P.G. Chase, 1993. On Mousterian and Natufian burials in the Levant. *Current Anthropology* 34(2), 170–75.
- Drell, J.R., 2000. Neanderthals: a history of interpretation. *Oxford Journal of Archaeology* 19(1), 1–24.
- Drucker, D. & H. Bocherens, 2004. Carbon and nitrogen stable isotopes as tracers of change in diet breadth during Middle and Upper Palaeolithic in Europe. *International Journal of Osteoarchaeology* 14, 162–77.
- Farizy, C., 1994. Spatial patterning of Middle Paleolithic sites. *Journal of Anthropological Archaeology* 13, 153–60.
- Feblot-Augustins, J., 1993. Mobility strategies in the Late Middle Palaeolithic of central and western Europe: elements of stability and variability. *Journal of Archaeology* 12, 211–65.
- Finlayson, C., 2004. *Neanderthals and Modern Humans: an Ecological and Evolutionary Perspective*. Cambridge: Cambridge University Press.
- Foley, R.A., 1987. *Another Unique Species: Patterns of Human Evolutionary Ecology*. Harlow: Longman.
- Foley, R.A., 1999. Pattern and process in hominid evolution, in *Structure and Contingency: Evolutionary Processes in Life and Human Society*, ed. J. Bintliff. Leicester: Leicester University Press, 31–42.
- Foley, R.A., 2002. Adaptive radiations and dispersals in hominin evolutionary ecology. *Evolutionary Anthropology* 11(s1), 32–7.
- Gallup, G.G., D.J. Povinelli, S.D. Suarez, J.R. Anderson, J. Lethmate & E.W. Menzel, 1995. Further reflections on self-recognition in primates. *Animal Behaviour* 60(6), 1525–31.
- Gambier, D., 1989. Fossil hominids from the early Upper Palaeolithic Aurignacian of France, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. C.B. Stringer & P. Mellars. Edinburgh: Edinburgh University Press, 194–211.
- Gamble, C., 1993. *Timewalkers: the Prehistory of Global Colonization*. Stroud: Sutton.
- Gamble, C., 1999. *The Palaeolithic Societies of Europe*. Cambridge: Cambridge University Press.
- Gargett, R.H., 1989. Grave shortcomings: the evidence for Neanderthal burial. *Current Anthropology* 30(2), 157–90.
- Gaudzinski, S. & W. Roebroeks, 2000. Adults only: reindeer hunting at the Middle Palaeolithic site Salzgitter Leberstedt, northern Germany. *Journal of Human Evolution* 38, 497–521.
- Geertz, C., 1993. *The Interpretation of Cultures: Selected Essays*. London: Fontana Press.
- Guatelli-Steinberg, D., C.S. Larsen & D.L. Hutchinson, 2004. Prevalence and the duration of linear enamel hypoplasia: a comparative study of Neanderthals and Inuit foragers. *Journal of Human Evolution* 47, 65–84.
- Harrold, F.B., 1980. A comparative analysis of Eurasian Paleolithic burials. *World Archaeology* 12(3), 195–211.
- Harvati, K., 2003. The Neanderthal taxonomic position: models of intra- and inter-specific craniofacial variation. *Journal of Human Evolution* 44, 107–32.
- Harvati, K., S.R. Frost & K.P. McNulty, 2004. Neanderthal taxonomy reconsidered: implications of 3D primate models of intra- and interspecific differences. *Proceedings of the National Academy of Sciences of the USA* 101(5), 1147–52.
- Hayden, B., 1993. The cultural capacities of Neanderthals: a review and re-evaluation. *Journal of Human Evolution* 24, 113–46.
- Holloway, R.L., 1985. The poor brain of *Homo sapiens neanderthalensis*; see what you please, in *Ancestors: the Hard Evidence*, ed. E. Delson. New York (NY): Alan R. Liss, 319–24.
- Hothersall, D., 1995. *History of Psychology*. New York (NY): McGraw-Hill.
- Houghton, P., 1993. Neanderthal supralaryngeal vocal tract. *American Journal of Physical Anthropology* 90, 139–46.
- Ingold, T., 1993. Technology, language, intelligence: a re-consideration of basic concepts, in *Tools, Language and Cognition*, eds. S. Gibson & T. Ingold. Cambridge: Cambridge University Press, 449–72.
- Ingold, T., 1996. The optimal forager & economic man, in *Nature & Society: Anthropological Perspectives*, eds. P. Descola & G. Palsson. London: Routledge, 22–40.
- Ishinda, H. & O. Kondo, 2003. Ontogenetic variation in the Dederych Neanderthal infants: postcranial evidence, in *Patterns of Growth and Development in the Genus Homo*, eds. J.L. Thompson, G.E. Krovitz & A.J. Nelson. Cambridge: Cambridge University Press, 386–410.
- Johanson, D. & B. Edgar, 2001. *From Lucy To Language*. London: Cassell & Co.
- Kay, R.F., M. Cartmill & M. Balow, 1998. The hypoglossal canal and the origin of human vocal behavior. *Proceedings of the National Academy of Sciences of the USA* 95, 5417–19.
- Kennedy, K., 2004. Slings and arrows of predaceous fortune: Asian evidence of Prehistoric spear use. *Evolutionary Anthropology* 13, 127–31.
- Key, C.A., 2000. The evolution of human life history. *World Archaeology* 31(3), 329–50.
- Klein, R.G., 1999. *The Human Career: Human Biological and*

- Cultural Origins*. 2nd edition. Chicago (IL): University of Chicago Press.
- Klein, R.G., 2002. *The Dawn of Human Culture*. New York (NY): Wiley.
- Klein, R.G., 2003. Whither the Neanderthals? *Science* 299, 1525–7.
- Kochetkova, V.I. (ed.), 1978. *Paleoneurology*. Washington (DC): V.H. Winston.
- Lahr, M.M. & R.A. Foley, 1998. Towards a theory of modern human origins: geography, demography and diversity in recent human evolution. *Yearbook of Physical Anthropology* 41, 137–76.
- Laitman, J.T., R.C. Heimbuch & E.S. Crelin, 1979. The basicranium of fossil hominids as an indicator of their upper respiratory systems. *American Journal of Physical Anthropology* 51, 15–34.
- Lazenby, R. & A. Smashnuk, 1999. Osteometric variation in the Inuit second metacarpal: a test of Allens rule. *International Journal of Osteoarchaeology* 9, 182–8.
- Lev, E., M.E. Kislev & O. Bar-Yosef, 2005. Mousterian vegetal food in Kebara cave, Mt Carmel. *Journal of Archaeological Science* 32(3), 475–84.
- Lewin, R. & R.A. Foley, 2003. *Principles of Human Evolution*. Oxford: Blackwells.
- Lieberman, D.E. & J.J. Shea, 1994. Behavioural differences between archaic and modern humans in the Levantine Mousterian. *American Anthropologist* 96(2), 300–332.
- Lieberman, P., 1992. On Neanderthal speech and Neanderthal extinction. *Current Anthropology* 33(4), 409–10.
- Lumley, H., 1969. A Paleolithic camp at Nice. *Scientific American* 220, 42–50.
- MacLarnon, A.M. & G.P. Hewitt, 1999. The evolution of human speech: the role of enhanced breathing control. *American Journal of Physical Anthropology* 109, 341–63.
- MacLarnon, A.M. & G.P. Hewitt, 2004. Increased breathing control: another factor in the evolution of human language. *Evolutionary Anthropology* 13, 181–97.
- Madella, M., M.K. Jones, P. Goldberg, Y. Goren & E. Hovers, 2002. The exploitation of plant resources by Neanderthals in Amud Cave (Israel): the evidence from phytolith studies. *Journal of Archaeological Science* 29, 703–19.
- Majo, T. & A.M. Tillier, 2003. A new approach to the quantitative analysis of postcranial growth in Neanderthals and modern humans: evidence from the hipbone, in *Patterns of Growth and Development in the Genus Homo*, eds J.L. Thompson, G.E. Krovitz & A.J. Nelson. Cambridge: Cambridge University Press, 286–97.
- Mann, A.E., J. Monge & M. Lampl, 1991. Investigation into the relationship between perikymata counts and crown formation times. *American Journal of Physical Anthropology* 86, 175–88.
- Marean, C.W. & Z. Assesfa, 1999. Zooarchaeological evidence for the faunal exploitation behaviour of Neanderthals and early modern humans. *Evolutionary Anthropology* 8(1), 22–37.
- Marsh, I. (ed.), 2000. *Sociology: Making Sense of Society*. 2nd edition. Harlow: Prentice Hall.
- Marshack, A., 1990. The early hominid symbol and evolution of the human capacity, in *Emergence of Modern Humans: an Archaeological Perspective*, ed. P. Mellars. Edinburgh: Edinburgh University Press, 457–98.
- Martin, R.D., 2002. Primatology as an essential basis for biological anthropology. *Evolutionary Anthropology* 1 (Supplement), 3–6.
- McBrearty, S. & A.S. Brooks, 2000. The revolution that wasn't: a new interpretation of the origin of modern human behavior. *Journal of Human Evolution* 39, 453–63.
- Mellars, P., 1996. *The Neanderthal Legacy: an Archaeological Perspective from Western Europe*. Princeton (NJ): Princeton University Press.
- Mellars, P., 2005. The impossible coincidence: a single-species model for the origins of modern human behaviour in Europe. *Evolutionary Anthropology* 14, 12–27.
- Milton, K., 1999. A hypothesis to explain the role of meat-eating in human evolution. *Evolutionary Anthropology* 8, 11–21.
- Mithen, S., 1996. *The Prehistory of the Mind: a Search for the Origins of Art, Religion and Science*. London: Thames & Hudson.
- Munson, P.J. & C.W. Marean, 2003. Adults only? A reconsideration of Middle Paleolithic prime-dominated reindeer hunting at Salzgitter Lebenstedt. *Journal of Human Evolution* 44, 263–73.
- Munzel, S.C. & N.J. Conard, 2004. Change and continuity in subsistence during the Middle and Upper Palaeolithic in the Ach Valley of Swabia (South-west Germany). *International Journal of Osteoarchaeology* 14, 225–43.
- Niewoehner, W.A., 2001. Behavioural inferences from the Skhul/Qafzeh early modern human hand remains. *Proceedings of the National Academy of Sciences of the USA* 98(6), 2979–84.
- Niewoehner, W.A., A. Bergstrom, D. Eichele, M. Zuroff & J.T. Clark, 2003. Manual dexterity in Neanderthals. *Nature* 22, 395.
- Ogilvie, M.D., B.K. Curran & E. Trinkaus, 1989. Incidence and patterning of dental enamel hypoplasia among the Neanderthals. *American Journal of Physical Anthropology* 79(1), 25–41.
- Otte, M., 2000. On the suggested bone flute from Slovenia. *Current Anthropology* 41(2), 271–2.
- Paton, R., 1994. Speaking through stones: a study from northern Australia. *World Archaeology* 26(2), 172–84.
- Patou-Mathis, M., 2000. Neanderthal subsistence behaviours in Europe. *International Journal of Osteoarchaeology* 10, 379–95.
- Patou-Mathis, M., 2004. Subsistence behaviours in a Middle Palaeolithic site in Poland: the Raj Cave. *International Journal of Osteoarchaeology* 14, 244–55.
- Pearson, O.M., 2000. Activity, climate, and postcranial robusticity and scenarios of adaptive change. *Current Anthropology* 41(4), 569–607.
- Pettitt, P.B., 1997. High resolution Neanderthals? Interpreting Middle Palaeolithic intra-site spatial data. *World Archaeology* 29(2), 208–24.
- Pettitt, P.B., 1999. Disappearing from the world: an archaeological perspective on Neanderthal extinction. *Oxford Journal of Archaeology* 18(3), 217–40.

- Pettitt, P.B., 2000. Neanderthal lifecycles: development and social phases in the lives of the last archaics. *World Archaeology* 31(3), 351–66.
- Poole, J., 1996. *Coming of Age with Elephants*. London: Hodder & Stoughton.
- Ramirez Rozzl, F.V. & A.M. Bermudez de Castro, 2004. Surprisingly rapid growth in Neanderthals. *Nature* 428, 936–9.
- Richards, M.P., P.B. Pettitt, E. Trinkaus, F.H. Smith, M. Paunovic & I. Karavanic, 2000. Neanderthal diet at Vindija and Neanderthal predation: the evidence from stable isotopes. *Proceedings of the National Academy of Sciences of the USA* 97(13), 7663–6.
- Richards, M.P., P.B. Pettitt, M.C. Stiner & E. Trinkaus, 2001. Stable isotope evidence for increasing dietary breadth in the European mid-Upper Paleolithic. *Proceedings of the National Academy of Sciences of the USA* 98(11), 6528–32.
- Schepartz, L.A., 1993. Language and modern human origins. *Yearbook of Physical Anthropology* 36, 91–126.
- Schurr, T.G., 2004. The peopling of the new world: perspectives from molecular anthropology. *Annual Review Anthropology* 33, 551–83.
- Scott, K., 1980. Two hunting episodes of Middle Palaeolithic age at La Cotte de Saint-Brelade, Jersey (Channel Islands). *World Archaeology* 12(2), 137–52.
- Sere, D., A. Langaney, M. Chech, M. Teschler-Nicola, M. Paunovic, P. Mennecier, M. Hofreiter, G. Possnert & S. Paabo, 2004. No evidence of Neanderthal mtDNA contribution to early modern humans. *PLoS Biology* 2(3), 313–17.
- Shackelford, L.L. & E. Trinkaus, 2002. Late Pleistocene human femoral diaphyseal curvature. *American Journal of Physical Anthropology* 118, 859–70.
- Shears, R., 2005. I've found the Hobbits. *Daily Mail* 7 May, 34.
- Smith, F.H., 1991. The Neanderthals: evolutionary dead ends or ancestors of modern people? *Journal of Anthropological Research* 47(2) 219–38.
- Solecki, R.S., 1973. *Shanidar: Humanity of Neanderthal Man*. London: A. Lane.
- Sørensen, M. & W. Leonard, 2001. Neanderthal energetics and foraging efficiency. *Journal of Human Evolution* 40, 483–95.
- Speth, J.D., 2004. News flash: negative evidence convicts Neanderthals of gross mental incompetence. *World Archaeology* 36(4), 519–26.
- Speth, J.D. & E. Tchernov, 1998. The role of hunting and scavenging in Neanderthal procurement strategies: new evidence from Kebara Cave (Israel), in *Neanderthals and Modern Humans in Western Asia*, eds. T. Akazawa, K. Aoki & O. Bar-Yosef. New York (NY): Plenum Press, 223–39.
- Speth, J.D. & E. Tchernov, 2001. Neanderthal hunting and meat-processing in the Near East: evidence from Kebara Cave (Israel), in *Meat Eating and Human Evolution*, eds. C.B. Stanford & H.T. Bunn. Oxford: Oxford University Press, 52–72.
- Stewart, J.R., 2005. The ecology and adaptation of Neanderthals during the non-analogue environment of Oxygen Isotope Stage 3. *Quaternary International* 137(1), 35–46.
- Stiner, C. & N. Munro, 2000. The tortoise and the hare: small-game use, the broad spectrum revolution, and paleolithic demography. *Current Anthropology* 41, 39–73.
- Stiner, M.C., N.D. Munro, T.A. Surovell, E. Tchernov, O. Bar-Yosef, 1999. Paleolithic population growth pulses evidenced by small animal exploitation. *Science* 283(8 Jan 1999), 190–94.
- Stock, J.T. & S.K. Pfeiffer, 2004. Long bone robusticity and subsistence behaviour among Later Stone Age foragers of the forest and fynbos biomes of South Africa. *Journal of Archeological Science* 31(7), 999–1013.
- Strehlow, T.G.H., 1993. *Central Australian Religion*. Alice Springs: Government Printer of the Northern Territory.
- Strier, K., 2003. *Primate Behavioural Ecology*. Boston (MA): Allyn & Bacon.
- Stringer, C.B., 2002. New perspectives on the Neanderthals. *Evolutionary Anthropology Supplement* 1, 58–9.
- Stringer, C.B. & C. Gamble, 1993. *In Search of the Neanderthals: Solving the Puzzle of Human Origins*. London: Thames & Hudson.
- Stringer, C.B., C. Dean & R.D. Martin, 1990. A comparative study of cranial and dental development within a recent British sample and among Neanderthals, in *Primate Life History and Evolution*, ed. C.J. De Rousseau. Chichester: Wiley-Liss, 115–52.
- Tattersall, I., 2004. What happened in the origin of human consciousness. *The Anatomical Record (Part B): New Anat.* 276B, 19–26.
- Thieme, H., 1997. Late Palaeolithic hunting spears from Germany. *Nature* 385, 807–10.
- Thompson, J.L., G.E. Krovitz. & A.J. Nelson (eds.), 2003. *Patterns of Growth and Development in the Genus Homo*. Cambridge: Cambridge University Press.
- Tillier, A.-M., 1989. The evolution of modern humans: evidence from Young Mousterian individuals, in *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans*, eds. C. Stringer & P. Mellars. Edinburgh: Edinburgh University Press, 286–97.
- Trinkaus, E., 1993. Femoral neck-shaft angles of the Qafzeh-Skhul early modern humans, and activity levels among immature Near Eastern Middle Paleolithic hominids. *Journal of Human Evolution* 25, 393–416.
- Trinkaus, E. & P. Shipman, 1994. *The Neanderthals: Changing the Image of Mankind*. London: Cape.
- Trinkaus, E. & D.D. Thompson, 1987. Femoral diaphyseal histomorphometric age determinations for the Shanidar 3, 4, 5, 6 Neanderthals and Neanderthal longevity. *American Journal of Physical Anthropology* 72, 123–9.
- Trinkaus, E. & R.L. Tompkins, 1990. The Neanderthal life cycle: the possibility, probability, and perceptibility of contrasts with recent humans, in *Primate Life History and Evolution*, eds. C.J. De Rousseau. Chichester: Wiley-Liss, 153–80.
- Trinkaus, E., C.B. Ruff & S.E. Churchill, 1998. Upper limb

- versus lower loading patterns among Near Eastern Middle Paleolithic hominids, in *Neanderthals and Modern Humans in Western Asia*, eds. T. Akazawa, K. Aoki & O. Bar-Yosef. New York (NY): Plenum Press, 391–404.
- Trinkaus, M., 1984. Mortuary ritual and mortuary remains. *Current Anthropology* 25(5), 674–9.
- Underdown, S., 2004. Freezing, fighting and falling: an exploration of trauma causality in the Neanderthals, Fuegians, Eskimo and Aleut. *American Journal of Physical Anthropology* 123, 198.
- Weiner, J. (ed.), 1994. *Aesthetics is a Cross Cultural Category*. London: Language & Publishing Solutions.
- Williams, F.L., L.R. Godfrey & M.R. Sutherland, 2003. Diagnosing heterochronic perturbations in the craniofacial evolution of the *Homo* (Neanderthals and modern humans and *Pan* (*P. troglodytes* and *P. paniscus*)), in *Patterns of Growth and Development in the Genus Homo*, eds. J.L. Thompson, G.E. Krovitz & A.J. Nelson. Cambridge: Cambridge University Press.
- Wolpoff, M. & R. Caspari, 1997. *Race & Human Evolution*. New York (NY): Simon & Schuster.
- Wynn, T. & F.L. Coolidge, 2004. The expert Neanderthal Mind. *Journal of Human Evolution* 46, 467–87.

Author biographies

Robert Davies is interested in the development of complex cooperation, cultures and cognition in animals as well as modern human origins from a palaeoanthropological perspective. More generally, he is interested in the evolutionary patterns and processes and how they are reflected in the fossil record.

Simon Underdown is a senior Lecturer in Biological Anthropology at Oxford Brookes University. He is interested in hunter-gatherer patterns of disease and trauma, especially in the Neanderthals, from a palaeoepidemiological perspective.