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Becoming Human: the Archaeological Challenge

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Becoming human

IT MIGHT SEEM PRESUMPTUOUS, in delivering the British Academy lecture, to consider the human condition, a theme which has preoccupied the greatest philosophers. Yet while archaeologists can claim no special or exclusive insights into human nature, we can claim to offer information about the processes and events which have made us what we are. Here I want to speak of two related challenges arising from this theme: the challenge *of* archaeology, and the challenge *for* archaeology.

The first is the challenge which archaeology makes to the public (on the basis of a narrative which only a small part of the wider community knows and accepts) to understand how we humans have come to take our special place in the living world. The first glimpse of this perspective was offered by Charles Darwin in *On the Origin of Species* (1859) and, more explicitly, in *The Descent of Man* (1871). But while his insights were penetrating, he was not yet in possession of many of the facts. We know enough now to give a coherent narrative of prehistory and early history, far beyond anything which Darwin (or for that matter Marx) could offer. It carries with it interesting implications. I am often surprised by how little of it is generally known to the wider public (or even to my academic colleagues), a circumstance which explains, no doubt, the success of unashamed sensationalists, like the popular writer Graham Hancock,

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author of *Fingerprints of the Gods* (Hancock 1995), locating the original home of civilisation under the Antarctic ice. That his royalty cheques must far exceed those of more cautious scholars serves only to exacerbate exasperation at such tendentious nonsense. The challenge *of* archaeology is the opportunity which our field offers of encountering and appreciating this narrative. It is a narrative, which advances, in relevant techniques—radiocarbon and other radiometric dating methods, the application of molecular genetics—and thousands of archaeological excavations worldwide make increasingly reliable.

Yet we are now coming to realise that there is more to it than that. Advances in molecular genetics help us to confirm the origins of our species, *Homo sapiens sapiens*, in Africa some 200,000 years ago. They document the dispersal of early humankind out of Africa some 60,000 years ago. But they actually tell us very little about the processes by which these ape-like creatures, with their capacity for language, their social abilities, and their evident manual skills at manipulating the world (with the use of fire, the production of tools), later came to transform their own ways of life: how they moved from sedentism to urbanism, and from pyrotechnology to nanotechnology. The challenge *for* archaeology is to delve deeper into the human condition, to gain some more coherent understanding of these processes. How did they do it? How did *we* do it?

The challenge *of* archaeology

The challenge *of* archaeology is a story which ought to be taught in our schools as a basic ingredient of the National Curriculum. It should be a basic part of the heritage of every human being to know the story of how we came to be what we have become. And although, as I shall argue in a moment, we do not understand very clearly the processes which guided the paths of human development, the basic story has become reasonably clear. It goes something like this.

Already, three million years ago, our ancestors were walking: upright, bi-pedal gait is documented by the evocative footprints in the ash which Mary Leakey discovered at Laetoli in Tanzania, footprints almost certainly of our remote ancestor *Australopithecus*, whose fossil remains are known from several sites in East and South Africa. Her excavations with Louis Leakey at Olduvai revealed the earliest known stone tools, some two million years old, made probably by the aptly named *Homo habilis*.

And for well over a century the characteristic 'handaxes', made as much as 500,000 years ago by *Homo erectus* (or *Homo ergaster*) have been known from sites in Europe, and then in Africa and in Western and South Asia. They are the result of what seems to be the first hominid expansion out of Africa.

Anthropologists distinguish between Archaic Humans and what they term Early Modern Humans, who make their appearance nearly 200,000 years ago, in Africa. Modernity is clearly a movable feast! What are termed anatomically modern humans are seen as early as 70,000 years ago at the Blombos Cave in South Africa, doing such modern things as making necklaces by piercing seashells, and incising a pattern on a chunk of ochre. The pattern is only a network of intersecting lines, but it is the earliest record we have of any decorative visual marking (it is not yet 'representation') which might be called 'art'. It was not long after this that the principal dispersal of our species out of Africa took place, resulting in the peopling of much of the world—Asia, Europe, Australia by 40,000 years ago, but only later the Americas and the Pacific Islands.

All of these things were taking place against a background of climatic change. Rising temperatures from around 12,000 years ago establish the end of the Pleistocene climatic phase and the beginning of the Holocene. At that time all humans were hunter-gatherers. And it is not until around 11,000 years ago that we see the first settled villages in Western Asia, soon accompanied by agriculture and stock-herding. Preceding them we see indications of ritual activities. It is fascinating that the first nearly life-sized human images occur in Western Asia a few centuries before the emergence of agriculture. At about the same time the first purpose-built buildings were constructed which we can today recognise as shrines—places built primarily for ritual purposes. In the early village sites, small figurative representations are commonly found, among them some which may be regarded as images of divine beings.

Other farming revolutions take place elsewhere: in north China, based upon millet; in south China, based on rice; in Central America with an emphasis upon maize; and later in West Africa with millet. We can document all these things with increasing precision.

Settled village life is very difficult without a sound agricultural base, and certainly the emergence of cities has everywhere been dependent upon agriculture or herding of livestock, or both. In Mesopotamia, not long after 4000 BC we can recognise the development of the first urban centres, with the inception of writing soon to follow, there and in Egypt. In some ways analogous urban developments took place quite independently in

Mesoamerica, although very much later. By the first millennium AD we see a comparable conjuncture of vast urban centres, ceremonial buildings and a complex recording system, which thanks to the Maya decipherment in recent years it is now possible to read.

Although the circumstances were very different, we can recognise comparable processes at work in sub-Saharan Africa some centuries later, with the development of urban centres, and the production of metal objects surpassing in sophistication those of Mesoamerica.

Such developments seem to have occurred independently—that is to say without significant contacts between the various trajectories of development—at different times. In China, urban life similarly developed upon a basis of settled agriculture, with the emergence of what may be regarded as a state society, again associated with technological sophistication, and the emergence of its own system of writing.

In several of these cases, writing emerged in the context of urbanism and a state society (a system of hierarchical government based upon the legitimised use of force).

Since the application of radiocarbon dating in the 1960s we have been able to set these developments, in each part of the world, within a coherent context. There has sometimes been the temptation to see them in some way as universal processes. Gordon Childe's very effective analyses of what he termed 'the Neolithic Revolution' and 'the Urban Revolution' in Western Asia (Childe 1936) have been generalised by many scholars to suggest an almost worldwide applicability. The sometimes quite striking similarities in different parts of the world between the domestication process in different areas and then the urbanisation processes across the globe have been seen as the products of rather ill-defined rules about increasing complexity. Yet whatever the inadequacy of these explanations, the outlines of the story are clear.

This general narrative as I have reviewed it, began to take shape with the impact of radiocarbon dating half a century ago. It took coherent form with the publication of Grahame Clark's *World Prehistory* in 1961. It indicates some of the main stages in the development of humankind from the early days of our anthropoid ancestors to the linguistically gifted, intellectually able and remarkably competent communities found in every part of the world today, from the Inuit in the north to the San of the Kalahari in the south, from the peasants of Europe or China to the urban dwellers of Mexico City or Mumbai. In many ways it is a very satisfying story, which becomes richer every year as archaeology documents the diversity of human existence in every continent. It offers us both a

generalised history of our species, and a more detailed narrative of the life of every human group and nation. That this narrative should come to be understood more widely is the challenge *of* archaeology today. It is a cause for concern that fantasies of lost civilisations and ancient wisdoms continue to haunt the popular understanding. In a democratic nation it is important that citizens should have some valid notion of the place of humankind within the world.

The challenge *for* archaeology

In recent years, however, it has been possible to feel that this is not enough. This rather generalised story offers few insights into those particular features of our species that have led, in the space of ten or twenty thousand years, to those transformations in the human condition that I outlined. What is it about the human species that allows such momentous changes to take place in just a few millennia? All other species have genetically determined behaviours which change little in hundreds of thousands or even millions of years. Recent work in molecular genetics has served to define the problem more sharply, but as yet done very little to offer a solution. The answer, I shall argue, can only come from a more detailed understanding of the human mind, of the shared cognition of the social collective as well as the cognition of the individual. The truth is that the development of human culture and civilisation has indeed been quite well described. But it has been very little understood. That is now the challenge *for* archaeology.

There is no cause for self-flagellation here. It took a long time to understand the cosmos. Copernicus lived 1,500 years after Ptolemy of Alexandria, and if Tycho Brahe was a meticulous observer in the late sixteenth century, and Kepler could describe the regularities of planetary motion in the early seventeenth, it was not until 1687 that Newton published his *Principia*, which began to explain them. Natural History had its Linnaeus already in the early eighteenth century (*Systema Naturae* 1735), but after Darwin's *On the Origin of Species* it took nearly a century before Crick and Watson could propose the helical structure of DNA. Human society may be less easy to order or systematise: it has had its Plato or its Hobbes, but serious archaeology, or at least serious prehistory, did not really begin until 1859. It took only a century after this, with the aid of radiocarbon dating, for a coherent outline of world prehistory to emerge. We cannot be accused of dawdling.

Until about twenty years ago, 'the Human Revolution', as understood by anthropologists, referred to the sequence of events by which, in Africa, in eastern Asia and in Europe, our species *Homo sapiens sapiens* emerged from our ancestor *Homo erectus*, perhaps through an intermediate stage by way of that intriguing fossil hominid Neanderthal Man. The focus was very much upon the events taking place in Europe some 40,000 years ago, and the transition there from Neanderthal to Sapiens. The fossil record around that time shows that the Neanderthalers were replaced by our own species, and the lithic industries which archaeologists discover from their excavations changed then in character, the earlier simpler tools termed 'Mousterian' being replaced by new blade industries, representing composite tools, termed 'Aurignacian'. The archaeological record shows new forms of behaviour, such as the use of bone tools and shell ornaments, which may have been used to express identity—both personal identity and group identity. It was widely felt that this may have been the moment when the specifically human capacity for complex speech emerged, and perhaps that very special quality of self-consciousness which we tend to think of as exclusively human. Much emphasis was placed also upon the emergence, especially in Western Europe, of palaeolithic cave art, most famously at sites like Lascaux and Altamira, but also very much earlier, more than 30,000 years ago at the Grotte Chauvet. These images, and the stone and ivory representations often called 'Venus' figurines became emblematic of the Human Revolution. They were taken to indicate a significant general advance in human cognition.

The impact of molecular genetics, or archaeogenetics, upon archaeology has recently clarified some of these matters. But in some ways it makes the problem more acute.

One of the great triumphs of the past twenty years has been the application of DNA studies to the human past. Mitochondrial DNA, which is passed on exclusively from mother to offspring, and thus in the female line, has been sequenced from living individuals all over the world. Comparing the small differences between individuals allows a clear indication of how closely or distantly related the two are, assuming a slow but constant rate of mutation. On this basis the mitochondrial DNA (mtDNA) data of all those sampled can be arranged in a tree diagram, a dendrogram, which under certain assumptions can be regarded as a family tree. It can tell those sampled about their affinities and about their most recent common ancestor. Although the early results caused controversy, their main findings have been confirmed by analogous studies of

sequences from the Y-chromosome, which is passed on exclusively in the male line.

Studies of the mutation rates involved allow an approximate chronology, which ties in reasonably well with the radiometric dating available for the fossil remains. The conclusion is that our species did indeed emerge in Africa, that the 'Out-of-Africa' scenario is correct, and that the first and principal dispersal out of Africa took place about 50,000–60,000 years ago. The earliest fossil remains of *Homo sapiens* in Indonesia and Australia from around 45,000 years ago support this view. The remarkable feature of all this DNA work illuminating the deep human past (Forster 2004) is that it is based upon modern samples taken from living populations, and that their analysis allows the reconstruction of human history: the record of our past within us.

The results correlate quite well with the archaeological record. They have some important implications whose significance has been insufficiently appreciated. In the first place, the humans who dispersed out of Africa (as well as those who remained) were all very closely related. The physical (or 'racial') distinctions between different human groups in the world today must presumably have begun to develop from the time following the dispersal. The human groups outside Africa are all descended from mtDNA haplogroups M and N. It can probably be assumed that by then all human groups had the capacity for fully developed language. One good argument for that is that, following the dispersal, the processes of travel took humans in many different directions, to Asia, to Australia, to Europe and ultimately to the Americas. The populations of all these areas today, and indeed of other areas of the world, share this specially human language capacity. It is difficult to see how this could be so were that capacity not present in the initial dispersal. This reiterates the essential point, that our innate genetic constitution at birth (the human genotype) is closely similar from individual to individual today. That was an underlying assumption of the Human Genome Project, and it is being further researched in studies of human genetic diversity. We are all indeed born much the same. Moreover, a child born today, in the twenty-first century of the Common Era, would be very little different in the genotype, and hence in innate capacities, from one born 60,000 years ago.

The implication here must be that the changes in human behaviour and culture which have taken place since that time, and all the behavioural diversity which has emerged—sedentism, cities, writing, warfare—are not in any way determined by the very limited genetic changes which distinguish us from our ancestors of 60,000 years ago. They are the

product of 'cultural evolution', if that term is found acceptable. This is a key point. Our genetic makeup was largely defined before 60,000 years ago. So the differences in human behaviour which we see now, when contrasted with the more limited range of behaviours then, are not to be explained by any inherent or emerging genetic differences.

Modern molecular genetics suggests that, apart from the normal distribution range present in all populations in such matters as IQ, all men are born equal.

All of this leads to the conclusion that human evolution, the process of becoming human, may in effect be divided into two phases. The first of these is the process of becoming *Homo sapiens sapiens,* that process of genetic and cultural evolution, which led to the emergence of our species more than 100,000 years ago in Africa. Humans were already by then culturally competent, making tools, making and controlling fire. They had developed speech (we may infer) and with developed social skills, including the innate capacity for developing a 'theory of mind'—that ability to intuit the intentions, the feelings, the emotions, the motivations and the likely future behaviour of other humans. This we may term the Speciation Phase, that stage in human development when our species was taking definitive form, and its standard genetic structure (the human genome) was stabilising.

The second phase is that following the time of the out-of-Africa expansion of 50,000–60,000 years ago. Since then the degree of genetic diversity among humans has not varied markedly. The differences in human behaviour which we see along the different trajectories of development are not determined by genetic differences within the different populations shaping those different trajectories. They are the products of so-called 'cultural evolution'. This we may term the Tectonic Phase, following the OED definition of tectonics as 'the constructive arts in general' (from the Greek τέκτων, carpenter). This phase is characterised by new forms of human engagement with the material world. It is indeed the case that the first, speciation phase, of human development, was marked by such culturally based and thus broadly 'tectonic' activities as tool-making. This gave rise to one early and quite appropriate appellation of our species as *Homo faber*. During the second, tectonic phase, the genetic changes have been much less important—partly because the pace of change is now so much faster.

I would like now to turn to the colossal problem we face in analysing and understanding that process of development during the tectonic phase, after the dispersal of 60,000 years ago. And when we do so we shall

have to recognise that we can no longer speak of some general trajectory of cultural evolution. There are many trajectories. Communities soon became separated and lived very different cultural histories. What happened in Australia is not the same as what happened in New Guinea. That, in turn, differs from the trajectories of change in Central Asia, or in Europe or in China or in the Americas. We see before us a whole series of trajectories, all starting from the same raw material—the humans who left Africa 60,000 years ago (and, in Africa, those who remained).

After that, the different groups of humans, as they dispersed and went their ways over the generations, were no longer in contact. This implies that there was no single neolithic revolution, no single urban revolution. There were many different trajectories. Some, as in Australia, involved continuing patterns of hunter gathering, although seemingly with developments in cultural complexity which led to the rich inheritance of the contemporary Australian aborigines which we are only now learning to appreciate more fully. There was no one, generalised story of human 'progress', no uniform pattern of development.

We see instead developments, often quite intense developments, in a particular region, often enduring over some considerable time. Sometimes the innovations identified seem to become lost again by succeeding generations. In other cases they were incorporated within the cultural inheritance and so survive. These bursts of intense activity might be described as 'episodes'. Sometimes they have a *Nachlass*, an inheritance, but on other occasions this is less obvious.

An example of the former would be the phenomenon of cave art in the Upper Palaeolithic of France and Spain, already discussed. It was a phenomenon, clearly of great intensity, lasting for thousands of years, but it seems to have disappeared. Some complex societies or 'civilisations' seem to meet their demise in a comparable way: the phenomenon of 'system collapse'.

Meeting the challenge *for* archaeology: towards an archeology of mind

How then can we set out to meet the challenge *for* archaeology? How can we go beyond the outline of the human story, offered earlier, which, while accurate enough in itself, offers us little in the way of explanation or understanding of the processes at work? It is fair to say that most students of evolution from Darwin onwards, have focused more upon the

phenomenon of the emergence of *Homo sapiens*, which I would term the first human transition, the speciation phase, than they have on the remarkable and diverse developments in human culture following the out-of-Africa dispersal. That is what is here intended by the second human revolution or transition, the tectonic phase.

As we have seen, the mechanisms which count are now cultural mechanisms (see Shennan 2002). So that, although human developments during this tectonic phase, since the out-of-Africa dispersal, naturally do not fall outside the broad Darwinian view of evolution, those patterns of diversity are not in practice very well explained by existing evolutionary theory. Although there is a literature in archaeology which seeks to apply Darwinian concepts rather directly to cultural change and diversity (e.g. Durham 1991), this neo-Darwinian approach has so far been more successful with the processes of speciation associated with the first human transition of the palaeolithic period. Only when it is recognised and emphasised that transmission through learning, which is dominant during the second tectonic phase, is often very different from the transfer of the genetic inheritance between generations (see Shennan 2002) can a more coherent and progressive view emerge.

In 1982 I entitled my inaugural lecture in Cambridge *Towards an Archaeology of Mind* (Renfrew 1982), and there I outlined the potential for a cognitive archaeology which would successfully use the material remains which constitute the archaeological data to allow the reconstruction of some of the thought processes of now-vanished (and often prehistoric) societies. It is not the aspiration to learn what individuals (or groups) in those societies were actually thinking: we cannot put ourselves into their shoes or think their thoughts, as R. G. Collingwood once aspired to do. But we can hope to learn *how* the minds of the ancient communities in question worked, and the manner in which that working shaped their actions (Renfrew 1994; 1998). This is the approach which has come to be called 'cognitive archaeology'. But I have now come to realise that the 'archaeology of mind' will have to be a much vaster enterprise than I then contemplated, more than twenty years ago. Then I used an example, the stone cubes of the Indus Valley civilisation, to demonstrate that, by simple logic, a cognitive archaeology is indeed possible, even for periods and cultures, that are in effect prehistoric. But I did not realise then how great the challenge of mind would be.

One part of the necessary response is indeed the sort of 'symbolic archaeology', which Ian Hodder (1982) long ago envisaged. Man is by nature a symboling animal, as Leslie White (1959) had emphasised. But

we can now see that the implication that the notion of symbol is adequately described by the semiotic relation between 'signifier' and 'thing signified', is insufficient—and like so much philosophising in archaeology, influenced by critiques of written texts rather than by the real world of things.

Already, if that somewhat restricted view of cognitive archaeology is seen as one element of a larger field, it is possible to recognise several other components, all of which relate to the vast, complex and still little-understood notion of 'mind'.

Analysing 'mind'

The archaeology of symbols now seems a somewhat inadequate and partial approach to the archaeology of mind (Renfrew 2001). There is a natural tendency to equate the brain with the mind, and the archaeology of symbols does not immediately conflict with such an equation. The notion of 'brain', at least at first sight, seems relatively straightforward, even if the workings of the brain are not. The brain is what each one of us has in our skulls, the location of those billions of cranial neurons whose interactions, as we are beginning to learn, underlie our thought processes. The brain is what each one of us is born with, its structure at birth, as we have seen, in large measure genetically determined. The advance of neuroscience shows that in early childhood, neuronal pathways are reinforced by what we do, so that through this process the abilities and skills of one individual come to differ markedly from those of another. Many of the skills that become 'automatic' are learnt in this way. Swimming, speaking a specific language, riding a bicycle, driving a car, learning to read and write, typing at a word processor, these are all procedures which are learnt and have to be learnt. They are skills which come to be internalised within the brain through practical activity or praxis.

In reality, however, the human brain is not a disembodied entity, and the early artificial intelligence (AI) view that the mind may be viewed simply as a computer, situated in the brain, and driving an obedient robot, the body, now seems woefully insufficient. Brain and body work together, so that human experience occurs through engagement with the material world. It can indeed be argued that 'mind', our system of understanding and knowledge, comes about through a shared process of engagement of both brain and body with the external world. In order

better to understand this process, it is necessary, as philosophers have argued (e.g. Clark 1997), to overcome the Cartesian duality of mind and matter, body and spirit, and to seek a more integrated approach where thought and praxis are not separated.

That may sound a rather abstract point, but it works out very clearly in physical terms. Most intelligent activities which we initiate arise, at least in part, from the properties of the external world, not from the pure working of the brain. The carpenter constructs according to the properties of the wood which he is carving and those of the tools with which he is shaping it. The architect may imagine prodigious constructions but is constrained by the properties of bricks and mortar, of steel and glass. That is one reason why the term 'tectonic' is appropriate for the discussion of these processes. What we actually do in the world is governed by the properties of the external world as much as by the imagination. And the workings of the imagination themselves arise in part from material experience. It is through the intelligent engagement of humans with the material world that significant innovations come about.

Moreover there has been a tendency when speaking of 'mind' to consider an isolated mind, just as one might well consider the brain of a single, isolated individual. But the phenomena of mind are in large measure collective. Language is a collective phenomenon. Most of the conventions by which we live in society, the 'institutional facts' identified by the philosopher John Searle (1995), are shared understandings. Often these are understandings that do not need a linguistic basis in order themselves to be understood. Because these 'institutional facts' in large measure govern what we do, they are responsible also for aspects of the archaeological record, from which they may in favourable cases be inferred.

These ideas, in relation to archaeology, have been well developed by Lambros Malafouris (2004, 57), who argues that cognition involves action and bodily experience: cognition is embodied, enacted, and situated in action. At the same time, cognition is a collective phenomenon, being extended and distributed beyond the individual. It is socially mediated. Material culture is implicated and involved in these processes. All of this is directly relevant to our notion of 'mind', and to our understanding of the processes of human cognitive development, both in the speciation and tectonic phases.

In his informative book *Origins of the Modern Mind*, Merlin Donald (1991) discusses a number of stages in cognitive evolution. Characteristic in his view of *Homo sapiens*, from the beginning, is the developed use of language, and the construction through language of narrative and of

myth. That all human societies, from the completion of the speciation process and perhaps before, possessed a vast oral literature seems exceedingly likely. Donald underlies also what he sees as a subsequent theoretic stage in which various theoretical concepts become explicit. This stage is characterised by what he terms External Symbolic Storage (ESS). Writing until the advent of the electronic era, has been the main technology for ESS. The principal technologies of external symbolic storage developed, so far as we are aware, long after the out-of-Africa dispersal, and thus during the tectonic phase of human development. Certainly the experience of reading and writing can be said to constitute part of what it is to be fully human in the modern sense. To say this is not to deny the quality of humanity to those who are not literate or who live in communities without literacy, but simply to note that some fundamental human experiences are indeed dependent upon literacy. Writing is, however, only one form of external symbolic storage, and I have argued (Renfrew 1998) that Donald's account needs to be developed to allow for the importance of what might be thought of as symbolic storage in pre-literate times.

There are perhaps three main issues here, which need to be developed further: the extended mind, the embodied mind and the developments of neuroscience.

Archaeology and the extended mind

In his thought-provoking analysis of *The Construction of Social Reality*, John Searle (1995) drew attention to the key role of the often unspoken understandings which constitute the social realities by which society is governed. He called them 'institutional facts'. Some of them are shared understandings, like the rules of kinship, or the notion of marriage. Their functioning is often, at least in state societies, governed by laws. But the very existence of some of the key concepts has a prior reality, which precedes the formulation of any codified law. It is the emergence and development of some of these concepts or shared understandings which must form the basis for the new kind of cognitive archaeology which is needed to meet the 'challenge *for* archaeology'.

One good example would be the notion of property—that this house, or this sheep, or this artefact belongs to me, and can be disposed of by me at will, as through a gift, or indeed as a bequest.

John Searle speaks of the rules of chess as 'constitutive facts', for the game would not exist without them. The rules constitute the game. There

is something of the same with the notion of property, for without this notion the whole economy of the production and transfer of goods through exchange would not work. Yet the ethnographic study of many societies, especially hunter-gatherer societies, shows that many of these had not formulated the notion of disposable and heritable property that we find in many sedentary societies and accept as the norm in our own daily lives.

Money is another such reality, based entirely upon a shared understanding within a society, involving a system of values and equivalents, which is always somewhat arbitrary. It is most clearly seen in the form of coinage, which appears for the first time in the Aegean in the sixth century BC. It is an innovation which changed the world: the economy as we conceive of it could not exist without it. It is a very good example of the working both of the embodied mind and of the extended mind. For in the first place, coins had to have a material reality: they were made of precious metal. Other monetary systems are conceivable, indeed some existed. But coinage in the classical and medieval worlds was predicated upon knowledge of metallurgy, and in that sense upon the material properties of the world, which we know from our physical experience. It is a wonderful example also of the extended mind. For monetary value is a shared convention—in the modern world a whole complex of shared conventions. Indeed it has also become a form of communication, second only to language in its efficacity. Money speaks louder than words, and indeed some monetary transactions do not need words.

Indeed similar observations can be made for the very notion of intrinsic value, for instance in a precious metal, such as gold. In reality the high value of a precious substance such as gold is simply a convention. It is a convention so widely shared, first in the western world, and then more widely that this high value is seen as a reality. The price of gold is a good example of an institutional fact.

Moreover—and this is what should interest the archaeologist—they are facts which are specific to the cultural context within which they operate. And above all they are emergent facts. We can recognise a time in the archaeological record of each cultural trajectory, prior to which gold was clearly not regarded as a valuable. And a time also prior to which money did not exist. The emergence of these constructs can indeed be observed from the archaeological record.

It is becoming clear that these are the building bricks with which we construct the world, our world. But, as generations of anthropologists have persuasively documented, different worlds are differently con-

structed. One of the most interesting tasks, as I see it, is to define, for each area and each cultural trajectory in question, what are the crucial underlying conventions, the local institutional facts, by which the society operates, and whose formation was an important part of the construction process.

The shared religious beliefs of a society may also be regarded as institutional facts. Archaeologists spend much of their time recovering from the archaeological record evidence for the practice of what we could call 'religions' in different parts of the world. We do have abundant evidence relating to the belief systems of different early communities.

These fundamental underlying 'realities', out of which the social life of the different trajectories of development during the tectonic phase are constructed, have not yet been systematically recognised or investigated by archaeologists. They are all too often accepted as givens, as concepts so obvious in our own society as to be hardly worth specifying, and to be taken for granted also in other cultures.

To understand the processes of becoming human, or more human, or human in a specific way, during the tectonic phase, it will be necessary to seek more systematically the first appearance, in each area, along each trajectory of development, of such concepts as property, or deity, or computable value (of fungible commodities).

Of course anthropologists have already worked with some of these ideas, and what I have been discussing, using the perspective of Searle, is not far from Alfred Gell's version (Gell 1998) of the 'extended mind' (see Clark and Chalmers 1998). This is not a matter of a 'group mind' or of collective consciousness, nor of any mysterious, inherited Jungian 'archetypes'. Marilyn Strathern (1988) has discussed how any one social individual is the sum of their relations (distributed over space and time) with other persons. These ideas have strong relevance for the notion of mind, as considered here, for the formation of institutional facts (which have a place within the scope of the extended mind), and for the long-term processes of the construction of societies and of cultures.

Archaeology and the embodied mind

When we look at the origins of these various institutional facts, by which society operates and out of which our world is constructed, we see that often they are rooted in material experience, in the material engagement between humans and the world. The development within a community of

such a way of seeing the world is rooted in the personal experiences of the members of society where the 'fact' was first formulated or recognised.

Returning to the cubes of the Indus Valley civilisation, mentioned earlier, which have been recognised as serving as weights, in a system of weights and measures dating back nearly four millennia, it is interesting to speculate how the very concept of 'weight' arose. The concept of weight is more than a verbal convention: it is rooted in experience of the world. It must surely be that the notion of weight as a measurable property must have originated first not so much in some abstract notion of balance, but in the personal experience and awareness of balance—that object A held in the left hand is the equivalent of object B, held in the right, in terms of our own personal experience of weight or mass as understood in our own muscles and through a physical experience of equivalence. The experience of balancing, arising from our engagement with the material world, logically precedes the conception that A equates with B, and the subsequent insights that multiples can also be equated.

We live in a world of experiences, registered through the senses, out of which, both individually and collectively, we have to make sense of the world and learn to operate within the world. Yet while some experiences, out of which fundamental symbolic concepts and relationships are shaped (for instance that a specific cuboid object of stone, termed a 'weight' can be used to compare quantities of commodities) may be phenomenological in nature, others are more socially grounded, yet rooted in personal experience.

I already suggested that it was the development of sedentary life, coupled with the development of agriculture and stock-rearing, which must have been responsible for the emergence of new notions of property. When stock-rearing is practised, the ownership of livestock is an issue that must soon arise upon the agenda. With agriculture, the exclusive right of access to the fields that one has sown or the trees that one has planted similarly becomes an issue. So too does the exclusive right of access to the house which one has built. And with that exclusion comes the possibility of storage of commodities (grain, hides etc.) produced by the household, to which access must be controlled. In the longer term, the house as the home of the family, to be passed (like the livestock and the fields) between generations, implies the inheritance of goods.

It was not until the neolithic period—with the development of sedentism and agriculture—that these things emerged in Western Asia. Already, wide-ranging exchange systems in raw materials, such as obsid-

ian, must imply the prior existence of systems of counting and measure. But with the introduction of a system of standard weights can come a new refinement in the notion of commodity, and the formulation of standard exchange ratios between commodities. (See Fig. 1.)

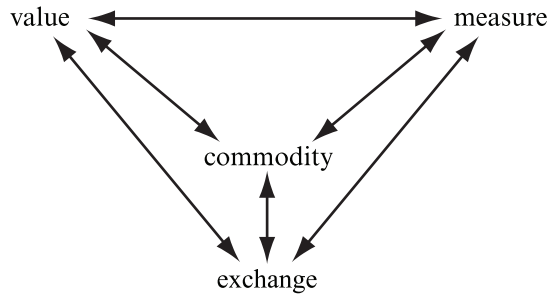

Figure 1. The commodity nexus: the cognitive relationships from which the economic system of early Western Asia and of Europe was constructed.

At first I thought that this nexus of relationships might have had a general validity beyond Western Asia and the wheat lands of the Indus Valley. But I now see that what I have outlined may be regarded as only one way of constructing the world. That approach does indeed lie at the root of Sumerian and Babylonian metrology, which in turn influenced the philosophers and mathematicians of the Classical Mediterranean and then Renaissance Europe as well as the Caliphate. We can recognise here the roots of western science. But how such things worked out in Mesoamerica or in China has to be considered in its own right for each trajectory. In prehistoric northwestern Europe things seem to have been rather different, at any rate until the arrival of the Romans.

It would, I think, be fair to say that the Western mercantile mind, upon which global capitalism is largely based, is constructed out of these elements. The critical nexus became even more powerful with the invention of coinage, in the sixth century BC in the Aegean, and more powerful again with the inception of banknotes more than two millennia later in Europe. That is one trajectory of growth, which we can certainly trace, with its own tectonic logic, from the earliest neolithic of Western Asia to the early civilisations of the Ancient World and so to the Middle Ages of Europe and Western Asia and on to their colonies and empires.

But I now see more clearly that this specific nexus was not a universal (although it may threaten to become so in the current world). It was one way of becoming even more human, and even more modern.

If we were to look, using a similar perspective, at calendrical measurement, we should see a different pattern, with a rich elaboration and sophistication in Mesoamerica, which exceeded in sophistication and precision the calendrical formulations of the West or of China until the time of the development of the telescope.

I am not competent to trace the equivalent trajectories in other parts of the world. But I can see how the study of systems of measurement, as they developed along different trajectories of development, could be very informative.

These are the areas of investigation with which an adequate cognitive archaeology will have to grapple, for each trajectory of development.

Brain and mind: the neuronal basis

These, I believe, are some of the directions which will shape a new cognitive approach to the archaeological record, such as will allow us to meet the challenge for archaeology, of which I have been speaking. But perhaps it is permissible to look into the future a little, and see where an emerging new scientific discipline may lead us.

The study of the brain is advancing at a prodigious rate, and rapid progress is being made in the field of neurophysiology and neurobiology. Indeed it has plausibly been asserted that just as molecular biology overtook physics as a key focus of scientific development in the later twentieth century, so neuroscience will hold centre stage in the first half of the twenty-first. Neuronal networks are now seen as a fundamental component of brain functioning, and to understand them it is not sufficient simply to examine the properties of individual neurons. There are many aspects of the functioning of the brain that one would wish to know more about, in relation to both phases, both transitions which together constitute the human revolution.

The development of molecular neurobiology has now allowed for more detailed considerations of mechanism (Changeux and Ricoeur 2002). Again, much of the emphasis has been upon the speciation process (e.g. Changeux and Chavaillon 1996), which we are here identifying with our first transition.

Such approaches are offering insights, or at least promising to, into such formerly intractable areas as the phenomenon of consciousness (Dehaene *et al.* 2001).

At the moment, the insights for archaeology to be had from this developing field of neuroscience may appear rather limited. Most aspects of the functioning of the brain remain opaque to us. Yet at the same time, it is from this field only that some of the answers must ultimately come.

It is already clear, however, that to understand the tectonic phase of human evolution, one essential focus must be upon the neuroscience of the learning process. That the key to understanding human development since the emergence of our species lies in the field of learning has been suggested by a number of researchers, including Greenspan and Shanker (2004), who have emphasised the importance of emotional learning as well as the storage of other information. It is now realised that activities in the early years of childhood allow the storage of information in developing neural networks, the result being, as Changeux puts it, 'to biologise culture'. This process involves the cultural appropriation of developing neuronal circuits, and the internalisation in this way of culture and the social environment. Such approaches to the study of brain function may be informative for the development of a cognitive archaeology, which must be alert to the underlying neural mechanisms.

The study of neural activity in the brain in relation to external stimuli and to the activities of the individual has been greatly facilitated by such techniques as functional magnetic resonance imagery (fMRI) which allow the recognition of areas of the brain which are active during the cerebral activities in question (e.g. Dehaene *et al.* 2001). Already these studies are giving insights into the way in which language learning operates, and the way in which the brain copes with the task of learning more than one spoken language (Simos *et al.* 2001). The neuroscience underlying human communication must ultimately offer important insights for the phenomenon of the extended mind.

Insights are becoming available also into the acquisition by learning of such skills as reading and writing, which are of course ones which occur relatively late in all known trajectories of tectonic (cultural) development.

Studies of the neurological processes which operate in the brain while the body is conducting skilled tasks (usually by means of the hands) are only now beginning. But it is not difficult to see how a study of the neuronal processes at work during flint knapping might have a significant bearing upon our understanding of the long-term evolution of lithic technology. The technique of positron emission tomography (PET) is already being applied in just this way (Stout, Toth and Schick 2000). The neuronal basis for the embodied mind is thus also open to investigation.

Many insights are yet to come. We shall understand better the experiences and sequences of learning and of innovation along the different trajectories followed by human societies when we understand better the neurology of learning. Merlin Donald's insight that mimesis (imitation) was a key process for earlier hominids such as *Homo erectus* is an interesting one (see Bloch 1991), and there are suggestions that the functioning of mirror neurones may be crucial to this process and offer insights into it (Onians, forthcoming).

It may be wrong to set our hopes too high for the insights which contemporary neuroscience may have to offer for both the speciation and the tectonic phases of the human story. Probably most of our new insights will have to be won from the archaeological record, both through the application of new techniques, but more particularly through the formulation of more pertinent questions.

Becoming human

Here I have sought to show that the experience of becoming human has involved two major processes, two great transitions. The first of these, the process of speciation, was achieved some 200,000 years ago, before the out-of-Africa dispersal which brought our species out, over most of the world. Yet, while these early humans of 60,000 years ago were in some senses fully sapient, modern in their physical and mental capacities, and as much entitled to respect as human beings as ourselves, they were in many ways not like us.

The different trajectories of development subsequently followed on the different continents led to very different kinds of human achievement, to the construction of worlds which differed profoundly one from another. As I have sought to show, the developmental processes at work during this 'tectonic' phase are still not very well understood. To reach a better understanding we need to analyse further the differing processes of human cognition at work along those differing trajectories. We need to achieve a better understanding of what is implied by the notion of 'mind' in order to grasp how the minds of the different groups in question differed. How did the minds of the Aztecs—or the Aztec mind (if one prefers a collective noun)—differ from an Inca mind, and these from that of a literate person in Han China? As I have sought to show, our blanket generalisations about the origins of agriculture or the origins of state society do not hold up very well under closer examination. That this should be so is not, however, a

case for abandoning the enterprise. It is rather an indication that we need to refine further our conceptual tools (including the very notion of 'mind') if we are to make a better job of the task.

Conclusions analogous to these in some respects have already been reached in the cognitive sciences, where concepts of the extended mind and the embodied mind are already widely discussed (Clark and Chalmers 1988; see Malafouris 2004). But the implications of these insights for the entire process of the development of human culture, indeed for the construction of different worlds (implicit in the notion of developmental trajectories in the tectonic phase of human development), has not yet been systematically investigated. Such an exploration will need to draw upon developments in neuroscience and in the cognitive sciences. But they will need more than the application of a few ready-made concepts from the world of AI. The pitfalls in that apparently easy path in the direction of cognitivism have already been well charted (Ingold 1998).

That is the challenge *for* archaeology. When we have accomplished it better, the challenge *of* archaeology will be even more arresting than at present. And the account which we have to offer to the academic community and to the wider world of the process of becoming human will be not only more complete but more enlightening.

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