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Neuroscience, evolution and the sapient paradox: the factuality of value and of the sacred

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The human genome, and hence the human brain at birth, may not have changed greatly over the past 60 000 years. Yet many of the major behavioural changes that we associate with most human societies are very much more recent, some appearing with the sedentary revolution of some 10 000 years ago. Among these are activities implying the emergence of powerful concepts of value and of the sacred. What then are the neuronal mechanisms that may underlie these consistent, significant (and emergent) patterns of behaviour?

Keywords: evolution of mind; speciation and tectonic phases; sedentary revolution; value; the sacred

1. INTRODUCTION

The human mind over the past 10 000 years, in most areas of the world, has developed symbolic concepts of such evident factuality that it is difficult for us now to imagine life without them. These include notions of value (including money), of number and measure, of individual people of high status and power, and of material things that embody the sacred and the forbidden. These are often considered givens of the human condition. Yet these features are not 'givens' at all—they are emergent features of the past 10 000 years. How are such fundamental changes in the human condition supported in the brain? The problem for the neuroscientist and the evolutionary archaeologist is to understand how this has come about on so short a time frame, when the human genome has been established for much longer, certainly since the out-of-Africa dispersals of some 60 000 years ago (Forster 2004; Mellars 2006*a*,*b*). This problem indeed relates to the sapient paradox (Renfrew 1996): that the biological basis of our species has been established for at least that time (and perhaps for as much as 200 000 years), while the novel behavioural aspects of our 'sapient' status have taken so long to emerge or to construct themselves, or rather that they have done so very recently. This must lay emphasis upon the plasticity of the human brain (its capacity to adapt within a single lifespan to new conditions) and on the aspects of the socialization process of shared experience.

Both this plasticity and the socialization process imply the significance of the development of neuronal networks in early childhood. As will be argued below, the mechanisms in question must form part of the learning process of the individual, a process shared with and participated in by other individuals in the society in question. These processes must favour the development and fixing of symbolic relationships and representations. In many cases, these are not simply verbal or conceptual relationships. Instead they involve contact with and understanding of the material world.

For the archaeologist, the challenge is to understand how human societies, through their interactions with the material world, came to bring about the transformations in life and culture over the millennia drawing upon a hardware (the human genome) that may not have changed significantly in the space of 10 000 years. This invites a cognitive archaeology: the archaeology of mind (Renfrew 1982; Renfrew & Zubrow 1994; Mithen 1996). For the neuroscientist, the equivalent challenge may be to show how the potential capacities of the human mind, presumably present 60 000 years and more ago, were brought into play, through the activities of successive generations of individuals, within specific trajectories of cultural development, so that human performance (and with it human existence) was profoundly transformed. The perspective has, in one sense, to be long term (phylogenetic), but if the genetic basis for the neonate in each generation is the same, the differences between succeeding generations must be explained within the learning processes of the individual in each generation (i.e. ontogenetically).

To approach these problems effectively may require a partnership between neuroscientists and archaeologists working on different aspects of the human condition. To do so will require a perspective that recognizes that 'mind' is the result of embodied experience and of material engagement with the world (Clark 1997; Malafouris 2004), so that the neuroscience of embodied experience and of social engagement will be crucially relevant. One crucial component of that experience and engagement is located within the individual human brain (inside the individual cranium), which seems to be the special preserve of the neuroscientist. But the only conceivable solution to the sapient paradox requires that the performance of this brain should be seen within a short-term evolutionary context where genomic change is probably not significant.

In what follows the evolutionary context, on the basis of recent archaeological understanding, will first

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be outlined in part I (§2). In part II (§3) an attempt will be made to consider and define more closely some of the emerging properties of the human mind for which some understanding of the neurological basis might be sought. For it is presumably on the basis of the neurological endowment of our species, present, even if still latent, within the human genome more than 60 000 years ago, that these emergent properties have been constructed.

2. PART I. THE EVOLUTIONARY CONTEXT: THE SPECIATION AND TECTONIC PHASES

(a) *The speciation phase*

Recent DNA studies (e.g. Forster 2004) appear to have resolved many of the controversies about the evolutionary ancestry of *Homo sapiens*. The multi-regional hypothesis, according to which hominin ancestors (such as *Homo erectus* or *Homo ergaster*) in various continents made their contributions, has given way to the out-of-Africa hypothesis, which states that the ancestors of all living humans were present in Africa prior to the dispersals *ca* 60 000 years ago (Foley & Lahr 2003; Mellars 2006*b*; Mellars *et al.* 2007). The departure from Africa of mtDNA haplogroups M and N provided the ancestry for all living humans elsewhere, while closely related humans remaining in Africa were ancestral to most subsequent Africa populations (other than M and N descendents subsequently back migrating).

The behavioural attributes associated with the new species are not so easy to define. Until a couple of decades ago (before the impact of that clear DNA picture), it was possible to speak of a 'human revolution' (Mellars & Stringer 1989). This was most clearly seen in southwest Europe where the transition from *Homo neandertalensis* to *H. sapiens* by *ca* 40 000 BP was accompanied by a range of new behaviours. It was suggested by some that this was the time when a capacity for complex speech first developed, and perhaps for self-conscious reflection also. These archaeologically attested behaviours (Mellars 1991) included: a shift in the production of stone tools from a 'flake' technology to a 'blade' technology, and an increase in the complexity of the stone tools produced; the appearance of artefacts made of bone, antler and ivory; increased tempo of change with regional diversification; the appearance for the first time of a wide range of beads and personal adornments; significant change in both the economic and social organization of human groups; and the development (although restricted mainly to France and Spain) of 'naturalistic' art.

More recently, work on the Middle Stone Age of southern Africa (McBrearty & Brooks 2000) has led scholars to situate the emergence of most of these features (although emphatically not the Franco-Cantabrian cave art) to a period prior to 70 000 years BP, where many of them are seen at sites including the Blombos Cave (Henshilwood & Marean 2003; Henshilwood *et al.* 2004). They are therefore plainly documented there prior to the out-of-Africa dispersals of *ca* 60 000 BP. Moreover fossil remains of what seem to be anatomically modern humans are found at sites such as Herto in Ethiopia as far back as 200 000 years ago. The appearance of the behavioural traits in question may have been more gradual and more piecemeal than has formerly been thought, so that the term 'revolution' has to be used with caution (Gamble 2007). There is no agreement at present as to whether speech capacity emerged by *ca* 200 000 BP with *H. sapiens*, or earlier and gradually over a much longer period. The discovery of clearly intentional patterning on fragments of red ochre from the Blombos Cave (at *ca* 70 000 BP) is interesting when discussing the origins of symbolic expression. But it is entirely different in character, and very much simpler than the cave paintings and the small carved sculptures which accompany the Upper Palaeolithic of France and Spain (and further east in Europe) after 40 000 BP.

For the purposes of the present paper, I would like to emphasize the (slightly over-simplified) point that in biological, i.e. genetic, terms the evolution of our species must have been effectively accomplished by the time of the out-of-Africa dispersals. Molecular genetics does of course indicate diversity among living humans, but on a relatively minor scale. All human societies share the same capacity for complex speech. Moreover, although we do not yet have ancient DNA from human fossils dating to the millennia following those dispersals, there is no reason to suggest that the human genome 60 000 years ago differs significantly and systematically from that of today. What we may term the 'speciation phase' of human evolution (Renfrew 2006, p. 224, 2007*a*, p. 94), the period when biological and cultural coevolution worked together to develop the human genome and the human species, as we know it, was fulfilled already 60 000 years ago. This implies that the basic hardware—the human brain at the time of birth—has not changed radically since that time.

That brings us to the sapient paradox.

(b) *The tectonic phase*

The life of the hunter-gatherers who left Africa some 60 000 years ago does not appear to have differed very significantly from those remaining in Africa, and indeed from their predecessors. These were relatively small bands of gatherers and hunters, leading a mobile existence, with no permanent places of residence. Their tool kits were often restricted to the artefacts that they could carry with them. In some respects they had highly sophisticated social relationships and technologies. Their ancestors had long known the use of fire. They were adept at using stone-tipped projectiles and at hunting in groups. As they peopled the continents of the earth, the different groups and lineages developed their own adaptations to the environment and their own trajectories of development. Interactions between neighbouring groups were very localized, so that in most respects the subsequent cultural evolution of the different territorial groups was an independent process, although always on the basis of the shared genetic and cultural heritage which they had brought with them from Africa.

It is important to remember that what is often termed cave art—the painted caves, the beautifully carved 'Venus' figurines—was during the Palaeolithic (i.e. the Pleistocene climatic period) effectively restricted to one

developmental trajectory, localized in western Europe. It is true that there are just a few depictions of animals in Africa from that time, and in Australia also. But Pleistocene art was effectively restricted to Franco-Cantabria and its outliers.

It was not until towards the end of the Pleistocene period that, in several parts of the world, major changes are seen (but see Gamble (2007) for a more nuanced view, placing more emphasis upon developments in the Late Palaeolithic). They are associated with the development of sedentism and then of agriculture and sometimes stock rearing. At the risk of falling into the familiar 'revolutionary' cliché, it may be appropriate to speak of the Sedentary Revolution (Wilson 1988; Renfrew 2007*a*, ch. 7). Along with village life, implying much larger permanent communities, there came in the Near East a whole range of new artefacts, including querns, grindstones, and polished stone tools, along with pottery and other products implying the controlled use of fire. New ritual practices appeared involving the use of shrines and sometimes of human representations. Long-distance trade developed, as did local stylistic zones. More importantly, new concepts arose—the institutional facts discussed by the philosopher Searle (1995). It is at this time that the notions of personal and heritable property must have become significant (Renfrew 2001). The pace of change became much more rapid.

Although the details are different in each area, we see a kind of sedentary revolution taking place in western Asia, in southern China, in the Yellow River area of northern China, in Mesoamerica, and coastal Peru, in New Guinea, and in a different way in Japan (Scarre 2005). In most of these places pottery soon came into use, and there were other features resembling the early developments in western Asia, including new ritual and cult practices, although each area had its own characteristic innovations. In each case they were soon sustained by the domestication of local plants, and in some cases animals. And often these were expansive economies. The increase in population density permitted by agricultural production and by sedentary life was accompanied by population expansions and agricultural dispersals, in some cases also generating the spread of specific languages and language families.

From a distance and to the non-specialist anthropologist, this Sedentary Revolution looks like the true Human Revolution. It was then that patterns of living changed directly and trajectories of development were initiated which in some areas soon led to the rise of urban life and of state societies and indeed to the rise of literacy.

Why did it all take so long? If the sapient phase of human evolution was accomplished some 60 000 years ago, why did it take a further 50 000 years for these sapient humans to get their act together and transform the world? That is the sapient paradox.

I believe that it presents a significant challenge to the neuroscientist. The hardware was there 60 000 years ago (in the sense of the genetically inherited component represented by the human genome). Why did it take the software—the (phylogenetically) accumulating skills along each trajectory of growth, transmitted to each new generation through the ontogenetic learning process—so long to develop?

This phase of human development, succeeding the speciation phase, may be termed the *tectonic phase* (from the Greek τεκτων, carpenter, builder; Renfrew 2006, p. 224, 2007*a*, p. 97). The construction of culture and society then developed rapidly on the basis of new forms of material engagement with the world by human individuals, leading to new and transformed relationships.

(c) *Childhood learning and neuronal pathways*

Culture is transmitted through learning (from parents as well as neighbours) and can thus be inherited as well as accumulated through association (Shennan 2002). Language itself is a very good example. For while the capacity to learn a language is part of the hardware—it is passed on genetically—the specific language that one first speaks comes about through early learning. The skills of the hunter-gatherer, such as the making of flint or wooden tools, or the making of fire, were accumulated in this way, just as are those much more recent skills of reading and writing.

Crucial among these skills for humans, as White (1949) so effectively emphasized, is the capacity to use symbols. Language, with its sophisticated use of symbols, was clearly a feature of the human condition well before 60 000 years ago. It was, however, during the tectonic phase that material things, artefacts, came to have great importance for their symbolic significance. Indeed the use of material symbols may be claimed as one of the most striking features of the tectonic phase until the development of writing, and with it of new forms of external symbolic storage (Donald 1991).

In §3, I want to focus upon two kinds of material symbol which came to play a very central role in human life and experience, and the neurological implications of which would merit investigation.

They are crucial to the understanding of the neurological basis of human behaviour. The chronology outlined above indicates that the analysis of the hardware of the human brain itself, established for more than 60 000 years, is not sufficient to generate an understanding of some of the principal aspects of human behaviour. The changes since that time, including the development of those special symbolling capacities outlined below, must form part of any coherent analysis. This paper strives to define this problem more closely, and invites the reframing of the problem in more specifically neuroscientific terms.

3. PART II. FACTUAL REALITIES OF THE TECTONIC PHASE: VALUE AND BELIEF

I would like to turn now to some of the enduring features of human existence as experienced at the present time, and indeed for many centuries or millennia. So pervasive are they that one would imagine them to have been 'hard-wired' into our brains, a 'given' of the human condition, established for us along with many other capacities through the human genome.

The interesting observation that archaeology allows us to make, however, is that some of these enduring features are nonetheless emergent features that occur, at least along some developmental trajectories, at a certain point in the archaeological record, prior to which they are simply not seen. So pervasive and influential are they that they must, one feels, have a neurological basis. But it is a basis that comes into play only at a specific and quite recent point in the evolutionary trajectory of human (phylogenetic) development.

(a) *Intrinsic value*

Let us start with gold. A bar of gold has an allure that is almost physical. The image of the miser taking pleasure in counting the coins of gold that constitute his wealth is a familiar one. For most of us, in the tradition of western capitalism, founded upon the monetary economy of the classical world, itself based upon the early mercantile economy of the first urbanism in western Asia, gold is a familiar valuable. Even if, since the early twentieth century, it has no longer been the basic standard of value, reserves of gold still underlie many currencies. Early colonists from Europe found similar circumstances in India and the Far East, where gold was highly prized. The situation was rather different in the Americas, but there too, before the arrival of the *conquistadores*, gold was highly valued.

When we look at the golden treasures of the classical world (like the Treasure of Panagyurishte, or the burial casket from the alleged tomb of Phillip of Macedon) or the golden coffin and face mask of the pharaoh Tutankhamun, it is easy to accept that gold is a substance of intrinsic value, and that this is one of enduring realities of human existence. However if we go back a few 1000 years, before the bronze age of Europe and before the early dynasties of Egypt and of Sumer, we find a very different situation. Before that time gold was accorded no significance whatever.

The earliest significant finds of golden artefacts come from the copper age cemetery of Varna in Bulgaria, by *ca* 4500 BC, and from others of the same area and period. The context of deposition in the graves allows one to infer that at Varna, gold was in fact highly valued (Renfrew 1986), which indeed needs to be demonstrated rather than assumed, if circular arguments are to be avoided. There are various opportunities in the archaeological record for recognizing specific contexts indicating that a particular material was considered valuable. Materials chosen for personal adornment, for example, for necklaces, or bracelets, head decoration, earrings, labrets, etc., when consistently so used, may give such an indication. Those used for other decorative purposes, such as inlay work offer similar indication, as well as materials used for artefacts likely to be involved in bodily contact, such as drinking cups. The hoarding of quantities of material can also be indicative, for instance as observed in shipwrecks. In Varna there is another significant indication, where gold leaf was used to give the impression that a stone shaft-hole axe was in fact made of gold.

The important point, however, is that before that time, gold was not collected or accorded any significance as a material of value. Native gold was undoubtedly available in some areas in metallic form but it was not exploited, so that this is not simply a question of the technology of extraction. We can safely conclude that in Europe and western Asia gold became a commodity of high value at a fairly well-defined time in each region. One can indeed show that the interest in gold, and the ascription of high value to it, came about at about the same time that another metal, copper, was becoming interesting as a material that could be worked, first through cold working and annealing and later by casting. Alloying of copper with tin to make bronze was a subsequent development. From that time on it seems that gold indeed became a commodity of 'intrinsic' value, but not before that time.

The intrinsic value of gold is, of course, culturally ascribed. It is what the philosopher Searle (1995) would call an 'institutional fact'. It attains its factuality within a given context in much the same sense that we can say that A and B are 'man and wife' if they have been properly married in an officially recognized ceremony. It is not what Searle would call a 'brute fact' of nature (as might be the fact that A and B were the biological parents of child C).

Of course there are other materials generally regarded as of intrinsic value (Clark 1986). Diamonds are forever and jade has been specially valued from early times in many cultures—in Neolithic Europe and especially in Neolithic China, but not earlier, not during the Palaeolithic of either region. Interestingly, marine shells and sometimes animal teeth were indeed used as adornments during the Palaeolithic and their use has recently been suggested as one of the behaviours by which our species *H. sapiens* may be recognized (Vanhaeren *et al.* 2006), but such early exploitation of minerals is rare, and metals make their appearance only later. Objects of gold or jade are not found accompanying burials in the Early Neolithic period, or earlier. Nor are hoards (buried accumulations of such materials) found at such early times, although they do occur later, testifying to the newly acquired importance of these materials. Of course most of the materials regarded as of intrinsic value do have physical properties to recommend them. The 'noble' metals do not oxidize easily. Many precious stones are very hard as well as brightly coloured. But these properties have not been enough, in themselves, to make these materials generally and universally valued. Their high value in each case is culture and context specific: an institutional fact.

What interests us here, however, is not whether this or that material is the more highly valued, but the very notion of value itself. Elsewhere I have sought to analyse some of the relationships involved (Renfrew 2001, 2007*a*, ch. 8).

In an exchange system (see figure 1) the notion of commodity implies both the measurement of quantity of the commodity and the possibility of exchange, where a quantum of one commodity may be regarded as equivalent to a defined quantity of another. It is of course the fungibility of gold—its use as the basis for coinage, and then as the underwriting material for a monetary currency in general—that gives it its particular significance in the modern world. But underlying that is its basic allure—that to the informed eye it

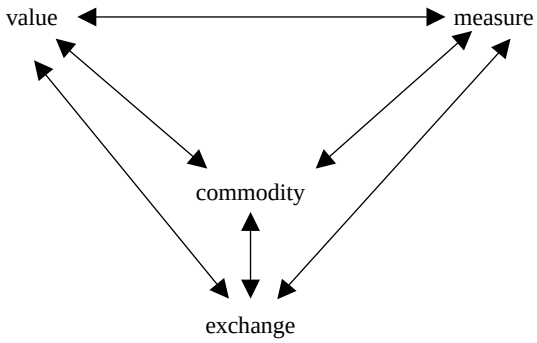

Figure 1. The place of a concept of value within a commodity-based exchange system.

incorporates and represents high value. It offers also the possibility of the accumulation of aggregate value, i.e. wealth, in a way previously only accessible through the accumulation of livestock.

Gold is a powerful motivating force. Explorers have devoted their lives in searching for it. Bankers have spent their lives hoarding it. Adventurers and criminals have endangered their lives and those of others in misappropriating it.

To recapitulate, during the Palaeolithic period gold was nowhere valued, nor were there other commodities that we can recognize as highly valued—unless marine shells that were already used for personal decoration and jewellery. The notion of high value came to be established in those regions where it did emerge only after what may be termed the sedentary revolution, and not generally at an early date among agrarian societies. But when it did come to be valued, its impact was considerable, and has since been taken up by money (Renfrew 2003, pp. 182–184). Most of us work for money, are paid in money and measure success by money.

I would like to see what light could be shed upon the powerful motivating force that materials or sums of high value, exemplified by gold, can generate. It relates to the material itself—the process is one of material engagement (Malafouris 2004; Renfrew 2004). This seems to be an important point. From the inception of the sedentary revolution, material things came to take a more important role in human affairs. Property, ownership and the accumulation of wealth became possible. They were accompanied by new power relationships, in which positions of personal high status became hereditary. The material engagement process led also to technological advances, for instance in the field of pyrotechnology. Yet the process is mediated also by cognitive aspects. Gold as a material is known to be of value and that sense of value is shared by the community.

The question is obviously of interest since most societies today are structured on the basis of value and finance. What is the neurological basis for these strong and enduring motivating forces? They have an effectiveness that often seems to be intuitive. The respect accorded to valuables such as gold is not always based upon verbal formulations. It depends often upon contexts of use, in some cases of ritual use. The 'factuality' of value is often not based upon verbal propositions but upon the reality that artefacts of this material are valued, and that they are used in contexts where high value is implicit.

(b) *The power of the sacred*

The archaeology of religion has become a well-defined area of research (Renfrew 1985; Boyer 1994; Mithen 1998; Insoll 2004). To explore the neurological basis of religious experience would be an interesting undertaking, but one difficult to extend to earlier time periods unless there are rich material indications in the archaeological record. However, as with the foregoing case of the construction of value and the identification of valuables, religious practice, as documented by material things, can indeed be observed archaeologically. It may be recognized through the identification of sanctuaries and shrines, through the depiction in two or three dimensions of deities, priests and worshippers, in the iconography of religious belief, and in evidence for the conduct of ritual where an orientation towards the supernatural or transcendental may be inferred. The specific indications that allow the practice of ritual to be inferred have recently been the subject of much discussion (e.g. Renfrew 1994; Insoll 2004; Barrowclough & Malone 2007). Nor should the possible distinctions between ritual and cult be ignored (Kyriakidis 2006; Renfrew 2007*b*)—the practice of ritual does not necessarily imply the transcendental focus generally implied by the term cult.

Once again, such evidence for religious practices is first seen, along various trajectories of development in different regions, at about the time of the sedentary revolution. (The specially early case of the European Upper Palaeolithic should again be recognized, with its cave art and its figurines, and might indeed be interpreted as a an exceptionally early case of incipient sedentism.)

It can be suggested, however, that religious faith, implying a coherent system of religious beliefs and practices, is an emergent feature of human experience, just as are the concepts of wealth and of value, discussed above.

What then are the neurological mechanisms that operate when the strong emotions evoked by faith and by the sacred come into play? As an example, I should like to highlight the special significance accorded to religious relics. This can involve a veneration which again entails a factuality accorded to such material things as a tooth of the Buddha or a fragment of the True Cross. To the non-believer these things have no intrinsic worth, and the discussion may be related to that for gold, as outlined above. Within a context of belief, however, such relics are the source of miracles. Their sacred quality is again such that powerful human motivations are generated, on a large scale, in relation to them.

These sacred materials are sometimes of great antiquity, in Muslim as well as Christian tradition, and sacred things have a powerful role in the early religions of Mesoamerica. I would like to obtain a clearer understanding of the neurological mechanisms that allow specific sacred objects to have such a potent effect upon the individual believer. And once again it seems particularly interesting that the emotions of intensity of faith involved would seem not to be a direct

and integral part of the phenotype and genotype of *H. sapiens* at the time of the out-of-Africa dispersals—or at any rate we have no evidence for them at so early a date.

4. CONCLUSION

Such powerful passions and beliefs as those involved in the recognition of high value and the veneration of the sacred must presumably have secure neurological foundations. But I have sought to show that these are nonetheless emergent properties, developing in human societies over the past 10 000 years or so, in many cases from the time of the sedentary revolution. Since the human genome has been established for at least the past 60 000 years, these features cannot be regarded as a direct and immediate consequence of the aspects of the genome which emerged during the speciation phase. Special mechanisms must therefore have come into play. Their potential must be inherent in the genome, as it has been for at least 60 000 years. But the material and social contexts of human societies, first effective around the time of the sedentary revolution, made possible their emergence and expression.

The mechanism, as suggested earlier, can only lie in the learning capacities of each child. For each child, coming to participate in the phylogenetic acquisition of culture, as the trajectory of cultural development unfolds, can only do so through the personal (ontogenetic) acquisition of skills and experience. This he or she may accomplish through the development of new neuronal networks in early childhood (Changeux 1985). But although these must be situated within the brains of individuals, the social, interpersonal relationships involved also imply different kinds of engagement with the material world. It is there that we must situate the development of mind, in the sense indicated above, rather than simply that of the 'brain'. The development of these significant factors governing behaviour must have a basis in the neuroscience of the brain.

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