Sex, symbolism and neanderthals

Not only did the neanderthals interbreed with our ancestors. These close cousins help shed light on what it is to be human, argues Camilla Power of the Radical Anthropology Group

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Did the neanderthals go through a symbolic revolution? The question helps us understand what exactly we mean by 'human revolution'. We can certainly learn a lot by comparing neanderthals with modern humans and establishing why our evolutionary outcomes were so different.

Neanderthals are, of course, our very close cousins, more closely related to us than any other species. Given recent genetic evidence for some level of interbreeding,[1] they can be considered as a human population anyway. Analysis of mitochondrial DNA from neanderthal bones found in Croatia suggests our most recent mtDNA common ancestor lived around 600,000 years ago,[2] and that individual was presumably an African hominin of the species *Homo heidelbergensis*. Our development was closely paralleled by that of the neanderthals. Only 300,000 years ago, our ancestors in Africa looked very similar to the European ancestors of neanderthals.

So I have little time for those who argue that neanderthals were deficient or stupid, with a poor grasp of language, were all brawn and no brain, had no ability to think and plan ahead and died out simply because they did not make the grade. Neanderthals coped in ice age Europe through a series of glaciations for a longer period of time than modern humans have yet existed. Let us see how long our span of existence compares before we judge them deficient.

I will approach the question through behavioural ecology, the science of animals' direct action on the world — how their behaviour changes in relation to their physical and social environment. The survival strategies of animals are influenced by purely material considerations, fundamentally ones of time and energy. If Marx and Engels were alive today, they would surely be pursuing this branch of Darwinism in order to understand the key features of human evolution.

Why are we here and the neanderthals are not? We must look in particular at symbolic culture and the symbolic revolution — a big and controversial issue. Today there are well grounded arguments that neanderthals, at times and in certain places, were indeed using symbolism. But if so, how did they compare with modern humans?

Let us start by looking at an image of the French Upper Palaeolithic, definitely made by modern humans of around 15,000 years ago (see pic 1). It is from a carving on an easily portable limestone plaquette, which shows women dancing together, with lines drawn between these 'power points' of the women — with repeated scoring of

[1] RE Green, J Krause, AW Briggs, T Marcic, U Stensel, M Kircher, N Patterson, M Fritz, N Hansen, EY Durand, A-S Malaspinas, JD Jensen,T Marques-Bonet, C Alkan, K Prüfer, M Meyer, HA Burbano, JM Good, R Schultz, A Aximu-Petri, A Butthof, B Höber, B Höffner, M Siegemund, A Weihmann, C Nusbaum, ES Lander, C Russ, N Novod, J Affourtit, M Egholm, C Verna, P Rudan, D Brajkovic, ☒ Kucan, I Gušic, VB Doronichev, LV Golovanova, C Lalueza-Fox, M de la Rasilla, J Fortea, A Rosas, RW Schmitz, EE Eichler, D Falush, E Birney, JC Mullikan, M Slatkin, R Neilsen, J Kelso, M Lachmann, D Reich, S Pääbo, 2010, 'A draft sequence of the neanderthal genome' *Science* 328: pp710-22.

[2] RE Green, A-S Malaspinas, J Krause, A Briggs, P Johnson, C Uhler, M Meyer, J Good, T Maricic, U Stenzel, 2008, 'A complete neanderthal mitochondrial genome sequence determined by high-throughput sequencing' *Cell* 134: pp416-26.

lines between their vulvas. It appears to be a cultural representation of some ritual, specifically around menstrual reproductive synchrony. Can we be sure the neanderthals never produced anything like this? If they were as intelligent as moderns, why not?

Now I will go back to evolutionary basics, about how animals use their resources of time and energy in order to replicate their genes. The hard-core Richard Dawkins 'selfish-gene' viewpoint focuses on the difference between the sexes in mammals and primates, as each sex has different means to pass on genes to the next generation. We can see the females as a kind of clock, because they have this precious, valuable fertility. For them, replication of genes is an intermittent, rare and very expensive process. In comparison, males produce their sperm relatively cheaply — there is plenty of it all the time, and a little of it goes a long way.

By altering the levels of synchrony of their fertility clocks, we see how females can transform their immediate social environment. If they align their fertile moments, one male can no longer pick and choose many females at their different moments of fertility, while keeping the other males out. Alignment brings more males into the mating system, and if the females need the males for anything, like protection or getting them food, then this is more readily achieved. On the other hand it may be a complete nuisance having all these males around — perhaps the males just compete for the food supply. The main point is that females potentially have the means either to align their cycles, bringing males in, or to disalign and throw most of the males out, leaving only one with access. This is the basic principle of reproductive synchrony, which is a fundamental variable in primate behavioural ecology of mating systems.[3]

That is the theory, but does it work in practice? For many primates, the ability or tendency of females to synchronise definitely exists. It may operate through pheromones or through power structure mechanisms. So a dominant female may be able to suppress reproduction in less dominant females. Alternatively she may synchronise with them and drive their cycles.

We have plenty of field evidence from studies of wild chimpanzees, our closest living relatives. When female chimps are in synchrony, reproductive success — literally measured by 'fitness', the ultimate currency of evolution — levels out among the males. The dominant males are unable to keep track of and guard all the females in oestrus — chimpanzee oestrous swellings being highly visible — so the lower ranking males get a chance to mate. In a study by Christophe Boesch and colleagues, when the females are out of synchrony, the alpha male monopolises reproduction almost completely — by as much as 90%. When females synchronise, fitness of the top three males levels out.[4]

[3] LM Carnes, CL Nunn and RJ Lewis, 2011, 'Effects of the distribution of female primates on the number of males', PLoS One 6 (5):e19853. doi:10.1371/ journal.pone.0019853.

[4] C Boesch, G Kohou, H Nene and L Vigilant, 2006, 'Male competition and paternity in wild chimpanzees of the Tai forest' *American Journal of Physical Anthropology* 130, pp103-15.

Langurs and infanticide

Field studies of hanuman langurs are famous for undermining what Trivers called the 'group selection fallacy'.[5] These monkeys featured in Sarah Hrdy's studyon infanticide, where langur males would kill babies other than their own. Usually one male guards his harem of females, while the other males live in bachelor bands. When these bands come into contest with a harem male and a new male takes over, almost his first act is to kill the babies up to a certain age. The females try to protect their babies, but that is difficult. After a very short time they return to menstrual cycling and will mate with the male that just killed their baby. Their babies are dead and this cannot be undone.

The advocates of 'group selection' used to argue that the top male kept the population down in order to protect limited available resources. The top male knows best and acts in the interests of the group as a whole. But, if so, how can the females' resistance to the infanticide be explained? Hrdy, a leading proponent of 'selfish-gene' theory, posed a different explanation: that the male is pursuing an entirely selfish strategy. He is trying to ensure that as many females as possible, as quickly as possible, become fertile and available to him. He is trying to change the clock of their fertility in order to do this.

Langurs do not always live in single-male harem groups. There is variability in the natural environment and the way in which females can affect the structure of social groups. Primatologist Volker Sommer and colleagues[6] have followed two distinctive groups, one in Ramnagar in Nepal, and an Indian group in Jodhpur — a very arid environment. Ramnagar fluctuates by season. After the rainy season, when there is a glut of food, many langur females suddenly become fertile. When the females' fertility becomes aligned, males flood in and we see multi-male groups. One harem male simply cannot keep out rivals. Unlike chimps, langurs do not show any sign of ovulation. Like humans, they can extend their receptivity — when they are interested in having sex — through a large chunk of their cycle: nine days or more out of a 28-day cycle. Generally langurs do not show any sign of menstruation either, so they have a cycle that does not pin-point the timing of fertility, but they are showing that they are interested in sex for a large part of that cycle. The effect is that plenty of males have sex with numerous partners, and they do not know whether the female is fertile when they copulate. Consequently subordinate males have a chance of getting a female pregnant. This spreads paternity among the males and makes infanticide unlikely, as the males do not know which baby is theirs.

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[5] RL Trivers *Social evolution* Menlo Park, CA 1985.

[6] V Sommer, A Srivastava and C Borries, 1992, 'Cycles, sexuality and conception in free-ranging female langurs (Presbytis entellus)' *American Journal of Primatology* 28 (suppl): S1-27; M Heistermann, T Ziegler, CP van Schaik, K Launhardt, P Winkler and JK Hodges, 2001, 'Loss of oestrus, concealed ovulation and paternity confusion in free-ranging Hanuman langurs', Proceedings of the Royal Society of London, 268, pp2445-51.

The females are winning as far as infanticide goes, but they suffer also. Having too many males around eating their food constricts the females' ability to reproduce. The females cannot escape the seasonality in Ramnagar's environment and are unable to avoid the males flooding in when they are all fertile. So there are costs and benefits in the strategy.

This situation is different in Jodhpur. Here too there is a very arid seasonal environment. But the group under study were fed year-round by a local temple community, changing the profile of the langurs' seasonality. Throughout the year some of the females, not all of them at once, are fertile. One male is able to guard the whole harem. Assisting this is the arid, open country, so the harem male can easily see when he is threatened by approaching males. But in these different circumstances the females, being non-seasonal, avoid synchronising themselves. They want only one male. They help achieve this by staggering their cycles. They enable one male to keep guard over them for a couple of days before moving onto the next fertile female. They do this by giving a clue that they are menstruating, implying that soon the male will need to come and mate them. This ensures that the male knows he is the father of the offspring — which is fine, as long as he is the male in charge. The cost is that if a new male takes over they will lose their babies. This is a huge cost when it happens — langurs take seven months to gestate and over a year to raise and breastfeed their babies. But there are not huge numbers of males around eating their food.

Consequently the Jaipur females, despite suffering infanticide every few years, are — in most years — actually able to have *more* babies, more regularly than those in Ramnagar. The female langurs are able to vary their sexual signals to manipulate males in different ways in different environments — within a *single* species. This 'natural experiment' with monkeys uses a framework within primate behavioural ecology which will be useful in thinking about the differences between neanderthals and humans.

In spite of being very different primates, the sexual signals used by women are quite similar to those of langurs. A key factor — even if you do not accept complete 'concealment' — is the extreme unpredictability of women's ovulation cycles.[7] Women are designed to scramble information about fertility by putting out all sorts of distracting signals: even considering the way we walk, the clothes we wear, etc. For instance, the 'copuline' hormones, thought to make women more sexually interesting to men, are not produced at the time of ovulation, as one might expect, but on an unrelated cycle, confusing the males. Copulines even things out. Men keep trying to work out the timing of these signals, but end up confused. This design in our evolutionary past of concealing any real information about when we are fertile is highly similar to that used by the langur monkeys. They must, as a matter of life and death, conceal information about ovulation.

[7] RD Martin, 1992, 'Female cycles in relation to paternity in primate societies' in RD Martin, AF Dixson and EJ Wickings (eds) *Paternity in primates: genetic tests and theories* Basel 1992, pp238-74.

In the case of our evolution, this results in paternity confusion, which helps the females by encouraging more males to hang around and provide food or protection. It is highly likely that our evolutionary heritage is one of paternity confusion. — this is basically supportive to the old Bachofen/Morgan/Engels argument. This attacks the idea that pair bonding, monogamy or the nuclear family is the standard evolutionary trajectory of humans. Paternity confusion — where more than one male thinks he may be the father of a child and therefore protects it — may have been a better strategy for human females. The use of concealment is a counter to infanticide. But humans are also different from langurs: human menstruation is clearly visible and marks out which females are pregnant and which are not.

Synchronisation

Obviously, we are very different from small monkeys like langurs in other respects, principally, our body size and of course, brain size. Let us look at the development of the brain. Fig 1 illustrates brain size, going back three million years. It shows a big leap from australopithecines to the first species of *Homo*, which had a brain about twice as big. Then it remains steady for a while, until about half a million years ago, when the common ancestor of neanderthals and modern humans evolves. The brains of this species were about three times the size of the australopithecines. Even two million years ago, the high cost to females of producing large-brained offspring was already an incentive towards concealment strategies as a means of limiting infanticide. And there is also the question of reproductive synchrony.

To fuel increasing brain size and break through the 'grey ceiling' of a 700-800cc brain, human females must have had help with child-rearing — some kind of social care system and cooperation. No other primates have broken through this barrier, because the females have to raise their offspring without help. The major candidates for assistance are female kin and males.

How can the females get the males interested in this task? Concealed ovulation helps to a certain extent. If all the females show and align their fertility, several males will be brought into the mating system and have a chance at fertilisation. However, knowing exactly when a female is fertile gives no motivation to hang around after copulation. Synchronised but concealed ovulation has a greater effect. More males are brought in, because they do not know when they have successfully fertilised a female. They are more likely to stick around to discover if this is the case and provide help or protection. This combination of concealing and synchronising ovulation should in theory bring more males into the mating system. Two million years ago in our ancestry, the combination of these two mechanisms may have been very useful for early *Homo erectus* females.

But, while langurs can bear young annually in favourable conditions, among our recent hunter-gatherer ancestors there was a three- to four-year interval between one

birth and the next: a nine-month gestation period and then breastfeeding for two to three years, before beginning to cycle again. That is seen in hunter-gatherer societies today with a sexual division of labour. Our *Homo* ancestors evolving from australopithecines with their chimpanzee-sized brains probably had a four- to five-year inter-birth interval.

This raises the question of how clockwork-like synchrony could be achieved. If a baby dies soon after birth, the mother is not going to wait three or four years until all the females are aligned in their fertile period, before becoming pregnant again. That would be too detrimental to her reproductive success. She will go ahead and become pregnant again. So there will be a group of females giving birth in every year. This random pattern means a dominant male does not have to guard all the females at once, because they are not all fertile. He can concentrate on the females who are actually cycling in any one year. This gives the dominant male in early *Homo* groups a high reproductive success rate.

It can be argued, however, that this can be kept in check if the females are highly seasonal: that is, all fertile only once a year (like the langurs in the rainy season). In a seasonal system, any male will have his work cut out trying to deal with more than one female at a time. He must wait until the following year, when more females begin to cycle, before moving on to another one. This means that at least a couple of other males will be brought into the mating system, which would be good for the females. It would be better still if each female could mate more than one male, spreading the chances of paternity around more males, getting a higher number involved in the mating system.

These two scenarios — random vs seasonal breeding — are radically different. We can play evolutionary computer simulations with these two games. In a random pattern where there is no seasonality, a dominant male has so much potential fitness by mating whichever female is currently fertile, that there is no motivation for him to start settling down and staying with one female to help her until her baby is in a good position to survive, before moving on. In the seasonal scenario, where he has only one female a year to breed with, it is in his interest (even for a top male) to stick with her and help her out during the first year of his offspring's life and give it a better chance of survival, rather than abandon her on the slim possibility of being able to mate again. So there is a radical difference in what males should do, in terms of invest or desert, if the females are in a seasonal pattern, as opposed to a random pattern of cycling.

From two million to 500,000 years ago, while the brain size of *Homo erectus* remained fairly steady (two to two and a half times chimp size), we can guess females had enough help from female kin and, occasionally during fertile periods, from males. When she was cycling, the males would become particularly interested in her. These periods would coincide with weaning, when gifts of food would be particularly useful and increase the weanling's chance of survival. Half a million years ago with *Homo heidelbergensis*, the common ancestor of ourselves and the neanderthals, we see a massive increase in brain size. These large-brained offspring were extremely energy expensive and meant the females needed their mates to start doing some serious work. In the archaeological

record, with *Homo heidelbergensis* we start to find hunting spears, which show they were already hunting large animals.

Human revolution

Going back to human sexual signalling, we saw that the precise moment of female fertility is hidden, but menstruation, and therefore pregnancy, is visible. This acts as a flag to males. In a 'selfish gene' world, they are unable to ignore this signal. All the males will be interested in the females who are menstruating and therefore not pregnant. But it is the ones who are not cycling — either pregnant or breastfeeding — who require extra food and are most in need of male support.

This means that a menstrual female immediately puts the males into competition with each other, and also females in competition with each other for male investment. Child-burdened mothers must resist the ability of dominant males to mate with cycling females as and when they become available. If one of the females in a group begins to menstruate, the other females need to take control and make sure no male gets hold of her.

Then, they have two options. Either they could try to hide the cycling female with her signal — which stays with the logic of concealing all signals from males. The other possibility is that the females appropriate and amplify the signal, sharing it around the whole group. This is what the 'cosmetic coalition' theory argues: modern human females used natural red ochre pigments to simulate menstruation. If all the females covered themselves in red ochre, males could not determine who was menstruating and about to become fertile. By spreading this signal evenly among the females, they assert equality, solidarity and are no longer in competition with each other. A dominant male will not be able to pick out just fertile females for his attention; instead all the males, in response to the female solidarity, now can work in solidarity to go hunting. When they return with hunted game, they will be welcome for sex. This signal was less about 'fooling' the males and more about signifying that the females formed a coalition in solidarity, that they had the kinship network to stand together and go on sex-strike if the males failed to help.

In the story of the human revolution this is a testable model, with specific predictions.[8] We expect the earliest evidence of symbolic behaviour to be a cosmetics industry focused on red pigment. Because females are under selection to produce larger-brained babies who require much more energy and work in terms of breastfeeding, the whole strategy will be driven by the degree of increase in brain size. Therefore, we expect the strategy to start during the main phase of brain size increase, somewhere between half a million years ago, up until about 150,000 years ago, when modern human brain sizes started to level off.

[8] C Power, 'Sexual selection models for the evolution of language: why they should be reversed', in R Botha and C Knight (eds) *The cradle of language* Oxford 2009, pp257-80.

Archaeological evidence of red ochre finds go back 300,000 years in Africa, with some possible older finds. The evidence for this increases with the emergence of modern humans from 160,000 years ago and is found all over the continent, from north Africa to southern Africa, and into the Middle East.[9] Red ochre pigment artefacts, engraved and decorated, are credited with being the earliest examples of symbolic production or art.[10] My colleague, Ian Watts, has focused his work on analysis of these pigments. Ochre also comes in yellow and there are black pigments which may have been used too. But he has found overwhelming evidence that some 80% of the ochre used tended to blood red. People have tried to argue that the ochre was being used for other utilitarian purposes and not only for symbolism or display. One argument against this is that, the more work done to a particular piece — whether it has been honed into a crayon, for example, or etched with engravings — the more likely it is to be of a deep red colour. Grinding the ochre into pigment is a labour-intensive task done mainly by women in recent historic ethnography; the grindstones used for this task turn up in the archaeological record from 200,000 years ago. Shell necklaces found from 100,000 years ago in the African and Middle Eastern archaeological record are sometimes coloured with ochre. The female cosmetic coalition theory is currently the only Darwinian hypothesis for the ochre which has been found.

Neanderthal parallel?

The next question is: what about neanderthals then? If our model is driven by the pressures on females from increasing brain sizes, neanderthals are known to have at least as large brains as our ancestors. So don't female neanderthals have the same problems in raising these very large-brained babies? Surely they also need male help, and need strategies to get it? What difference would there be between them and our *Homo sapiens* ancestors?

Despite the lesser amount of research done in Africa compared to that done on the neanderthals in Europe, we have a more frequent, more consistent pigment record in Africa. The evidence of ochre goes back 300,000 years, it is found all over Africa and when our ancestors began to spread out from there, they took it with them; it is like a species mark of *Homo sapien*s. It should be stressed that we are talking about symbolic culture in Africa two or three times longer than it has existed anywhere else on the planet.

But is that true? What about Eurasia? Ochre is not only found in European sites in France, Czechoslovakia and Holland, but also in India. From about a quarter-million

[9] I Watts, 'Red ochre, body painting and language: interpreting the Blombos ochre', in R Botha and C Knight (eds) *The cradle of language* Oxford 2009, pp62-92.

[10] CS Henshilwood, F d'Errico, R Yates, Z Jacobs, C Tribolo, GAT Duller, N Mercier, JC Sealy, H Valladas, I Watts and AG Wintle, 2002, 'Emergence of modern human behavior: Middle Stone Age engravings from South Africa' *Science* 295, pp1278-1280.

years ago, a crop of cases with red ochre appear. So you could say — and some of the 'pro-neanderthal' people, who want to prove that the neanderthals are every bit as capable as moderns, are saying — it is about the same timeline as in Africa. However, between about 200,000 and 100,000 years ago, there is virtually no pigment evidence found in Eurasia — a significant difference between the Eurasian record and the African one. After this gap in the record, the evidence of pigment begins to build again. Particularly interesting are well researched French sites in the Dordogne. Here there is evidence of a neanderthal pigment industry dating from before moderns spread into Europe. Looking back 50 or 60 thousand years, before there were any modern humans around, there is a considerable amount of pigment being used — but, in some sites, it is black manganese, not red.

To sum up the comparison of the cosmetic record, although the pigment record starts at roughly the same time in Europe as in Africa, there are nowhere near as many sites: only a few clusters and a big gap (in Africa it is continuous). Frequent use of pigment gets going late in the day and then there is rather more black than red. Also, we never get pigments across all neanderthal sites, just some of them.

So let us look at the energetics. Did the neanderthals need the same amount of time and energy to go about their daily business and get the food they needed to survive and reproduce? If you look at the fossil record in Europe and Africa and compare the rates of increase in brain size through time, they hardly differ. What is different is 'robusticity'- body size, shape and weight. Quite late in the day, after 100,000 years, modern humans became relatively gracile — or light-boned — compared to neanderthals. Brain size in neanderthals and moderns may not be different, but in body size and shape there is a big difference, and this changes energetic requirements. Neanderthals had large, barrelled chests and were very muscular — the shoulder bones of both males and females show grooves of the musculature — and they had big, strong, grasping hands. Their body weights are bigger, which implies that they need more energy to move those bodies and be able to find the food to fuel them.

Various energetics models have focused firstly on their bigger body size and secondly on their shape — they were very short. Their short stocky limbs are believed to have developed as a result of adapting to the cold environment: they lived in periglacial European environments during ice ages. Their short limbs may have made their locomotion less efficient than ours, which are efficiently designed for moving around the African savannah. Their much colder environment may have meant that they had to raise their metabolic rate and therefore their food intake. Studies of Arctic hunters and those of Tierra del Fuego have suggested that they would have needed an extra 10% of calories daily.[11]

[11] MV Sorenson and WR Leonard, 2001, 'Neanderthal energetics and foraging efficiency' *Journal of Human Evolution* 40: pp483-495; AT Steegmann jr, FJ Cerny and TW Holliday, 2002, 'Neanderthal cold adaptation: physiological and energetic factors' *American Journal of Human Biology* 14, pp566-83.

Wil Roebroeks and colleagues at Leiden University have looked at how neanderthal energetics requirements affects what we are likely to see in the archaeology.[12] Neanderthals would have had different solutions to moving about their environment and the way in which they use it. With their big, strong, hefty bodies they could not have travelled long distances efficiently every day. That might mean, for instance, that if they make camp, they would go only a short distance outside it, exhausting the food in quite a short radius around it and then having to move on quite quickly. Modern humans, in contrast, could travel long distances from their camp, and spend long periods travelling. While neanderthals would shift base frequently, modern humans would set up a base camp and operate from there. This difference will be reflected in the archaeology. Neanderthals are not going to be bothered to make fancy campsites with beautiful shelters, because they would soon be moving on. For a long time it was thought that neanderthals did not beautify their homes because they were just too stupid. No, they were using the landscape in a different way. This could explain many differences between the archaeology of the moderns compared to the neanderthals.

Seasonality

Let us focus on that 100,000-year gap in the penultimate glacial, the glacial cycle from about 190,000 years ago. While modern humans were speciating in Africa, neanderthals were going through this long period of cold in Europe. Of course, they would not have been where the glaciers were — they would have been southerly; but they would have been dealing with periglacial and steppe-like environments.

The importance for my argument is that neanderthal females are certain to have been highly seasonal in terms of reproduction. Females would have come out of winter really lean, completely infertile, needing the spring and summer to build up energy reserves for reproduction. We can predict they would be cycling towards late summer. So we are talking about significant seasonal synchrony, which would impact on the profile of reproduction.

I am arguing that neanderthal females were cycling within a short time of each other, with births clustering at certain times of the year, while tropical African females were cycling in a much more random way with births spread out throughout the year. A neanderthal male's chances of finding more than one female in a year were slim, because he had to stick with his female when she was likely to be fertile around mid to late summer. This is something we know from Inuit seasonality. The population breaks up into pair-bonds during the summer time and people come back together in winter.

This 'seasonality thermostat' model now overlays the model of the female cosmetic coalition that I have already argued. During harsh climate in glacial cycles, it would

[12] W Roebroeks, and A Verpoorte, 'A "language-free" explanation for differences between the European Middle and Upper Palaeolithic record', in R Botha and C Knight (eds) *The cradle of language* Oxford 2009, pp150-66.

not pay males to philander and seek other mates, because females will be lined up seasonally. Any male will have access to one female each year. In those conditions it begins to pay even alpha males to stay home and look after the children. In these glacial conditions, affecting female reproductive synchrony, the females do not need cosmetic rituals to make the males work.

The neanderthals existed through a time of great fluctuations in climate. Ice ages were interspersed with some much warmer periods. When climate warms to the extent that seasonality is disrupted, we would expect to find neanderthals using cosmetics again (see fig 2). And we do start to find clusters of examples of worked ochre and manganese. There are sites in India, Czechoslovakia and Holland which may coincide with these warm periods. These theories can best be tested at well researched sites like Combe Grenal, where the ochre can be traced through levels which coincide with relatively mild periods. At Pech de l'Azé, again the major finds of pigment occur at a relatively mild period. It is black, but here worked into crayons.[13]

It is sheer prejudice to look at these examples of colour crayons, and not acknowledge neanderthal symbolic usage. Similar materials among modern humans are immediately given that status. There is now also strong evidence that 45,000–50,000 years ago neanderthals in south-east Spain had elaborated symbolic traditions combining pigment with marine shells,[14] while in northern Italy at around 44,000 years ago, they were interested in the ornamental exploitation of the feathers of large raptors.[15]

The point of contact between neanderthals and moderns occurred about 42,000 years ago. The actual dating is a subject of huge controversy. Some people say that modern humans came in earlier, which is why you find evidence of ritual and symbolism; that the neanderthals did not develop these things by themselves, but copied them from the moderns. But there are sites where beautifully crafted examples of fox teeth beads are found, in an autonomous neanderthal style (illustrated by the pictures on this page).[16] In this Chatelperronian industry, red ochre becomes far more frequent again than the black manganese. What that says to me is that it does not matter if the neanderthals were picking it up from the modern humans or were already starting to do it by themselves; they were able to read the signals. In other words, the signals

[13] M Soressi and F d'Errico, 'Pigments, gravures, parures : les comportements symboliques controversés des néandertaliens', in B Vandermeersch and B Maureille (eds)*Les Néandertaliens: Biologie et cultures* Paris 2007, pp297-309.

[14] J Zilhão, D Angelucci, E Badal-García, F d'Errico, F Daniel, L Dayet, K Douka, TFG Higham, MJ Martínez-Sánchez, R Montes-Bernárdez, S Murcia-Mascarós, C Pérez-Sirvent, C Roldán-García, M Vanhaeren, V Villaverde, R Wood and J Zapata, 2010, 'Symbolic use of marine shells and mineral pigments by Iberian neanderthals', proceedings of the National Academy of Sciences 107, pp1023-28.

[15] M Peresani, I Fiore, M Gala, M Romandini and A Tagliacozzo, 2011, 'Late neanderthals and the intentional removal of feathers as evidenced from bird-bone taphonomy at Fumane 44 ky BP, Italy', proceedings of the National Academy of Sciences 108, pp3888-93.

[16] F d'Errico, J Zilhão, M Julien, D Baffier and J Pelegrin, 1998, 'Neanderthal acculturation in western Europe? A critical review of the evidence and its interpretation' *Current Anthropology* 39 (suppl), S1-S44.

worked. To me it means that the neanderthals and moderns were able to communicate on some level, ritually, through those signals.

There are people willing to argue that rather than neanderthals being killed off by moderns rampaging in from Africa, actually they would have had plenty of common ground; they would have been able to trade and signal to each other, even if they were not talking the same language. If ultimately the neanderthals were mobilising symbolic strategies as a regularity, I do not doubt there was linguistic communication going on. And we do now have significant evidence of interbreeding (although not yet from DNA of the European Upper Palaeolithic period).

Neanderthal cultural evolution

My final point comes out of the langur example and the different uses of sexual signals. The female cosmetic coalition theory is driven by mothers' material requirements of energy as brain sizes increased. Brain expansion pushes it, and females have to resist the problem of male philanderers, who are going to try to pick and choose the fertile females, whilst the pregnant and lactating females get left out. One of two options are available. Either you confuse the menstrual signals through the use of ritual, so amplifying them and showing yourselves off. Or you hide them.

This is the road the neanderthals would have been going down because of the ice age climate with strong reproductive seasonality. If seasonality is being used to keep the males in check, menstrual signals must be hidden from all the males except the one the female has paired with, because if the males can see menstruating females, it will cause competition, and undermine the system. So neanderthals hide the signals, while moderns exaggerate them.

But when the climate changes and it gets really warm, things go into reverse for the neanderthals. Suddenly they are able to reproduce through longer periods of the year. Then these menstrual signals are there and the philandering can start. So, in the case of the neanderthals and symbolic culture, it was as though they were stopping and starting, stopping and starting, in relation to the overall climate. In terms of cultural evolution, this would undermine any 'ratchet effect' of accumulating and building on cultural knowledge.

If such cultural traditions were recurrently abandoned at the shift into glacial phases, especially the penultimate glacial of 190,000–130,000 years ago, this could prevent cosmetic signalling being driven by sexual selection in the way it was for moderns. Another possibility is that the sexual selection effect was delayed until later and localised in the neanderthal case.

On the question of neanderthals and language, this model potentially implies that *Homo heidelbergensis* of 300,000–400,000 years ago would have had many capacities which enabled language to be used as a communications system. To the extent that *Homo heidelbergensis* was beginning to engage with a ritually structured sexual division

of labour, then I think they could be language-using. As soon as anything like 'cosmetic coalitions' were going on — and, remember, I am only taking into account when there is evidence of pigment — some of this could have happened on an impromptu basis even before we see any pigment. If those people were hunting huge, dangerous animals such as mammoths 400,000 years ago, they had to be able to work rituals together. Each had to know what the other was going to do in those dangerous conditions. If they could trust each other that much, they must have been able to speak to one another. So we can imagine language emerging both in the ancestry of neanderthals and the ancestry of modern humans around 400,000 years ago when those populations had already diverged. I do not see why not.

The same driving forces of brain expansion and the same requirements of sexual division of labour would be in place. I profoundly disagree with Robin Dunbar's view that language comes first and drives ritual. With Chris Knight's arguments and this prototype of ritual activity, we strongly argue that trust must be established among ritual coalitions for the linguistic capacities to then flow into performance and enable us to start talking to each other. To be able to trust each other we have to have ways of performing costly signals of commitment and bonding with each other. Linguistic signals can just too easily be used to deceive. We are extremely Machiavellian in our intelligence. Without strong bonds of commitment to each other, those cheap signals will be used to lie.

The key to all this human potential, whether modern or neanderthal, was overcoming male competition (just as Engels had it on mutual tolerance of the males). The theory of the human revolution has to explain the revolution that went right through the whole society, resulting in trust that enabled language, the construction of kinship systems, to enable economic exchange and all the capacities for flexible cultural and technological innovation. Ritual must come first, before language; as soon as ritual is there, language flows. Marx called language "agitated layers of air". You cannot drive material economic factors with words. You cannot tell men to go hunting with little words, especially if those men are worried that if they go off hunting some philanderer is going to come to the camp and have sex with the fertile females. It is only when you have overcome the difficulties of competition that you can you afford to leave camp altogether and go and hunt those animals. Otherwise, you are too worried about keeping watch over your pair-bond partner.

As for the cosmetic strategy, the neanderthals seem to drop it and take it up again, drop it and take it up again — not because they were stupid and could not work it out, but because they were able to survive with other strategies, and did not need it. When it finally got going, in at least some places in France and Spain, they were handicapped by not having the same pressures which the modern humans had as a regularity pushing them all the way through.

In conclusion, we can see a sequence of different outcomes in a revolutionary process. We can see revolution as a strategy which was repeated and performed, or maybe not performed and just left aside, before it was utilised again. I would highlight this

'revolutionary' factor — you could call it consciousness, I suppose, which is a vital factor beside the Darwinian motor of sexual selection. Those forces were driving the process of speciation, whether genetically or culturally.

But the crucial difference in the processes between moderns and neanderthals may have been to do with this spread of revolutionary action. Sometimes it cropped up, like temporary picket lines, then the struggle died down again, and nothing was happening, before neanderthal females were forced into trying again with cosmetic strategies. Somehow, for the neanderthals, it always remained too localised, constrained in space and time, and did not really become species-wide. The 'seasonality thermostat' may be the reason why.

This article is based on a speech given to the CPGB's Communist University

Camilla Power
Sex, symbolism and neanderthals
Not only did the neanderthals interbreed with our ancestors. These close cousins help shed light on what it is to be human, argues Camilla Power of the Radical Anthropology Group
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