

## CHAPTER 9

# Reframing Neanderthals

### Abstract

Neanderthals have occupied a rather problematic position in our evolutionary history for many years. Neanderthals and modern humans share fundamental features of humanity, such as care for the vulnerable, yet differences in their use of symbolism, adoption of innovations and intergroup relationships have been hard to explain. Evidence suggests that Neanderthals lived in small living groups with only rare connections to outsiders and high levels of inbreeding, whilst modern human populations from their first arrival in Europe were highly interconnected and maintained connections between communities stretching over large regions. It has been tempting to interpret these differences in terms of an inferior social or intellectual cognition in Neanderthals. Subtle differences in emotional dispositions may, however, be a better explanation. A more inwardly focused or close-knit nature of Neanderthal communities, and a more outwardly focused or approachable nature of modern humans, can explain previously enigmatic elements of their archaeological record without recourse to ideas of progression or advancement.

(Abstract continued on next page)

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Our understanding of Neanderthals as displaying subtly different emotional dispositions gives us an opportunity to think about human evolution differently. Rather than a ladder, or even a braided stream, here we argue that our evolutionary past is better conceptualised as a series of branching pathways which sometimes rejoin and sometimes follow different directions. Allowing past hominins to be different but equal opens up new lines of interpretation, as well as challenging us to understand that there is more than one way to be human.



**Figure 9.1:** Recent reconstruction of a Neanderthal woman. Neanderthals were no less human, yet their physical and behavioural distinctions challenge our understanding of our relationship to these close cousins. Neanderthal Saint-Césaire © Sculpture: Elisabeth Daynes/Photo: S. Entresangle. Used with permission.

## Introduction

The role of Neanderthals in our evolutionary story has a long and chequered history from their first recognition (see Figure 9.1). In 1864, when William King considered the status of a Neanderthal cranium that had been discovered only a few years earlier in the Neander valley in Germany, he was challenged by its unusual appearance. Despite being essentially human-like and possessing a large brain, it was clear that this individual was distinctly robust, with a large brow ridge and notably long and low brain case (Figure 9.2). Here was a human, or human-like, being that was disturbingly different. In typical Victorian style, he concluded that this difference must relate to some inferiority on a perceived ladder of human progression. Furthermore, he decided that this being simply must have had an animal, rather than human, nature. He concluded:

Considering that the Neanderthal skull is eminently simial, both in its general and particular characters, I feel myself constrained to believe that the thoughts and desires which once dwelt within it never soared beyond those of a brute. (King 1864: 96)



**Figure 9.2:** The cranium (known as Neanderthal 1) from the Neander valley that was derided as brutish by William King in 1864. Image of cast. Gunnar Creutz, CC BY-SA 4.0, via Wikimedia Commons: [https://commons.wikimedia.org/wiki/File:Homo\\_neanderthalensis\\_\(cast\\_of\\_Neanderthal\\_1\\_skull\\_cap\)\\_at\\_G%C3%B6teborgs\\_Naturhistoriska\\_Museum\\_8790.jpg](https://commons.wikimedia.org/wiki/File:Homo_neanderthalensis_(cast_of_Neanderthal_1_skull_cap)_at_G%C3%B6teborgs_Naturhistoriska_Museum_8790.jpg).

We may be alarmed by this ready assumption of brutishness to any different-looking human. However, for more than a century, the unfamiliar appearance of Neanderthals, coupled with pervasive ideas that our own species rose above others through some innate superiority, naturally led to Neanderthals being portrayed as lumbering and brutish (Madison 2020; McCluskey 2016; Peeters and Zwart 2020). Even as their close-relatedness to our own species became clear (to the point where we might at most consider them a subspecies), this relatedness often made them too close for comfort, leading to continued derision both in public portrayals as well as academic interpretations. The term 'Neanderthal' itself even became an insult, implying an aggressive and primitive nature.

Attitudes have changed over the last decade. New evidence for Neanderthal care for illness and injury, the production of art and mortuary practices have elevated our attitudes to the capacities of our nearest evolutionary cousins, whilst evidence for interbreeding and a contribution of Neanderthal DNA to our modern genome has made us increasingly uncomfortable about negative portrayals of people who are now seen as close family (Sykes 2020).

Neanderthals remain a challenge to approach and interpret, even within a more modern framework. Even though there has been notable interbreeding with our own species, so-called 'modern' humans (Hajdinjak et al. 2021; Lalueza-Fox 2021), Neanderthals have followed a largely different path to that of our own species for most of the last half a million years. They seem to have benefited from physical adaptations to their particular environments and ecology that are notably different, such as increased levels of brown fat (Sazzini et al. 2014) and adaptations to a high protein diet (Ben-Dor et al. 2016), and seem to have been better suited to short sprints rather than running for long periods (Higgins and Ruff 2011). They may even have undergone something similar to hibernation to escape resource shortages in winter months (Bartsiokas and Arsuaga 2020). Their brains also developed differently (Gunz et al. 2010). As well as evident robusticity and the presence of a notable brow ridge and different cranial shape (see Figure 9.3), Neanderthals show notable differences in adult visual cortex (Pearce, Stringer, and Dunbar 2013), parietal lobes (Pereira-Pedro et al. 2020) and cerebellum (Kochiyama et al. 2018). The archaeological record shows differences in technology and in symbolism, and most particularly in patterns of mobility, interaction and innovation (Spikins, Hitchens, and Neeham 2017).



**Figure 9.3:** Neanderthal (right) and modern human crania (left), showing distinctive differences in cranial shape, robusticity, and presence/absence of a brow ridge. Hairymuseummatt (original photo), DrMikeBaxter (derivative work), CC BY-SA 2.0, via Wikimedia Commons: [https://commons.wikimedia.org/wiki/File:Sapiens\\_neanderthal\\_comparison\\_en\\_black\\_background.png](https://commons.wikimedia.org/wiki/File:Sapiens_neanderthal_comparison_en_black_background.png).

In trying to explain why the material evidence for Neanderthal behaviour is different from that of the modern humans who replaced them, our attention has traditionally tended to focus on Neanderthal thinking skills. Particular attention has been paid to areas of Neanderthal cognition that might be seen as inferior to that of modern humans, in keeping with our assumption that our species ought to be cleverer than any others. Certainly, there is some evidence that Neanderthal thought and perception were different. There are a number of regions of modern human brains that seem to demonstrate potentially important differences from theirs (Bruner 2021). Differences in the parietal cortex may influence technical and visual cognition (Pereira-Pedro et al. 2020), for example, differences in the cerebellum may be significant in organisational skills (Kochiyama et al. 2018), and there may even be differences in body cognition (Bruner and Gleeson 2019). The idea that any differences, no matter how subtle, should imply human cognitive superiority seems somehow unsatisfactory, however (Hoffmann et al. 2018; Langbroek 2012; Zilhão 2014). Moreover, there tends to be little attempt to focus on where areas of Neanderthal cognition might have been superior. If we start by assuming that, in terms of their thinking skills, Neanderthals occupied a lower rung of an evolutionary ladder than modern humans, we

tend to find what we are looking for. We then ascribe behavioural differences to their supposedly inferior thought.

The only alternative to a view of Neanderthals as necessarily inferior has tended to be portrayals and interpretations of Neanderthals as the same as our own species. Certainly, Neanderthals are no less human. Nonetheless, seeing Neanderthals as *the same* is, perhaps, too easy a solution to the challenge of approaching differences without assumptions of superiority and inferiority. Even a recent tendency to move away from an evolutionary model of a ladder by thinking of human evolution as a braided stream with different species of humans all going in the same direction, is far from perfect as it fails to allow for different evolutionary directions. No one likes to be seen as inferior, but equally we might doubt if any Neanderthal meeting a modern human would want to be seen as *just the same*.

The problem of how to approach and understand differences we see in past species who lived contemporaneously with each other, without imposing concepts of progression, has become even more pressing in recent years. Evidence has revealed that the relatively recent evolutionary past, and particularly the period between 300,000 and 30,000 years ago, was one in which there were a wealth of different human species, from those who were robust, such as the Denisovans and Neanderthals, to the tiny *Homo floresiensis* or *Homo luzonensis* or small-brained hominins such as *Homo naledi*, many of which lived in similar regions at the same time. It is far too easy to find ourselves assuming that our ancestors, the taller and more gracile forms amongst these unusual creatures, were better in every way, simply because we see ourselves as 'the survivors' of this remarkable proliferation of forms. The real story of what happens is likely to be far more complex.

Considering emotional dispositions may provide some insights. It may be possible to find explanations for differences in behaviours which do not depend on inferring that Neanderthals possessed an inferior cognitive capacity.

### **Different types of 'social'**

Can contrasts in emotional dispositions between closely related species today help us reframe differences between Neanderthals and our own species?

We have seen how there can be subtle but important contrasts between quite closely related species that do not clearly divide into ideas of better or worse (Chapter 8). Contrasts between wolves and dogs, and those between chimpanzees and bonobos, are particularly relevant. In contrast to free-ranging dogs, wolves are much more willing to share food amongst the group and to collaborate in care of offspring, as well as to hunt collaboratively, for example. Free-ranging dogs, in contrast, rarely share or collaborate in offspring care, and the extent to which they collaborate in hunting is very limited. Yet, before we simply see wolves as *more social or more collaborative*, we must at the same time recognise that free-ranging dogs are far more open to external connections, and form packs of unrelated individuals that contrast with the largely kin groups we see in wolves. There seems to be a certain inward focus to wolf pack social relationships that contrasts with the outward focus we see in free-ranging dogs, and neither can simply be described as more social or more collaborative than the other. Different contrasts, which share some similarities, can also be drawn between chimpanzees and bonobos. Chimpanzees are far more effective collaborative hunters, and more prolific users of a wider variety of tools than bonobos. They cannot be seen as either more collaborative or more intelligent, however. Bonobos take a more outward focus to their community social relationships, and have a more intuitive emotional response to others within their communities.

These *differently social* distinctions are apparent between many closely related species. As we have seen in Chapter 8, African wild dogs and grey wolves seem very similar and are both highly collaborative, yet communicate their intentions in markedly different ways. We should not be surprised to find something similar to these subtle but important differences in types of social collaboration or communication when we consider differences between some closely related human species. Ideas that any one species is *superior* to a close relation – more collaborative, more social or more intelligent – tend to be over simplistic.

Different evolutionary branches bring differing advantages and disadvantages depending on context, and also bring compromises. Changes in emotional disposition are no different. Animals that become more externally socially tolerant, both under direct human influence and in the wild, show a greater social sensitivity and openness to new experiences (and, as we have seen, dogs have a longer period of openness to new experience

as puppies than do wolves). However, social sensitivity brings with it a certain neediness. Whilst wolves famously ‘don’t look back’ to their fellows or plead for support, and tend to solve problems independently, dogs immediately seek support, particularly from people, and look to others to how they should behave. Bonobos both reach out to help others much more willingly than chimpanzees do, and also seem to need and reach for closeness and affection more often. We cannot simply describe these different types of social behaviour as inferior or superior, or more or less complex. They are social behaviours that suit different contexts, and come along with compromises.

A better understanding of potential differences in emotional dispositions affecting social tolerance, social sensitivity and emotional vulnerability, as differences that cannot easily be placed within a ladder of progression, may help us understand different behaviours between different human species.

Here, we focus on how insights from understanding different pathways in emotional dispositions may help us to understand archaeological

<b>Contrasts seen when comparing closely related species</b>	<b>Comparing wolves and dogs</b>	<b>Comparing chimpanzees and bonobos</b>
Differing inward and outward focus to social relationships	Evident	Evident
Differing levels of group collaboration (hunting, sharing food, offspring care)	Evident	Evident
Differing willingness to include outsiders	Evident	Evident
Differing social sensitivity/vulnerability	Evident	Evident
Differing individual independence	Evident	Unconfirmed
Differing facial expressivity	Evident	Unconfirmed

**Table 9.1:** Key contrasts in emotional dispositions and behaviours between closely related social species (discussed in more detail in Chapter 8), often simplified into a generalisation ‘wild’ versus ‘tame’.

evidence for contrasting patterns of social behaviour between communities of Neanderthals and those of modern humans in Europe. We suggest that Neanderthals are best seen as differently emotional, and differently social. These differences, rather than some inferior cognition, can explain the differing structure of their communities, and different behaviours seen in the archaeological evidence.

### **Archaeological evidence for contrasting patterns of intergroup connection between Neanderthals and modern humans in Europe**

#### *Background*

It is easy to forget that Neanderthals were a highly successful hominin. They lived in Europe from around 300,000 years ago, and descended from earlier species that had been living in the region since at least 1 million years ago. Whilst there were early incursions of so-called 'modern' humans from Africa into Europe (such as over 200,000 years ago in Greece; Harvati et al. 2019), their sustained occupation of the region has been quite recent, largely taking place after 40,000 years ago. Yet, after several thousand years of overlap and interbreeding, modern humans eventually occupied all of Europe and displaced Neanderthals.

The similarities between these two populations far exceed any distinctions. As we have seen in Chapter 2, Neanderthal communities were highly collaborative, showing strong altruistic motivations within their own groups, being willing to care for others for extended periods, and to risk their lives to bring back food (Spikins et al. 2018). Neanderthals, like modern humans, were very intelligent, highly socially complex beings who cared deeply for those around them. Both Neanderthal and modern humans share large brains, capacities for social complexity, learning and altruism. Furthermore, any genetic dividing line is far from clear cut, with a notable contribution of Neanderthal DNA to modern European and Asian populations, for example (Sankararaman et al. 2016). Many of the traditional interpretations of Neanderthals, which portrayed them as having inferior intelligence or being inferior in other ways, such as in their symbolic capacities, have eroded over recent years (Hoffmann et al. 2018; Langbroek 2012; Zilhão 2014).

Remaining distinctions, which are difficult to explain, are seen in patterns in the structure of Neanderthal and modern human social networks, social groups and communities. Explanations for these differences have tended to focus on the concept that Neanderthals were socially or cognitively less competent (see Pearce 2013). Insights into differing emotional dispositions between closely related species may provide alternative explanations.

### *Neanderthal community relationships*

Like all members of the genus *Homo* (discussed in Part 1), Neanderthals were social beings, living in groups and thriving on emotional connection. When it came to contacts outside of family and living groups, it is clear that Neanderthal families did not live in isolated social bubbles. It seems reasonable to talk of Neanderthal communities, stretching beyond the confines of a single local living group (Sykes 2012). Similar artefacts found across large regions demonstrate that Neanderthals within some regions had a shared understanding of how certain things should be made. Regional styles are identified in Middle Palaeolithic lithic technology, for example (Ruebens 2013), as well in mortuary practices (Pettitt 2010). Individuals must have moved between groups at certain times.

Nonetheless, though there were some connections between Neanderthal groups, the scale of everyday social life seems to be small. Living groups seem to have been largely small and kin-based. At El Sidrón, in northern Spain, the skeletal remains of several individuals who were presumably a single group, victims of an unfortunate rock fall, were recovered. The group consisted of 13 Neanderthals: seven adults, three adolescents, two juveniles and one infant, of whom three of the adults were brothers, whilst the adult females were unrelated (Lalueza-Fox et al. 2011; Ríos et al. 2019). Intrasite spatial patterns also suggest that a small group of this size may have been typical (Spikins, Hitchens, and Needham 2017).

Archaeological evidence also suggests that interactions *between* groups, whilst they must have occurred occasionally to maintain mating networks, were infrequent. In many regions, raw materials used for making flint tools are moving only within the expected 'home range' (the area in which any single group might have travelled to find enough food). For example, raw

materials within sites in the Southern Massif Central in France come predominantly from within the region itself, suggesting that there was little travel beyond this region (Fernandes, Raynal, and Moncel 2008). Raw materials for flint tools typically come from the most local source possible in this region – such as within five kilometres (Fernandes, Raynal, and Moncel 2008), with even only 20 kilometres away being exceptional.

Moncel commented:

The data suggest highly mobile human groups, travelling in small territories on plateaus and valleys, along the Rhône corridor for daily subsistence. There is no evidence of human travel into the Massif Central Mountains to the west to collect raw materials; in fact any geographical obstacle appears to have stopped human movements along the south-eastern border of the Massif Central. (2011: 261)

This is not unusual for many European Middle Palaeolithic sites, such as in northern Italy (Spinapolice 2012) and the Swabian Alb (Conard, Bolus, and Münzel 2012), where raw materials predominantly come from within 10 kilometres. Across the whole of Europe, raw material movements are commonly small-scale, with those of more than 100 kilometres being exceptional (Féblot-Augustins 1993; Féblot-Augustins 1999; Féblot-Augustins 2009).

Raw materials are *sometimes* transported in a notable quantity from beyond what might be a typical home range. However, this only seems to occur where it seems to be a matter of necessity. In southern Italy, for example, the majority of flint raw material used in some of the sites in the Salento region comes from about 100–150 kilometres to the north. However, in this case, local raw materials are particularly poor quality and would have been difficult to use (Spinapolice 2012). Regular movements between home ranges may have been possible when required, without necessarily *being a welcome pleasure*.

There are frequent instances where a few examples of distant materials are recovered from Middle Palaeolithic sites, providing evidence of inter-group interactions or movements. For example, at Lezetxiki, in northern Spain, a marine shell that had travelled over 500 kilometres was recovered from Middle Palaeolithic deposits dating to 55,000–48,000bp (Arrizabalaga 2009), seemingly as a 'one off' transport (Spikins, Hitchens, and Needham

2017). A few well-used artefacts found at Cap Grand in south-west France had travelled over 400 kilometres (Slimak and Giraud 2007). Furthermore, flint from distant raw material outcrops has been found in certain Middle Palaeolithic assemblages at Amud cave in Israel, even though there seems to be no systematic exploitation of these raw materials (Ekshtain et al. 2017: 207). However, these occasional longer-distance movements fit within what we expect through *personal transport* (Kuhn 2012), that is, tools or raw materials that someone took with them, perhaps over a long period of time, and which ended up moving a longer distance from the source. The evidence for longer-distance movements outside of a group's typical range are consistent with what we might expect when external social connections were not common (Djindjian 2012). Such movements are not at all surprising, potentially occurring within mating networks and perhaps only as frequently, as we see in other social animals such as chimpanzees or bonobos. What we lack is any good evidence for *frequent* social interaction between groups.

There even seems to be marked constraints on significant movements across different home ranges in some regions. In the Middle Palaeolithic of the Levant, detailed studies of the transport of flint materials to the site of 'Ein Qashish suggest potential borders between groups where resources remain unexploited (Ekshtain et al. 2014; Ekshtain et al. 2017; Hovers 2018). This 'gap' in raw material procurement regions between what were probably neighbouring home ranges of different Neanderthal groups suggests that separate groups largely kept to the 'their side' of the border.

Genetic evidence adds to this picture of restricted intergroup movement. At El Sidrón, intergroup movements, such as they were, may have been constrained to a patrilocal pattern in which related males stayed in the group and females moved at maturity (Lalueza-Fox et al. 2011; Ríos et al. 2019). Other genetic evidence from the Altai Mountains in Siberia also supports the notion of females moving between groups whilst males stayed within their local group (Gibbons 2021). This would suggest that it was females who were creating patterns of long-distance transport, and maintaining cultural contacts. There is little to no archaeological evidence for sustained gatherings of communities any larger than local family or living groups (Spikins, Hitchens, and Needham 2017). Limited social connections are also associated with high levels of inbreeding. Half-sibling matings were common in the ancestry of the Altai individual (Prüfer et al. 2014),

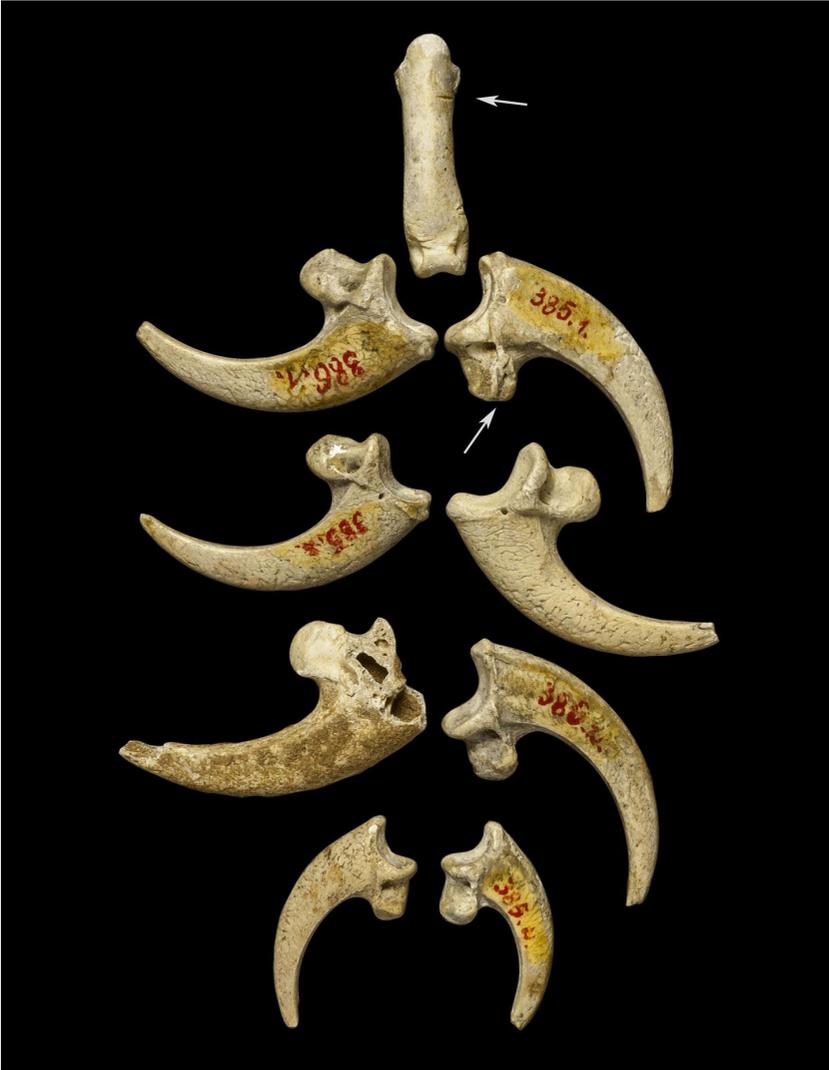
for example. Moreover, levels of developmental abnormalities, such as cleft palate at El Sidrón (Ríos et al. 2015), are higher than those typically seen in social primates (Trinkaus 2018), and may even have been a contributing factor to Neanderthal demise (Ríos et al. 2019).

A rather close-knit focus to Neanderthal social life may explain characteristics of their art. Neanderthals were clearly capable of symbolism, creating a range of symbolic material culture, from using decorative eagle features (Finlayson et al. 2012; Peresani et al. 2011) to cave art engravings (Rodríguez-Vidal et al. 2014). We see, as well, paintings and hand prints (Aubert, Brumm, and Huntley 2018; Hoffmann et al. 2018), incised and painted shells (Peresani et al. 2013) and even a facial representation (Marquet and Lorblanchet 2003), many of which clearly predate the arrival of moderns who cannot simply have been the inspiration for such creativity. Pigment use dates back to at least 200,000 years ago and is widespread, probably as a form of body decoration (Roebroeks et al. 2012), as do mortuary practices (Majkić et al. 2017; Pettitt 2011). However, Neanderthal art and symbolism is locally distinctive and there is not one but many varied forms of personal expression (see Figures 9.3 (Radovčić et al. 2015) and 9.4 (Rodríguez-Vidal et al. 2014)). In many cases, each example is entirely unique. It seems likely that the scale of Neanderthal social relationships had an impact on their style of cultural interactions, leading to a certain independence of local art styles rather than shared regional norms of expression.

Modern human communities replacing Neanderthals in Europe were similar to them in many ways, including finely tuned exploitation of their environments, care for the ill and injured, complex cultures and sophisticated technologies. However, their community connections were distinctly different in scale.

### *Modern human communities*

We should be cautious of oversimplifying these different populations, particularly given variability in both Neanderthal and modern human occupation over vast realms of time and space. Nonetheless, it seems that the social lives of modern humans in Europe were distinctively different from those of Neanderthals in certain important characteristics.



**Figure 9.4:** White-tailed eagle talons from the Krapina, dating to approximately 130,000 years ago. These talons are particularly significant as they seem to have been worn suspended as jewellery. Radovčić, Sršen, Radovčić, and Frayer. 2015. 'Evidence for Neandertal Jewelry: Modified White-Tailed Eagle Claws at Krapina.' PLoS ONE 10 (3): e0119802. DOI: <https://dx.doi.org/10.1371/journal.pone.0119802>. Luka Mjeda, Zagreb, CC BY 4.0, via Wikimedia Commons: [https://commons.wikimedia.org/wiki/File:Neandertal\\_Jewelry\\_\(from\\_PLoS\).jpg](https://commons.wikimedia.org/wiki/File:Neandertal_Jewelry_(from_PLoS).jpg).



**Figure 9.5:** Neanderthal engraving in cross hatch shape found in Gorham's Cave, Gibraltar. AquilaGib (Stewart Finlayson, Gibraltar Museum), CC BY-SA 4.0, via Wikimedia Commons: [https://commons.wikimedia.org/wiki/File:Neanderthal\\_Engraving\\_\(Gorham%27s\\_Cave\\_Gibraltar\).jpg](https://commons.wikimedia.org/wiki/File:Neanderthal_Engraving_(Gorham%27s_Cave_Gibraltar).jpg).

From the first arrival of Upper Palaeolithic populations into and across Europe, their community relationships seem to be markedly different from those of the Neanderthals (see Table 9.1). They spread remarkably quickly into the region then occupied by Neanderthals around 40,000 years ago (Hoffecker 2009), soon reaching regions as far flung from their eastern entry through the Levant as southern Spain (Cortés-Sánchez et al. 2019) and Siberia (Douka et al. 2019). It is tempting to conclude that these populations were simply cleverer than previous ones, or more adaptable, but that many dispersals also failed, or were so risky as to be irrational rather than clever, argues that other distinctions were important. New motivations, and new types of social connection, are likely to have played an important role in motivations for this new level of mobility (see Spikins 2015).

The movements of raw materials and spread of art and personal ornamentation suggest that new large-scale alliances appeared quickly. From the very start of the occupation, identical Aurignacian beads were found over large regions and were transported across large distances along networks (Pettitt 2014; Vanhaeren and d'Errico 2006), for example. Marine shells commonly travelled over 200 kilometres, and some travelled over 1,000 kilometres. Unusual examples even include those that are made of human teeth, and are much worn, suggesting a close relationship with someone was being marked out and remembered (Spikins 2015a; White 2007). Large regions sharing similar styles of beads, and with transfers of beads across them, also suggest that people were re-enforcing a concept of 'us' that included whole communities (Vanhaeren and d'Errico 2006), much like those seen in hunter-gatherer ethnic communities today (Layton, O'Hara, and Bilsborough 2012). Indirect procurement, i.e. the deliberate travel over some distance typically outside of the home range in order to pick up raw materials for later use, or exchange of materials between groups, appears to have been common (Tomasso and Porraz 2016). Raw materials are typically brought from outside the area of a typical home range, with the transport of materials over 100 kilometres being common (Féblot-Augustins 2009). In some Gravettian sites, for example, more than 50% of the raw material comes from over 100 kilometres (Féblot-Augustins 2009). A drawing of a seal on a shale plaquette from the Late Magdalenian at Andernach-Martinsburg, found with marine shells and a whale bone fragment, over 1,000 kilometres from the coast, was probably made by an individual who had travelled that distance (Langley and Street 2013).

Genetic evidence also shows frequent movements and interaction between groups, beyond what would be purely functional (Fu et al. 2016). The genome sequences of Sunghir burials II, III and IV on the Russian Plain, dating to around 34,000 years ago, indicate extensive connections between groups and exogamous mating practices (Sikora et al. 2017).

There is even remarkable evidence from northern Spain for community aggregations. Collaborative hunting of mammoths at large mammoth megasites, such as Předmostí in the Czech Republic (with a minimum of 105 mammoths, dated to 26,000 years ago; Shipman 2015), is also likely to have needed collaborations between groups. Towards the end of the period at

<b>Differences</b>		
	<b>European Neanderthals</b>	<b>Upper Palaeolithic modern humans in Europe</b>
Population spread and migration	Archaeological evidence for slow spread of populations, typically in response to ecological changes and not crossing major ecological barriers (e.g. the Straits of Gibraltar) (Spikins 2015b)	Genetic and archaeological evidence for rapid population migration into new areas, and against ecological barriers (Cortés-Sánchez et al. 2019; Hoffecker 2009; Hublin 2015)
Mating networks	Genetic evidence for limited mating networks. Half-sibling matings common (Prüfer et al. 2014). High rates of inbreeding (Sánchez-Quinto and Lalueza-Fox 2015, Gibbons 2021), leading to high rates of developmental abnormalities (Trinkaus 2018), such as cleft palate at El Sidrón (Luis Ríos et al. 2015).	Mating networks large scale, and similar to modern hunter-gatherers (Fu et al. 2016; Pearce 2013)
Scale of movements within foraging areas	Raw material procurement: Raw materials typically transported within constrained territories (Djindjian 2012) (for example within the Vercors basin) (Fernandes, Raynal, and Moncel 2008; Pearce 2013)  Isotope evidence: Short distances travelled over lifetime: example of Lakonis, Greece (Richards et al. 2008)	Raw material procurement: Apparently very large foraging areas (at least up to last glacial maximum; Djindjian 2012) and high mobility within these areas
Frequency of long-distance movements	Regionally longer-distance procurement rare, and in case of need (such as lithics imported into southern Italy) (Spinapolice 2012)	Regionally indirect procurement (to select optimal-quality flint) probably common (Tomasso and Porraz 2016)

*Continued.*

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<b>Differences</b>		
	<b>European Neanderthals</b>	<b>Upper Palaeolithic modern humans in Europe</b>
	Over large areas long-distance movements rare, and limited to certain contexts (e.g. the East European Plain) (Féblot-Augustins 1993; Féblot-Augustins 1999; Féblot-Augustins 2009)	Over large areas long-distance movements are common (Féblot-Augustins 1993; Féblot-Augustins 1999; Féblot-Augustins 2009). Whilst these may be a result of transfers of materials and finished products, there is also evidence of movement of individuals (Langley and Street 2013)
Use of art objects within social networks	Symbolism of many different forms, including cave art, but remains local	Material and finished personal ornaments in the early Upper Palaeolithic transported over long distances (marine shells or mammoth ivory typically travel over 200 kilometres, sometimes over 1000 kilometres)
Cultural resilience (maintenance of local cultural styles)		Highly conservative art styles over large regions

**Table 9.2:** Archaeological and related evidence for similarities and differences between Neanderthal and modern human large-scale social interactions.

the Magdalenian site of Altamira in northern Spain, many design elements were represented on engraved and decorated bone and antler artefacts that were not found together in surrounding sites (Conkey et al. 1980). Conkey concluded that this was an aggregation site, to which many surrounding groups, each with their separate distinctive design styles, had travelled (Conkey et al. 1980). With no particular reason for any concentration of

resources at this site, this aggregation seems to have been fulfilling a social need, rather than an immediately practical one.

These social alliances seem to have played a key role in survival at times of resource shortfall, much as they do in modern hunting and gathering contexts (Whallon 2006).

There are certainly important survival advantages to regional connection and collaboration. Intergroup collaboration can make exploiting certain resources possible. Certain ethnographically and archaeologically documented populations join together to hunt particularly large or concentrated resources that might otherwise have been risky or impossible to hunt alone. The collaborative hunting of whales is a well-known case, as such hunting is difficult, if not impossible, without large numbers of people working together (Reeves and Smith 2006). Groups of Inuit coming together for collaborative whaling activities have been recorded from the late 18th century (see Figure 9.5). Hunting of bowhead whales has even been shown to be a major factor in the significant population expansion of Thule culture around ad 1000 (Wenzel 2009). Collaborative whale hunting is also known ethnographically elsewhere. Collaborative sperm whale hunters in Indonesia bring home more resources through their collaboration than they could through more individual fishing (Alvard and Nolin 2002), for example.

On the level of individuals, the most famous example of the survival significance of distant friendships is that of the Ju/'hoansi xaro network. The xaro is a network of gift-giving, visits and mutual friendships that buffers human communities from the effects of shortfalls and famines. Members of Ju/'hoansi bands each forge alliances with non-kin or distantly related kin in other bands, giving them carefully made gifts and visiting them. It is these allies whom they turn to in times of local crisis (Wiessner 2002a; Wiessner 2002b). When food shortages following high winds destroyed much of the mongongo nuts in /Xai/xai province, for example, half of the population moved in with distant exchange partners, and would not have survived if this social support was not possible (Wiessner 2002a). These external allies can sometimes make a difference to survival, with such alliances even a matter of life and death.

Connected regional communities also favour survival in other ways. The best-studied effect of the emergence of social networks has been in

allowing the spread of new ideas and innovations (Apicella et al. 2012; Fogarty 2018). Although they might live in small social groups, any individual in a similar hunting and gathering context is likely to interact with over a thousand other people over the course of their lifetime. Hill notes, for example, that, amongst the Hadza and the Aché, men are likely to have learnt how to produce tools from over 300 other individuals (Hill et al. 2014). An awareness of what is happening elsewhere, and an ability to pick up new ideas, can be important in allowing populations to adapt quickly to environmental changes (Derex, Perreault, and Boyd 2018; Foley and Gamble 2009; Muthukrishna and Henrich 2016). Connections thus foster rapid adaptability.

It would be easy to frame the contrast in communities as one between simple and complex, or even primitive and advanced, particularly since we associate the extensive social networks of the Upper Palaeolithic with the survival advantages of providing a social buffer for resource shortfalls. However, a closer consideration shows that, by focusing on the role of emotional dispositions in social tolerance, we reveal that *equal but different* may be a better way to understand such contrasts.

### **The structure of social networks and contrasting emotional dispositions in social tolerance**

From our privileged position as the apparent survivors, it is easy to see networks of allies across connected Upper Palaeolithic communities as a sign of superiority. These populations appear socially and cognitively more complex, and better able to negotiate collaborations than Neanderthals. However, a focus on the economics of resilience to resource shortfalls may be hindering our understanding that the underlying mechanisms allowing their creation are not calculated or cognitive but emotional. Moreover, those capacities that allow the creation and maintenance of large-scale connections also carry costs. Considering the emotional basis underlying community connections in Neanderthals and modern humans allows a reframing away from inferior or superior.

The creation and maintenance of the regional communities and social networks seen in modern humans depend on a high level of social tolerance, on a strong drive to connect and, above all, on an individual emotional vulnerability that is both a strength and a weakness of these interconnected communities.

When we look in more depth at what drives regional collaborations in modern hunter-gatherers, we reveal the significance of emotional connections, rather than logical or calculated arrangements. Mutual generosity and trust, rather than calculated collaboration, is the basis for the collaborations to exploit resources. The coastal-living Yamana of Tierra del Fuego developed mutually generous alliances in order to exploit periodically beached whales, for example, which were a cause for many celebrations and shared rituals, such as the *chiexaus* and *kina* initiations (Chapman 1997; McEwan, Borrero, and Prieto 2014). Smoke signals were sent to invite as many other groups as possible to join in the feast, with this mutual give and take maintained by trust that this goodwill would be returned in the future (Gusinde 1986; Santos et al. 2015).

Where individual networks of friendships with distant allies are concerned, similar emotional motivations based on social tolerance, mutual generosity and trust are also key. The *xaro* has been seen in terms of networks of obligations, almost like a contract, but this would be a misunderstanding of the emotions underlying such networks. It is clear that people look forward to seeing *xaro* partners, and find preparing gifts a pleasure rather than a chore (Wiessner 2002a). *Xaro* partners 'hold each other in their hearts' (Wiessner 2002a: 27). Moreover, evening talk around campfires is not just about those people present at the time but also involves stories told about ties to distant people and remembered gatherings in the past (Wiessner 2014).

The value of connected communities lies not just in knowing a lot of people, as we might consider a social network today, but in caring about distant friends who also care about you. Migliano et al. demonstrated, for example, that networks amongst the *Agta* and *Bayaka* are made up of close relationships maintained over lifetimes with a few individuals (Migliano et al. 2016). In viewing networks of social alliances as economic systems, we can easily lose sight of the social and emotional capacities and motivations which they depend on. Yet it is clear that neither systems of obligation, nor simple agreements, work to ensure support in times of need. Relationships based on 'needs-based transfers' (responding to the vulnerability of those in need), rather than on systems of obligations, are those that ensure survival (Campenni, Cronk, and Aktipis 2017; Cronk et al. 2017; Smith et al. 2019). Strong emotional drives to make close friends outside our kin are

motivators of human behaviour that provide mutual support everywhere (Cronk et al. 2017).

Networks of trusting relationships and close friendships are built on both a high level of social tolerance towards strangers, and also on certain social needs and emotional vulnerabilities to loneliness or lack of belonging. This individual vulnerability is also important to how social alliance networks are maintained as, without a strong emotional need to sustain and extend networks of social support to avoid a sense of isolation or loneliness, connections would fall out of use. Even when food supplies and the emergence of a cash economy made the Ju/'hoansi xaro network unnecessary, networks of social ties with distant friends were still kept up, even though fewer partners are typically involved (an average of seven rather than 15). These distant allies were socially and emotionally necessary, even if they did not perform a practical economic function (McCall 2000; Wiessner 2002a). Maintaining such relationships involves effort. The Jo-huansi spent about a third of the year visiting close friends in distant camps, and about 75 to 80 days making gifts to give them (Wiessner 2002a).

Opportunities to gather together are also important. A universal feature of modern hunter-gatherers, in all different environments, is that small living groups or bands will periodically join together as larger communities, or aggregations (Conkey et al. 1980; Kelly 2013). These gatherings are important in ensuring the sustainability of mating networks. However, they also fulfil a need to reconnect with old friends and develop new emotional connections, as well as for people to feel part of a larger community. Periodic gatherings seem to be as much about a human emotional need for meaningful social connection as they are a functional necessity. The times and places of aggregations usually coincide with a seasonal concentration of resources, but also provide an opportunity for important rituals to take place. Even where resources are more predictable and the risk of shortfalls less acute, alliances are still maintained.

Gatherings in modern ethnographically documented hunter-gatherers occurred even in the most difficult of conditions and despite notable costs. Gathering together is something people need to do. Even in the extraordinarily harsh conditions of the Western desert of Australia, in which

population densities were as low as one person per 300km<sup>2</sup>, the Martu still put considerable effort into coming together at aggregations, for example. In this highly arid region, it was typical to travel over 200 kilometres at least once a year to attend social gatherings (McDonald and Veth 2012). A 'tjabal' (the multitude) took place once or twice a year, particularly in winter, when seeds were abundant, and around reliable water sources in summer, for example (McDonald and Veth 2012). These social gatherings did not have a direct practical function but were nonetheless seen as vital. They were the focus for rituals, exchanges of goods and marriage arrangements, and general socialising that continued as long as resources and water allowed (typically a few weeks to a couple of months; McDonald and Veth 2012: 93). Moreover, these gatherings were also about extending friendships rather than reinforcing existing communities. There were no clear limits to the community who were allowed to attend and the attendance at aggregations amongst the Martu was flexible, sometimes including different dialect units and never the same set of individuals as previously. Hunter-gatherers commonly adapt their mobility patterns to maintain contact, even where this is costly (Grove 2018).

Oral histories within modern ethnographically documented groups confirm that it is emotional needs that underlie social connections. Gatherings and shared ceremonies are essential to maintaining emotional resilience and wellbeing. Coming together as a group and meeting distant friends provided a marked buffer to depression, anxiety and suicide (Danto and Walsh 2017).

Informants amongst the Cree commented:

'It was always through ceremonies and people talking to each other – Everybody would migrate as a whole, come from different places to get that and go back. You see ... that was our form of communication and life. And we used ceremonies to do that.' 'It's not just something to talk about. It's a way of life, you know...' 'those are the things that made our people strong: ceremonies'. (Danto and Walsh 2017: 723)

Collaborative social networks can only be maintained through strong emotional desires to maintain friendships, and by extending genuine emotional motivations to help others' wellbeing well beyond kin and co-residents (Cronk et al. 2017; Fowler and Christakis 2010). Being socially astute or clever

is not enough. Far from being a product of calculated strategy or cognitive complexity, connected social networks depend on emotional motivations. They depend on strong emotional needs and motivations to seek out friendships and to avoid loneliness or lack of belonging. Only these strong emotional motivations maintain networks of friendships in times of plenty, so that they also exist at times of need.

We have always assumed that large-scale regional connections in Upper Palaeolithic communities were brought about through new superior social capacities, and that 'we' modern humans are simply cleverer and more social than our predecessors. However, it is much more likely that new sensitivities, emotional vulnerabilities and new elevated needs for widespread emotional connections lay at the root of these new connected societies. Rather than a change in cognition, it is far more probable that a change in emotional dispositions towards an external focused tolerance, bringing with it individual emotional vulnerability, needs for connection and belonging, and tendencies to loneliness, explains the creation of Upper Palaeolithic social networks.

Rather than a concept of 'better' and more social Upper Palaeolithic communities, we might perhaps see the differences in behaviours observed in the archaeological record in a new light, reflecting the advantages and disadvantages of alternative evolutionary trajectories in the focus of emotional connections. As we have seen in Chapter 8, a more outward or inward emotional focus is suited to different contexts. Despite the lack of resilience at community level, there will have been benefits to the close-knit and inward-focused emotional connections of Neanderthals. An internal or close-knit emotional focus, and with this greater levels of internal social cohesion, can foster greater levels of give and take within the living group. Close-knit Neanderthal groups would have benefited from widespread care, willingness to take risks on behalf of the group, and individual emotional resilience (discussed in Chapter 2).

There are other practical advantages to close knit emotional dispositions. Limiting social mobility between groups can also reduce the energetic costs of such travel, which, as we have seen, can be extensive to maintain functioning friendships. For Neanderthals, the travel cost of maintaining social networks are likely to have been even greater than those of modern

humans. Their robust body, for example, may have added at least 10% to the energetic costs of travel, even before we take into account low population densities, making distances between living groups much greater (Churchill 2014). Moreover, there is no need to manage challenging relationships outside of a largely kin-based social group. As we have seen in Chapters 4 and 5, avoidance of other groups can be an effective social strategy for avoiding aggressive encounters. The more pronounced brow ridge of the archaic population would have restricted subtle muscle movements around the eyes, limiting the movements that may have been important to how modern humans created affiliative gestures of recognition and sympathy, fostering trust (Godinho, Spikins, and O'Higgins 2018). Furthermore, individual emotional resilience, rather than emotional vulnerability to lack of social contact or to loneliness, fosters survival in conditions in which social support is lacking. Neanderthals may have benefited from being more emotionally resilient and from not needing to create costly compensatory attachments to animals or even things (Chapters 6 and 7) at times of social stress. Overall, their ecological situation and particular biology seem likely to have discouraged intercommunity tolerance in Neanderthals, whilst, in contrast, particular ecological conditions in regions of Africa may have particularly encouraged intercommunity tolerance amongst early modern humans (Spikins et al. 2021). The price of maintaining social connections, both in practical terms of the costs of travel and in emotional terms of the individual costs of emotional vulnerabilities to loneliness or lack of belonging, may not have been worth paying for Neanderthals. Rather than a social or cognitive inferiority, a close-knit focus and individual emotional resilience simply seems to have made more sense in the context in which Neanderthals survived.

Of course, we should always be cautious when we discuss differences between populations. Our human biology, whether Neanderthal or modern human, is only one of many influences on how we behave (discussed in Chapters 1, 4 and 5). Culture, upbringing and individual choice play a key role in who we are, and differences identified at a group level do not imply that any individual must be different on those terms. It is also easy to make simple assumptions about what differences in emotional disposition, identified from genetics and anatomy, mean. As we have seen in Chapter 8, we might imagine that wolves, with elevated androgen levels compared to 'tame' dogs, would suffer from higher levels of aggression and violence. The converse is true, with free-ranging dogs being more at risk from lethal

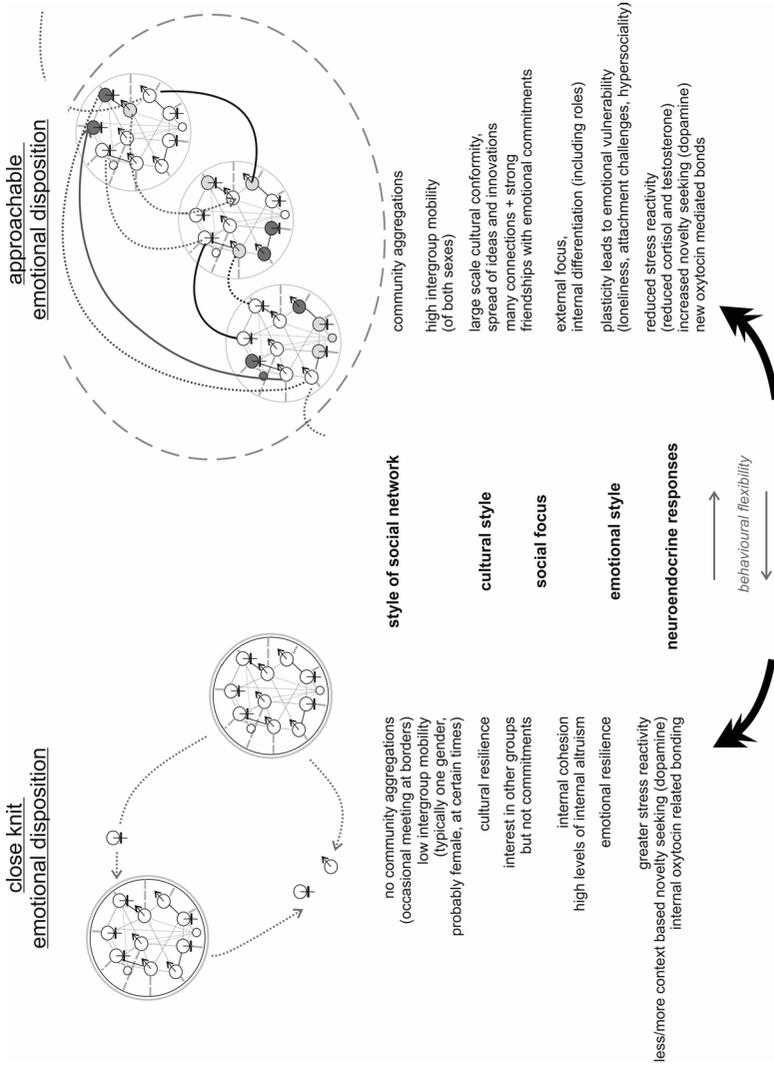
attacks within their own less socially cohesive group than close-knit wolf packs. In the even more complex situation of human societies, as we have seen in Chapter 4, testosterone is more associated with competition to fit into social norms of respect than aggression *per se*. Thus, whilst genetics and anatomy, including not only cranial anatomy but also 2D:4D digit ratios (see Chapter 4 and Chapter 8), suggest that Neanderthals also had higher androgen levels than modern humans, this does not imply higher levels of violence. In fact, we only see clear evidence of intergroup conflict in modern humans rather than Neanderthals. Whilst external social tolerance may lead to generous collaboration between groups, greater levels of engagement between groups also carry risks of an escalation of conflict. Emotional dispositions have to be understood in context.

### **Reframing Neanderthals as emotionally *close-knit* and modern humans as emotionally *approachable***

#### ***Differing emotional dispositions explain contrasts in the structure of communities***

The archaeological evidence discussed here, alongside the ecological, genetic and anatomical evidence discussed in Chapters 4, 5 and 8, suggests that a key distinction affecting differences in Neanderthal and modern human behaviour may be their differing emotional dispositions, and differing social tolerance. These differing dispositions are best seen as *different ways of being social*. Rather than seeing Neanderthals as cognitively inferior, or socially less complex, or resorting to shoehorning them into being *the same*, these seem to be societies that were more inward-collaborative and potentially individually independent, or *close-knit*. In contrast, the modern human pathway is one of being outward-focused and socially sensitive in emotional relationships, or being *approachable*. Each evolutionary pathway has both advantages and disadvantages in different contexts (Figure 9.6).

As we have seen in Part 2, archaeological evidence suggests a pattern in which modern humans became more socially sensitive and emotionally vulnerable, expressed in both material culture and relationships with animals. Neanderthals may have progressed some way along this path already, given their reduced brow ridge in contrast to early *Homo heidelbergensis*. However, in comparison to modern humans, Neanderthals seem to have a



**Figure 9.6:** Simplified figure to illustrate contrasts between the close-knit emotional dispositions hypothesised to be characteristic of Neanderthals (left) and, in contrast, the approachable dispositions hypothesised to be characteristic of modern humans in Europe (right). The different line patterns between schematic living groups in the latter (right) denote different types and strengths of social connection (e.g. strong bonds with mutual generosity, casual friendships, family or ritual ties etc). The dashed outer circle (right) denotes a loosely defined regional community. Penny Spikins, CC BY-NC 4.0.

tendency to form close-knit groups, leading them to be highly internally collaborative yet more suspicious of unfamiliar individuals. As a result, we see differences in the relative constraints or openness of large-scale social interactions between the different species. Subtle but important differences in emotional dispositions would make the cultural character of Neanderthal communities distinctive from that of Upper Palaeolithic communities, without any implications for intelligence or social understanding.

Considering changes in emotional dispositions and the focus of emotional connections may better explain many of the differences previously attributed to intelligence, capacities for language or symbolism, or other ways in which modern populations have been seen as *more complex*.

***Differing emotional dispositions explain previously enigmatic elements of the archaeological record***

Understanding Neanderthal behaviour as reflecting a different, less externally socially tolerant but more internally socially collaborative pathway of human variation gives us a different perspective. This *different pathway* in which Neanderthals are *differently social* explains many characteristics which have been interpreted in terms of Neanderthals being on a lower rung of some cognitive ladder or less socially complex than the modern humans who replaced them.

Subtle changes in emotional dispositions, driven by changes in the pathways driving novelty and reward-seeking (through hormones such as dopamine), stress reactivity (cortisol), competitiveness (testosterone) and the nature of social bonds (oxytocin, vasopressin and beta endorphins), seen in genetic evidence (discussed in Chapter 8) and in line with Neanderthals being more internally cohesive, would have had subtle but important effects.

A reduced drive to seek out novelty, compared to that which is typical of modern humans (discussed in Chapter 6), explains the rather constrained nature of Neanderthal patterns of mobility. Unlike modern humans, it seems that Neanderthals may have felt no particular attraction to the novelty of strangers and, as a result, their external social relationships seem to have been oriented around the minimum practical needs. Interactions with neighbouring groups need not have been aggressive, and sometimes resources

and materials travelled across the areas occupied by different living groups, particularly when such resources were important to survival. However, there may have seemed no particular pleasure in seeking out new friends. An elevated stress reactivity of internally cohesive Neanderthals, in comparison to the reduced stress reactivity of approachable modern humans (discussed in Chapters 4 and 5), is also likely to have made the experience of large groups, particularly of unfamiliar individuals, particularly stressful. This was a close-knit social life, without any big parties.

It is not surprising that Neanderthal art seems unimpressive in comparison to that of the Upper Palaeolithic when taken in the context of their inward-focusing sociality. Neanderthal art is far from elaborate or time-consuming, mostly requiring only a few minutes of attention. This contrasts markedly with displays of technological skills in Upper Palaeolithic contexts, not only in carefully produced artworks but even in flint tools such as elaborately made Solutrean foliate points (Sinclair 2015). This is, however, only what we expect within inward-focusing social contexts. There is, simply, little need to impress anyone. Whilst modern humans moved within vast networks where they needed to develop a social identity and reputation across large areas, Neanderthals would already be well known within their local group, without the need for any ostentatious display or for subtle eye movements to express affiliation to strangers (Godinho, Spikins, and O'Higgins 2018). Added to which, differences in dopamine production between archaic and modern humans may have made 'art' in aesthetics, depiction or music far less enticing to the average Neanderthal brain than it is to the modern human (see Chapter 4 and 5). Nature itself may have been enough of an aesthetic delight for Neanderthals, without needing to go to extreme lengths to produce something artificially beautiful. Furthermore, a relative lack of personal ornaments or cherished possessions also reflects this intimate focus on social life. Without loved ones ever being far away, there would be no need to rely on alternative sources of security. This greater inward focus makes sense of why Neanderthal children and adults show a relative lack of *personal* symbolic objects compared to those of the Upper Palaeolithic. As discussed in Chapter 6, whatever their meaning, such objects are likely to also have been part of compensatory attachments for modern humans, filling in when caring relationships come under threat. Whatever the ecological hardships, growing up as a Neanderthal child in a small inward-focused group will have encouraged emotional security. Neanderthals may have

experimented out of curiosity, but most probably did not need 'art' in any of its forms.

The nature of social interactions in Neanderthals will also have affected how innovations may have begun or been adopted (Hovers and Belfer-Cohen 2006). Interactions with new ideas will have been much less frequent, constraining their spread. Certainly, at particular times, some individuals, particularly adolescents and young adults, must have been lured by novelty and sought out new connections in other groups. Nonetheless, distant travel by entire groups across the homelands of other groups may have been rare. Moreover, evidence suggests that even mating networks were constrained. Those individuals who move between groups may have been predominantly female, and external matings constrained by lack of connections (Luis Ríos et al. 2015). By implication, it would have been women who played a particularly significant role in Neanderthal social connections, not only in the maintenance of mating networks but in the spread of ideas and cultural connections across large areas of landscape. This is in no way surprising, as it is female primates who pass on mechanisms of producing and using tools. Chimpanzees largely depend on their mothers to learn how to make and use termite fishing sticks, for example. There is no reason to assume that males were any less competent than females in tool technology, simply that in a patrilocal context they are likely to have played a less significant role in the spread of shared knowledge and styles. Mobility constrained by gender, the comparative rarity of intergroup movements and a lack of regular aggregations will all have affected the potential for ideas and ways of doing things to spread.

In being more robust, and so having a greater energetic footprint per individual, Neanderthals already suffered from a relative demographic restriction to the size of their living groups and to their capacities to reproduce compared to modern humans in a similar ecological context. Fewer Neanderthals could survive on the same resources as modern humans, and it took more energetic costs for each child raised to adulthood. An additional, indirect effect may come from changes towards increasing tameness or friendliness on reproduction. An extended period of fertility is one of the notable side effects of increasing friendliness or tameness in other domesticated animals, including in the silver fox study (see Chapters 4 and 5). Genetic evidence suggests that the generational interval reduced in modern humans

after 40,000 years ago (e.g. from around 30 to around 25 years between generations) (Macià et al. 2021). Whilst Neanderthals may have been able to give more care to each child, this increased child security would have come at a demographic cost. Modern human populations were able to bounce back more quickly after population declines (as shown from analysis of radiocarbon dated sites following Heinrich events; Bradtmöller et al. 2012).

The comparative failure of early modern human incursions into Europe can also be explained by their emotional dependence on social networks. Small groups of humans, unusually dependent on regional interactions not only for ecological resilience but also as part of their emotional support network, would be disadvantaged in comparison to inward-focused and independent Neanderthal populations. Whilst significant communities of modern humans, after 40,000 years ago, may have been more successful than Neanderthals at times of shortfalls, early incursions of modern populations into Europe or the Near East would in any case be at a competitive disadvantage if isolated.

Whilst the demise of Neanderthals is perhaps most likely to relate to either chance or subtle differences in biology, the possibility also exists that one influencing factor in Neanderthal demise was not that they were *vulnerable* but rather that, at least individually and emotionally, they *were not vulnerable enough*. Without emotionally needing to form social networks, or seek support in compensatory attachments, they will have had no need to go to great costs to maintain social contacts at a distance and, in lacking large social networks, may have been far more prone to resource shortfalls. That our relative survival may have come about through emotional vulnerability is a very different type of human evolutionary narrative.

## Conclusions

The very presence of Neanderthals challenges us. We know that they were different from ourselves anatomically, with their increased robusticity, longer, lower crania and prominent brow ridges. Moreover, they were different physiologically and in their brain structures, even if these differences can be subtle and evident only at a population level. Furthermore, as argued here, they seem to have been emotionally different in terms of their levels of internal or external social tolerance, their social sensitivity and their

emotional vulnerability. Such differences are hardly surprising since the line that led to Neanderthals diverged from that leading to our own species perhaps as far back as half a million years ago, albeit with some intermixing. It has been all too easy to fit this difference within a narrative in which 'we' modern humans boast superior intellect and social abilities.

Rather than seeing modern humans as socially or cognitively superior to our close Neanderthal cousins, it seems more appropriate to appreciate that there are different ways of being social. Different evolutionary pathways between *close-knit* and *approachable* emotional dispositions explains the distinctions we observe in the archaeological record of Neanderthal and modern human behaviours in Europe. Whilst the former dispositions led to strong internal bonds and high levels of individual emotional resilience, the latter led to the formation of large social networks, resilient to resource shortfalls but at the expense of individual emotional vulnerability and sensitivities to loneliness or a lack of belonging. Neanderthals were no less human and, like our own species, needed close emotional connections to survive and thrive. However, the focus of these connections seems to have differed.

If Neanderthals represent a humanity without our social loneliness, lack of belonging, or sensitivity to what others think, and with the unquestioning support and loyalty of a small social group, it is not surprising that we see interbreeding between these two lineages. Rather than a sign of Neanderthals being *the same* as modern humans, it might rather be a sign of *what was attractive about the differences*.

### Key points

- Archaeological evidence for differences in mobility patterns and community interactions, alongside other lines of evidence (discussed in Chapter 8), suggest that Neanderthals and modern human communities show contrasting inward and outward social focus in their community relationships, described here as *internally cohesive* and *approachable* emotional dispositions.
- Contrasting behaviours may not indicate any inferiority or superiority but, rather, differing ways of being social.

- Differing emotional dispositions may also explain previously enigmatic aspects of the archaeological record, such as the characteristics of Neanderthal art.
- We are naturally tempted to impose concepts of progression when we consider our human evolutionary past. Accepting differences as neither better nor worse may be important in moving past these narratives.

## References

- Alvard, Michael S., and David A. Nolin. 2002. 'Rousseau's Whale Hunt? Coordination among Big-Game Hunters.' *Current Anthropology* 43 (4): 533–59.
- Apicella, Coren L., Frank W. Marlowe, James H. Fowler, and Nicholas A. Christakis. 2012. 'Social Networks and Cooperation in Hunter-Gatherers.' *Nature* 481 (7382): 497–501.
- Arrizabalaga, Alvaro. 2009. 'The Middle to Upper Paleolithic Transition on the Basque Crossroads: Main Sites. Key Issues.' *Mitteilungen Der Gesellschaft Für Urgeschichte* 18: 39–70.
- Aubert, Maxime, Adam Brumm, and Jillian Huntley. 2018. 'Early Dates for "Neanderthal Cave Art" May Be Wrong.' *Journal of Human Evolution* 125: 215–17.
- Bartsiokas, Antonis, and Juan Luis Arsuaga. 2020. 'Hibernation in Hominins from Atapuerca, Spain Half a Million Years Ago.' *L'Anthropologie* 124 (5): 102797.
- Ben-Dor, Miki, Avi Gopher, and Ran Barkai. 2016. 'Neandertals' Large Lower Thorax May Represent Adaptation to High Protein Diet.' *American Journal of Physical Anthropology* 160 (3): 367–78.
- Bradtmöller, Marcel, Andreas Pastoors, Bernhard Weninger, and Gerd-Christian Weniger. 2012. 'The Repeated Replacement Model—Rapid Climate Change and Population Dynamics in Late Pleistocene Europe.' *Quaternary International: The Journal of the International Union for Quaternary Research* 247: 38–49.
- Bruner, Emiliano. 2021. 'Evolving Human Brains: Paleoneurology and the Fate of Middle Pleistocene.' *Journal of Archaeological Method and Theory* 28 (1): 76–94.
- Bruner, Emiliano, and Ben T. Gleeson. 2019. 'Body Cognition and Self-Domestication in Human Evolution.' *Frontiers in Psychology* 10: 1111. DOI: <https://dx.doi.org/10.3389/fpsyg.2019.01111>.
- Campenni, Marco, Lee Cronk, and Athena Aktipis. 2017. 'Correlated Disasters and Need-Based Transfers: The Limits of Risk Pooling Systems in Simulated Ecologies.' *bioRxiv* 230607.
- Chapman, A. 1997. 'The Great Ceremonies of the Selk'nam and the Yámana: A Comparative Analysis.' In: Colin McEwan, Luis A. Borrero, and Alfredo Prieto (eds.) *Patagonia: Natural History, Prehistory, and Ethnography at the Uttermost End of the Earth*: 82–109. London: British Museum Press.

- Churchill, Steven E. 2014. *Thin on the Ground: Neandertal Biology, Archeology and Ecology*. New Delhi: John Wiley & Sons.
- Conard, Nicholas J., Michael Bolus, and Susanne C. Münzel. 2012. 'Middle Paleolithic Land Use, Spatial Organization and Settlement Intensity in the Swabian Jura, Southwestern Germany.' *Quaternary International: The Journal of the International Union for Quaternary Research* 247 (January): 236–45.
- Conkey, Margaret W., Antonio Beltrán, G. A. Clark, J. González Echegaray, M. G. Guenther, Joachim Hahn, Brian Hayden, K. Paddayya, Lawrence G. Straus, and Karel Valoch. 1980. 'The Identification of Prehistoric Hunter-Gatherer Aggregation Sites: The Case of Altamira [and Comments and Reply].' *Current Anthropology* 21 (5): 609–30.
- Cortés-Sánchez, Miguel, Francisco J. Jiménez-Espejo, María D. Simón-Vallejo, Chris Stringer, María Carmen Lozano Francisco, Antonio García-Alix, José L. Vera Peláez, et al. 2019. 'An Early Aurignacian Arrival in Southwestern Europe.' *Nature Ecology & Evolution* 3 (2): 207–12.
- Cronk, Lee, Colette Berbesque, Thomas Conte, Matthew Gervais, Padmini Iyer, Brighid McCarthy, Dennis Sonkoi, et al. 2017. 'Managing Risk through Cooperation: Need-Based Transfers and Risk Pooling among the Societies of the Human Generosity Project.' Unpublished manuscript, Rutgers University.
- Danto, David, and Russ Walsh. 2017. 'Mental Health Perceptions and Practices of a Cree Community in Northern Ontario: A Qualitative Study.' *International Journal of Mental Health and Addiction* 15 (4): 725–37.
- Derex, Maxime, Charles Perreault, and Robert Boyd. 2018. 'Divide and Conquer: Intermediate Levels of Population Fragmentation Maximize Cultural Accumulation.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 373 (1743). DOI: <https://doi.org/10.1098/rstb.2017.0062>.
- Djindjian, François. 2012. 'Is the MP-EUP Transition Also an Economic and Social Revolution?' *Quaternary International: The Journal of the International Union for Quaternary Research* 259 (May): 72–77.
- Douka, K., V. Slon, Z. Jacobs, C. Bronk Ramsey, M. V. Shunkov, A. P. Derevianko, F. Mafessoni, et al. 2019. 'Age Estimates for Hominin Fossils and the Onset of the Upper Palaeolithic at Denisova Cave.' *Nature* 565 (7741): 640–44.
- Ekshtain, Ravid, Shimon Ilani, Irina Segal, and Erella Hovers. 2017. 'Local and Nonlocal Procurement of Raw Material in Amud Cave, Israel: The Complex Mobility of Late Middle Paleolithic Groups.' *Geoarchaeology* 32 (2): 189–214.

- Ekshtain, Ravid, Ariel Malinsky-Buller, Shimon Ilani, Irina Segal, and Erella Hovers. 2014. 'Raw Material Exploitation around the Middle Paleolithic Site of 'Ein Qashish.' *Quaternary International: The Journal of the International Union for Quaternary Research* 331: 248–66.
- Féblot-Augustins, Jehanne. 1993. 'Mobility Strategies in the Late Middle Palaeolithic of Central Europe and Western Europe: Elements of Stability and Variability.' *Journal of Anthropological Archaeology* 12 (3): 211–65.
- Féblot-Augustins, Jehanne. 1999. 'Raw Material Transport Patterns and Settlement Systems in the European Lower and Middle Palaeolithic: Continuity, Change and Variability.' In: Wil Roebroeks and Clive Gamble (eds.) *The Middle Palaeolithic Occupation of Europe*: 193–214. Leiden: University of Leiden.
- Féblot-Augustins, Jehanne. 2009. 'Revisiting European Upper Paleolithic Raw Material Transfers: The Demise of the Cultural Ecological Paradigm?' In: Brian Adams and Brooke S. Blades (eds.) *Lithic Materials and Paleolithic Societies*: 25–46. Wiley-Blackwell.
- Fernandes, Paul, Jean-Paul Raynal, and Marie-Hélène Moncel. 2008. 'Middle Palaeolithic Raw Material Gathering Territories and Human Mobility in the Southern Massif Central, France: First Results from a Petro-Archaeological Study on Flint.' *Journal of Archaeological Science* 35 (8): 2357–70.
- Finlayson, Clive, Kimberly Brown, Ruth Blasco, Jordi Rosell, Juan José Negro, Gary R. Bortolotti, Geraldine Finlayson, et al. 2012. 'Birds of a Feather: Neanderthal Exploitation of Raptors and Corvids.' *PLoS One* 7 (9): e45927.
- Fogarty, Laurel. 2018. 'Cultural Complexity and Evolution in Fluctuating Environments.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 373 (1743). DOI: <https://doi.org/10.1098/rstb.2017.0063>.
- Foley, Robert, and Clive Gamble. 2009. 'The Ecology of Social Transitions in Human Evolution.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 364 (1533): 3267–79.
- Fowler, James H., and Nicholas A. Christakis. 2010. 'Cooperative Behavior Cascades in Human Social Networks.' *Proceedings of the National Academy of Sciences of the United States of America* 107 (12): 5334–38.
- Fu, Qiaomei, Cosimo Posth, Mateja Hajdinjak, Martin Petr, Swapan Mallick, Daniel Fernandes, Anja Furtwängler, et al. 2016. 'The Genetic History of Ice Age Europe.' *Nature* 534 (7606): 200–205.
- Gibbons, Ann. 2021. 'Genomes Offer Rare Glimpse of Neanderthal Family Groups.' *Science* 372 (6548): 1251–52.

- Godinho, Ricardo Miguel, Penny Spikins, and Paul O'Higgins. 2018. 'Supraorbital Morphology and Social Dynamics in Human Evolution.' *Nature Ecology & Evolution* 2 (April): 956–61.
- Grove, Matt. 2018. 'Hunter-Gatherers Adjust Mobility to Maintain Contact under Climatic Variation.' *Journal of Archaeological Science: Reports* 19 (June): 588–95.
- Gunz, Philipp, Simon Neubauer, Bruno Maureille, and Jean-Jacques Hublin. 2010. 'Brain Development after Birth Differs between Neanderthals and Modern Humans.' *Current Biology: CB* 20 (21): R921–22.
- Gusinde, Martin. 1986. *Los Indios de Tierra del Fuego: Tomo 2, Los Yámana*. Centro Argentino de Etnología Americana.
- Hajdinjak, Mateja, Fabrizio Mafessoni, Laurits Skov, Benjamin Vernot, Alexander Hübner, Qiaomei Fu, Elena Essel, et al. 2021. 'Initial Upper Palaeolithic Humans in Europe Had Recent Neanderthal Ancestry.' *Nature* 592 (7853): 253–57.
- Harvati, Katerina, Carolin Röding, Abel M. Bosman, Fotios A. Karakostis, Rainer Grün, Chris Stringer, Panagiotis Karkanas, et al. 2019. 'Apidima Cave Fossils Provide Earliest Evidence of Homo Sapiens in Eurasia.' *Nature* 571 (7766): 500–50.
- Higgins, Ryan W., and Christopher B. Ruff. 2011. 'The Effects of Distal Limb Segment Shortening on Locomotor Efficiency in Sloped Terrain: Implications for Neanderthal Locomotor Behavior.' *American Journal of Physical Anthropology* 146 (3): 336–45.
- Hill, Kim R., Brian M. Wood, Jacopo Baggio, A. Magdalena Hurtado, and Robert T. Boyd. 2014. 'Hunter-Gatherer Inter-Band Interaction Rates: Implications for Cumulative Culture.' *PLoS One* 9 (7): e102806.
- Hoffecker, John F. 2009. 'Out of Africa: Modern Human Origins Special Feature: The Spread of Modern Humans in Europe.' *Proceedings of the National Academy of Sciences of the United States of America* 106 (38): 16040–45.
- Hoffmann, Dirk L., Christopher D. Standish, Alistair W. G. Pike, Marcos García-Díez, Paul B. Pettitt, Diego E. Angelucci, Valentín Villaverde, et al. 2018. 'Dates for Neanderthal Art and Symbolic Behaviour Are Reliable.' *Nature Ecology & Evolution* 2 (7): 1044–45.
- Hovers, Erella. 2018. 'Continuity and Change in Research about the Neanderthals in the Levant.' Presented at Neanderthal: The Conference, Gibraltar Museum, 13 September 2018.
- Hovers, Erella, and Anna Belfer-Cohen. 2006. "'Now You See It, Now You Don't"—Modern Human Behavior in the Middle Paleolithic.' In: Erella

- Hovers and Steven L. Kuhn (eds.) *Transitions Before the Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*: 295–304. Boston, MA: Springer.
- Hublin, Jean-Jacques. 2015. 'The Modern Human Colonization of Western Eurasia: When and Where?' *Quaternary Science Reviews* 118: 194–210.
- Kelly, Robert L. 2013. *The Lifeways of Hunter-Gatherers: The Foraging Spectrum*. Cambridge University Press.
- King, William. 1864. 'The Reputed Fossil Man of the Neanderthal.' *Quarterly Journal of Science, Literature, and the Arts* 1: 88–97.
- Kochiyama, Takanori, Naomichi Ogihara, Hiroki C. Tanabe, Osamu Kondo, Hideki Amano, Kunihiro Hasegawa, Hiromasa Suzuki, et al. 2018. 'Reconstructing the Neanderthal Brain Using Computational Anatomy.' *Scientific Reports* 8 (1): 6296.
- Kuhn, Steven L. 2012. 'Emergent Patterns of Creativity and Innovation in Early Technologies.' In: Scott A. Elias (ed.) *Origins of Human Innovation and Creativity*: 69–87. Elsevier.
- Lalueza-Fox, Carles. 2021. 'Neanderthal Assimilation?' *Nature Ecology & Evolution* 5 (6): 711–12.
- Lalueza-Fox, Carles, Antonio Rosas, Almudena Estalrich, Elena Gigli, Paula F. Campos, Antonio García-Taberner, Samuel García-Vargas, et al. 2011. 'Genetic Evidence for Patrilocal Mating Behavior among Neanderthal Groups.' *Proceedings of the National Academy of Sciences of the United States of America* 108 (1): 250–53.
- Langbroek, Marco. 2012. 'Trees and Ladders: A Critique of the Theory of Human Cognitive and Behavioural Evolution in Palaeolithic Archaeology.' *Quaternary International: The Journal of the International Union for Quaternary Research* 270 (August): 4–14.
- Langley, Michelle C., and Martin Street. 2013. 'Long Range Inland–Coastal Networks during the Late Magdalenian: Evidence for Individual Acquisition of Marine Resources at Andernach-Martinsberg, German Central Rhineland.' *Journal of Human Evolution* 64 (5): 457–65.
- Layton, Robert, Sean O'Hara, and Alan Bilsborough. 2012. 'Antiquity and Social Functions of Multilevel Social Organization Among Human Hunter-Gatherers.' *International Journal of Primatology* 33 (5): 1215–45.
- Macià, Moisès Coll, Laurits Skov, Benjamin Marco Peter, and Mikkel Heide Schierup. 2021. 'Different Historical Generation Intervals in Human Populations Inferred from Neanderthal Fragment Lengths and Patterns

- of Mutation Accumulation.' *bioRxiv* preprint. DOI: <https://dx.doi.org/10.1101/2021.02.25.432907>.
- Madison, Paige. 2020. 'Characterized by Darkness: Reconsidering the Origins of the Brutish Neanderthal.' *Journal of the History of Biology* 53 (4): 493–519.
- Majkić, Ana, Sarah Evans, Vadim Stepanchuk, Alexander Tsvelykh, and Francesco d'Errico. 2017. 'A Decorated Raven Bone from the Zaskalnaya VI (Kolosovskaya) Neanderthal Site, Crimea.' *PLoS One* 12 (3): e0173435.
- Marquet, Jean-Claude, and Michel Lorblanchet. 2003. 'A Neanderthal Face? The Proto-Figurine from La Roche-Cotard, Langeais (Indreet-Loire, France).' *Antiquity* 77 (298): 661–70.
- McCall, Grant S. 2000. 'Ju/'hoansi Adaptations to a Cash Economy.' *African Sociological Review/Revue Africaine de Sociologie* 4 (1): 138–55.
- McCluskey, Alan. 2016. "'Race" and the Changing Representations of Neanderthals.' *Human Geography* 9 (1): 68–78.
- McDonald, Jo, and Peter Veth. 2012. 'The Social Dynamics of Aggregation and Dispersal in the Western Desert.' In: Jo McDonald and Peter Veth (eds.) *A Companion to Rock Art*: 90–102. Chichester: Wiley-Blackwell.
- McEwan, Colin, Luis A. Borrero, and Alfredo Prieto. 2014. *Patagonia: Natural History, Prehistory, and Ethnography at the Uttermost End of the Earth*. Princeton University Press.
- Migliano, Andrea Bamberg, Abigail Page, Jesus Gomez-Gardenes, Sylvain Viguier, Mark Dyble, James Thompson, Nikhill Chaudhary, et al. 2016. 'High-Resolution Maps of Hunter-Gatherer Social Networks Reveal Human Adaptation for Cultural Exchange.' *bioRxiv*. DOI: <https://doi.org/10.1101/040154>.
- Moncel, Marie-Hélène. 2011. 'Technological Behavior and Mobility of Human Groups Deduced from Lithic Assemblages in the Late Middle and Early Late Pleistocene of the Middle Rhône Valley (France).' In: Nicholas J. Conard and Jürgen Richter (eds.) *Neanderthal Lifeways, Subsistence and Technology: One Hundred Fifty Years of Neanderthal Study*: 261–87. Dordrecht: Springer.
- Muthukrishna, Michael, and Joseph Henrich. 2016. 'Innovation in the Collective Brain.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 371 (1690). DOI: <https://doi.org/10.1098/rstb.2015.0192>.
- Pearce, Eiluned. 2013. 'The Effects of Latitude on Hominin Social Network Maintenance.' Doctoral thesis, Oxford University.

- Pearce, Eiluned, Chris Stringer, and Robin Dunbar. 2013. 'New Insights into Differences in Brain Organization between Neanderthals and Anatomically Modern Humans.' *Proceedings. Biological Sciences/The Royal Society* 280 (1758): 20130168.
- Peeters, Susan, and Hub Zwart. 2020. 'Neanderthals as Familiar Strangers and the Human Spark: How the "Golden Years" of Neanderthal Research Reopen the Question of Human Uniqueness.' *History and Philosophy of the Life Sciences* 42 (3): 33.
- Pereira-Pedro, Ana Sofia, Emiliano Bruner, Philipp Gunz, and Simon Neubauer. 2020. 'A Morphometric Comparison of the Parietal Lobe in Modern Humans and Neanderthals.' *Journal of Human Evolution* 142 (May): 102770.
- Peresani, Marco, Ivana Fiore, Monica Gala, Matteo Romandini, and Antonio Tagliacozzo. 2011. 'Late Neanderthals and the Intentional Removal of Feathers as Evidenced from Bird Bone Taphonomy at Fumane Cave 44 Ky B.P., Italy.' *Proceedings of the National Academy of Sciences of the United States of America* 108 (10): 3888–93.
- Peresani, Marco, Marian Vanhaeren, Ermanno Quaggiotto, Alain Queffelec, and Francesco d'Errico. 2013. 'An Ochered Fossil Marine Shell from the Mousterian of Fumane Cave, Italy.' *PLoS One* 8 (7): e68572.
- Pettitt, Paul. 2010. *The Palaeolithic Origins of Human Burial*. London: Routledge.
- Pettitt, Paul. 2011. 'Religion and Ritual in the Lower and Middle Palaeolithic.' In: Tim Insoll (ed.) *The Oxford Handbook of the Archaeology and Ritual of Religion*: 331–43. Oxford: Oxford University Press.
- Pettitt, Paul. 2014. 'The European Upper Palaeolithic.' In: V. Cummings, P. Jordan, and M. Zvelebil (eds.) *The Oxford Handbook of the Archaeology and Anthropology of Hunter-Gatherers*. Oxford University Press.
- Prüfer, Kay, Fernando Racimo, Nick Patterson, Flora Jay, Sriram Sankararaman, Susanna Sawyer, Anja Heinze, et al. 2014. 'The Complete Genome Sequence of a Neanderthal from the Altai Mountains.' *Nature* 505 (7481): 43–49.
- Radovčić, D., Sršen, A. O., Radovčić, J., & Frayer, D. W. 2015. 'Evidence for Neanderthal Jewelry: Modified White-Tailed Eagle Claws at Krapina.' *PLoS One* 10 (3): e0119802.
- Reeves, Randall R., and Tim D. Smith. 2006. 'A Taxonomy of World Whaling.' In: James A. Estes, Douglas P. DeMaster, Daniel F. Doak, Terrie M. Williams, and Robert L. Brownell (eds.) *Whales, Whaling, and Ocean Ecosystems*: 82–101. Berkeley, CA: University of California Press.

- Richards, Michael, Katerina Harvati, Vaughan Grimes, Colin Smith, Tanya Smith, Jean-Jacques Hublin, Panagiotis Karkanas, and Eleni Panagopoulou. 2008. 'Strontium Isotope Evidence of Neanderthal Mobility at the Site of Lakonis, Greece Using Laser-Ablation PIMMS.' *Journal of Archaeological Science* 35 (5): 1251–56.
- Ríos, Luis, Tracy L. Kivell, Carles Lalueza-Fox, Almudena Estalrich, Antonio García-Taberner, Rosa Huguet, Yuliet Quintino, Marco de la Rasilla, and Antonio Rosas. 2019. 'Skeletal Anomalies in the Neandertal Family of El Sidrón (Spain) Support a Role of Inbreeding in Neandertal Extinction.' *Scientific Reports* 9 (1): 1697.
- Ríos, Luis, Antonio Rosas, Almudena Estalrich, Antonio García-Taberner, Markus Bastir, Rosa Huguet, Francisco Pastor, Juan Alberto Sanchís-Gimeno, and Marco de la Rasilla. 2015. 'Possible Further Evidence of Low Genetic Diversity in the El Sidrón (Asturias, Spain) Neandertal Group: Congenital Clefts of the Atlas.' *PLoS One* 10 (9): e0136550.
- Rodríguez-Vidal, Joaquín, Francesco d'Errico, Francisco Giles Pacheco, Ruth Blasco, Jordi Rosell, Richard P. Jennings, Alain Queffelec, et al. 2014. 'A Rock Engraving Made by Neanderthals in Gibraltar.' *Proceedings of the National Academy of Sciences of the United States of America* 111 (37): 13301–306.
- Roebroeks, Wil, Mark J. Sier, Trine Kellberg Nielsen, Dimitri De Loecker, Josep Maria Parés, Charles E. S. Arps, and Herman J. Múcher. 2012. 'Use of Red Ochre by Early Neanderthals.' *Proceedings of the National Academy of Sciences of the United States of America* 109 (6): 1889–94.
- Ruebens, Karen. 2013. 'Regional Behaviour among Late Neanderthal Groups in Western Europe: A Comparative Assessment of Late Middle Palaeolithic Bifacial Tool Variability.' *Journal of Human Evolution* 65 (4): 341–62.
- Sánchez-Quinto, Federico, and Carles Lalueza-Fox. 2015. 'Almost 20 Years of Neanderthal Palaeogenetics: Adaptation, Admixture, Diversity, Demography and Extinction.' *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 370 (1660): 20130374.
- Sankararaman, Sriram, Swapan Mallick, Nick Patterson, and David Reich. 2016. 'The Combined Landscape of Denisovan and Neanderthal Ancestry in Present-Day Humans.' *Current Biology*: CB 26 (9): 1241–47.
- Santos, José Ignacio, María Pereda, Débora Zurro, Myrian Álvarez, Jorge Caro, José Manuel Galán, and Ivan Briz i Godino. 2015. 'Effect of Resource Spatial Correlation and Hunter-Fisher-Gatherer Mobility on Social Cooperation in Tierra Del Fuego.' *PLoS One* 10 (4): e0121888.

- Sazzini, M., G. Schiavo, S. De Fanti, P. L. Martelli, R. Casadio, and D. Luiselli. 2014. 'Searching for Signatures of Cold Adaptations in Modern and Archaic Humans: Hints from the Brown Adipose Tissue Genes.' *Heredity* 113 (3): 259–67.
- Shipman, Pat. 2015. 'How Do You Kill 86 Mammoths? Taphonomic Investigations of Mammoth Megasites.' *Quaternary International: The Journal of the International Union for Quaternary Research* 359–360 (March): 38–46.
- Sikora, Martin, Andaine Seguin-Orlando, Vitor C. Sousa, Anders Albrechtsen, Thorfinn Korneliusen, Amy Ko, Simon Rasmussen, et al. 2017. 'Ancient Genomes Show Social and Reproductive Behavior of Early Upper Paleolithic Foragers.' *Science* 358 (6363): 659–62.
- Sinclair, Anthony. 2015. 'All in a Day's Work? Early Conflicts in Expertise, Life History and Time Management.' In: Fiona Coward, Robert Hosfield, Matt Pope, and Francis Wenban-Smith (eds.) *Settlement, Society and Cognition in Human Evolution*: 94–116. Cambridge: Cambridge University Press.
- Slimak, Ludovic, and Yves Giraud. 2007. 'Circulations Sur Plusieurs Centaines de Kilomètres Durant Le Paléolithique Moyen. Contribution à La Connaissance Des Sociétés Néandertaliennes.' *Comptes Rendus. Palevol* 6 (5): 359–68.
- Smith, Daniel, Mark Dyble, Katie Major, Abigail E. Page, Nikhil Chaudhary, Gul Deniz Salali, James Thompson, Lucio Vinicius, Andrea Bamberg Migliano, and Ruth Mace. 2019. 'A Friend in Need Is a Friend Indeed: Need-Based Sharing, Rather than Cooperative Assortment, Predicts Experimental Resource Transfers among Agta Hunter-Gatherers.' *Evolution and Human Behavior: Official Journal of the Human Behavior and Evolution Society* 40 (1): 82–89.
- Spikins, Penny. 2015a. *How Compassion Made Us Human*. Barnsley: Pen and Sword.
- Spikins, Penny. 2015b. 'The Geography of Trust and Betrayal: Moral Disputes and Late Pleistocene Dispersal.' *Open Quaternary* 1 (1). Available at: <http://www.openquaternary.com/articles/10.5334/oq.ai/print>.
- Spikins, Penny, Jennifer French, Seren John-Wood and Calvin Dytham. 2021. 'Theoretical and Methodological Approaches to Ecological Changes, Social Behaviour and Human Intergroup Tolerance 300,000 to 30,000 Bp.' *Journal of Archaeological Method and Theory* 28: 53–75.
- Spikins, Penny, Gail Hitchens, and Andy Needham. 2017. 'Strangers in a Strange Land? Intimate Sociality and Emergent Creativity in Middle

- Palaeolithic Europe.' In: G. Warren and B. Finlayson (eds.) *The Diversity of Hunter-Gatherer Pasts*. Oxbow.
- Spikins, Penny, Andy Needham, Barry Wright, Calvin Dytham, Maurizio Gatta, and Gail Hitchens. 2018. 'Living to Fight Another Day: The Ecological and Evolutionary Significance of Neanderthal Healthcare.' *Quaternary Science Reviews* 217: 98–118.
- Spinapolice, Enza Elena. 2012. 'Raw Material Economy in Salento (Apulia, Italy): New Perspectives on Neanderthal Mobility Patterns.' *Journal of Archaeological Science* 39 (3): 680–89.
- Sykes, Rebecca M. Wragg. 2012. 'Neanderthals 2.0? Evidence for Expanded Social Networks, Ethnic Diversity and Encultured Landscapes in the Late Middle Palaeolithic.' In: Karen Ruebens, Iza Romanowska, and Rachel Bynoe (eds.) *Unravelling the Palaeolithic: Ten Years of Research at the Centre for Archaeology of Human Origins*. University of Southampton Archaeology Monograph Series.
- Sykes, Rebecca Wragg. 2020. *Kindred: Neanderthal Life, Love, Death and Art*. Bloomsbury.
- Tomasso, Antonin, and Guillaume Porraz. 2016. 'Hunter-Gatherer Mobility and Embedded Raw-Material Procurement Strategies in the Mediterranean Upper Paleolithic.' *Evolutionary Anthropology* 25 (3): 164–74.
- Trinkaus, Erik. 2018. 'An Abundance of Developmental Anomalies and Abnormalities in Pleistocene People.' *Proceedings of the National Academy of Sciences of the United States of America* 115 (47): 11941–46.
- Vanhaeren, Marian, and Francesco d'Errico. 2006. 'Aurignacian Ethno-Linguistic Geography of Europe Revealed by Personal Ornaments.' *Journal of Archaeological Science* 33 (8): 1105–28.
- Wenzel, George W. 2009. 'Canadian Inuit Subsistence and Ecological Instability—if the Climate Changes, Must the Inuit?' *Polar Research* 28 (1): 89–99.
- Whallon, Robert. 2006. 'Social Networks and Information: Non-"utilitarian" Mobility among Hunter-Gatherers.' *Journal of Anthropological Archaeology* 25 (2): 259–70.
- White, Randall. 2007. 'Systems of Personal Ornamentation in the Early Upper Palaeolithic: Methodological Challenges and New Observations.' In: P. Mellars (ed.) *Rethinking the Human Revolution: New Behavioural and Biological Perspectives on the Origin and Dispersal of Modern Humans*: 287–302. McDonald Institute for Archaeological Research.

- Wiessner, Polly. 2002a. 'Taking the Risk out of Risky Transactions: A Forager's Dilemma.' In: Frank K. Salter (ed.) *Risky Transactions: Trust, Kinship, and Ethnicity*: 21–43. Oxford: Berghahn Books.
- Wiessner, Polly. 2002b. 'Hunting, Healing, and Hxaro Exchange: A Long-Term Perspective on !Kung (Ju/'hoansi) Large-Game Hunting.' *Evolution and Human Behavior: Official Journal of the Human Behavior and Evolution Society* 23 (6): 407–36.
- Wiessner, Polly. 2014. 'Embers of Society: Firelight Talk among the Ju/'hoansi Bushmen.' *Proceedings of the National Academy of Sciences of the United States of America* 111 (39): 14027–35.
- Zilhão, João. 2014. 'The Neanderthals, Evolution, Palaeoecology and Extinction.' In: Vicki Cummings, Peter Jordan, and Marek Zvelebil (eds.) *The Oxford Handbook of the Archaeology and Anthropology of Hunter-Gatherers*. Oxford University Press. DOI: <https://dx.doi.org/10.1093/oxfordhb/9780199551224.013.054>.