PROCEEDINGS OF THE IFRAO CONGRESS
September 2010

2013 # 5

http://www.palethnologie.org
ISSN 2108-6532

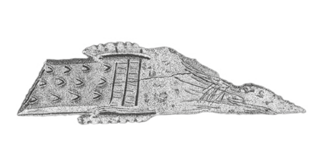
directed by
Jean CLOTTES

PLEISTOCENE ART OF THE WORLD

Short articles








P@LETHNOLOGY
Bilingual review of prehistory

SIG02 Bullen
Full article, pp. 1613-1625

FINDING THE FIRST *INTENTIONAL* MARK MAKERS:

Clues in Brain Development

Margaret BULLEN

In this paper I endevour to reach back before the creation of the lionesses of the Upper Palaeolithic to find the point in time when the realisation occurred that a mark made by one individual could influence another.

It is a quest not only for the time but also for what was needed. Was it a larger, more specialised brain, more connectivity or more complexity of synapses? Was it necessary to have language before pictures?

Early hominids left few traces; some stone tools, faint evidence for habitation and scattered skeletal material. Endocasts may be misleading and the only brains available are those of our closest living relatives, the non-human primates. In the paper I first explore how non-human primate behaviour differs from that of humans noting the over achieving pygmy chimpanzees trained by Savage- Rumbaugh, and then consider the physical differences between the human and non-human primate brains before observing hominid evolution at the macro and micro level. A major difference between human and non-human primates is that of brain size, the human brain being 35% larger than that expected of an ape the same size and more importantly the frontal cortex, Brodman's Area 10, is twice the size in humans as it in chimpanzees. The importance of studying cyto-architecture rather than surface anatomy is stressed.

Brain asymmetry, once considered unique to the human brain is shown to be present even in birds but the nature of the asymmetry may be a defining human feature. Petalias are extensions of the cerebral cortex beyond their counterparts on the other side of the brain. Primates do show some asymmetry but rarely the petalial pattern nor true handedness.

Asymmetry in fossil skulls is contentious and it's presence in skulls from Australopithecines to Neanderthals is discussed more fully in the paper remembering that information from endocasts is literally superficial.

The use of language and the ability to think in words is linked to being human yet there are no unique human anatomical correlates for language. Broca's area in the inferior frontal lobes and Wernicke's area in the angular gyrus at the temporal-parietal-occipital junction are essential in humans for the production and comprehension of the spoken word.

Mirror neurones were originally discovered in Area F5 of macaque monkeys and were shown to become active not only when the animal carried out a task such as grasping an object, but also when it observed another monkey or a human performing the same action The region in the human brain homologous to F5 in the macaque is near Broca's area, the expressive speech area.

This area becomes active when an individual carries out a task themselves or observes another person doing it. An important difference between the mirror neuron system in macaques and humans is that the latter responds also to intransitive meaningful hand movements The mirror neuron system in humans not only mirrors the goal but also the pathway to achieve it considerably enhancing the speed and efficiency of learning.

Hominid evolution

Australopithecines had small brains of less than 500 cc and perhaps had asymmetry of their Sylvan fissure. Endocasts of *Homo habilis*, dating from 2 Mya, with an average brain size of 646 cc, indicate developments in the regions corresponding to Broca's area and Wernicke's speech area. Most significantly, primitive tools, Oldowan pebbles, are associated with *Homo habilis*. They would not have required a great deal of processing and the objectrelated mirror system described in macaques would have supported the copying of the action from one individual to another.

Acheulian tools associated with *Homo erectus*, dating from around 1.5 Mya, are found over a wide geographic and temporal range. Unlike the Oldowan tool kit, there is evidence for a prepared core technology that differed between sites but was consistent within sites. This seems to be the first evidence of shared intentionality with both process and outcome being transmitted from one individual to another.

It is not until *Homo sapiens neanderthalensis*, with a brain capacity averaging 1 450 cc, appears around 130 000 years ago, that the tool kit really expands and there is evidence, if controversial, for symbolic behaviour.

Cells and Synapses

The paper discusses in detail the importance of specific cells such as spindle cells which experimentally are associated with the empathy trait and appear to have developed in the last 15 Mya. It pursues the new fields of proteomics and genomics discussing the enormous computational power of the neural synapse, which transmits information in the form of a neural code.

The fact is there was no sudden becoming human. The basic protosynapse present in the simplest unicellular organism is preserved in all animals with complexity building on the basic framework.

Somewhere along the line of hominid evolution people started to imagine, to shape things with intention. Did they need language? Temple Grandin, an academic with high functioning autism, says no. Pictures provided all that she needed to construct her world.

Homo erectus made tools, at times bringing material from a considerable distance to their working floors. They needed to work cooperatively and while they could have done this without using symbols or leaving messages, it is possible that they made marks encoding information.

Evidence of ornamentation by Neanderthals suggests a society in which individuals were aware of themselves and their capacity for influencing others. Making marks with intention was within their power.

Connectivity is perhaps the key element in the development of a brain that thinks and that knows that others think. The problem is that the evidence of connectivity – those long white tracts that make pathways through the brain, the networks of interconnecting cells and the thousands of proteins that make up the postsynaptic density – disappear as easily as the narratives they carry.