

On the Cognitive Development of Hominids

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Introduction

Before addressing the difficult subject of early cognitive development it is requisite to relate two antithetical concepts of reality. One is of the 'range of realities' as perceived by contemporary humans, with the perceptual and conceptual means available to them; the other concerns the idea or abstraction of an 'objective reality' (Kant's '*Das Ding an Sich*'), which has been speculated to exist, and which would have existed and would go on existing independent of human constructs. In the present context it is essential to appreciate that the former of these concepts is not necessarily a reflection of the latter, and that our examination of cognition or its epistemology is severely limited by the tools available to us: we can only study this phenomenon with means (conceptual constructs) that are its own, subjectively conceived products. This may hardly seem a scientific basis (and it should be understood before we proceed), yet it is no worse than that of most other areas of 'scientific' endeavour. Indeed, I have recently postulated that only one area of human consciousness can be studied objectively by humans (Bednarik in press).

'Biological intelligence' does not necessarily lead to a better grasp of objective reality for the species concerned. On the contrary, its development follows evolutionary laws that render this unlikely, as they tend to lead an intelligent organism away from, rather than towards reality. While it is true that intelligent forms of life must participate in a process that inevitably leads to the evolution of more intelligent forms of life, the improvements will always be in terms of their ability to enhance access to energy and nutrient resources, and to promote procreational potential, never in terms of facilitating a better grasp of reality. Genotypes determine the sensory faculties of an organism and changes only occur within the confines of phenotypic plasticity. These abilities determine which material stimuli an organism can detect. Genes can also form neural circuitry that allows cross-referencing of sensory information, but the ability to construct conceptual models of reality, which defines 'intelligence' biologically (Jerison

1973), is not itself genetically determined. Among highly advanced life forms, selection will favour organisms capable of the conceptual and behavioural innovations from which new behavioural modes can be constructed: the mental faculties, not their constructs, are the selective determinant.

Some years ago I proposed that 'the evolution of our sensory facilities and intellect can be assumed to have only equipped us with adequate faculties to make them useful; they were not selected on the basis of their suitability in defining the reality of the cosmos - in fact *there was no survival value in that ability*' (Bednarik 1984). I argued that because of the limitations of the genetically based sensory systems of organisms there could not be a direct correlation between humanly perceived reality and objective reality, and that this lack of relationship is the reason for the discrepancies between these realities. This, however, is not the only reason for the formulation of an anthropocentric world. There is at least one other, albeit more complex factor.

Human knowledge is derived from applying concept-building cognitive processes to external stimuli, i.e. sensory information, thus accumulating percepts. It is self-evident, I have suggested, that human knowledge has a tendency to reinforce itself through its own products, because it is continually validated and augmented by our material and cultural achievements (Bednarik 1985). But this interdependence becomes rather more sophisticated and complete when we involve the role of culture. In the sense used here, the term 'culture' does not refer specifically to human culture, but to the biological concept of culture: the individually acquired system of 'understanding' which reflects the distinctive life trajectory of the organism in question (Handwerker 1989). In this sense, cultural dynamics refer to the processes by which the intelligent organism alters its perceptible environment through its dialectic participation in the processes shaping it. Selection in favour of increased levels of 'intelligence' is the inevitable outcome of such interaction among percepts, concepts and behaviour

patterns, but at no stage of this autonomous process is there any need for the concepts to be in tune with objective reality. Provided that the internally consistent logical framework is not challenged by it, there is no reason to assume that an entirely false, cultural cosmology or epistemological model could not be formed and maintained indefinitely by an intelligent species. Once again it is obvious that evolutionary success is irrelevant to the objective merits or validity of such models.

One can conjecture about the possible shortcomings of a cosmological construct, for instance by comparing them to those of scientific constructs that are based on confirmation (Tangri 1989). Indeed, the comparison appears to be valid, and quite illuminating. Just as the basic error in confirmation or induction is the inability of the inevitably subjective observer to identify the one variable of the phenomenon category that determines the common characteristics we perceive as crucial (the 'crucial common denominator', Bednarik in press), the deficiencies of conceptual models of reality cannot possibly be explored from within such a model, which is the only way in which we have been able to proceed so far as a species. In an anthropocentric system of reality, ideas or mental constructs must adhere to its inherent order not only to be acceptable, but even to be liable to be conceived - even though they comprise elements relating to material stimuli, i.e. elements that must be assumed to have some form of objective validity. This is because they can only be generated by involving memory traces based on the same system, and one could argue that the inherent order might simply be a reflection of neural hierarchies, so we cannot even speculate whether there is any such order in objective reality 'out there'.

About Science and Reality

To summarise what has been said so far: the concepts of reality that have evolved in the course of hominid and human history have led to the one apparently held by all extant human populations. There is no reason to assume that these concepts could be particularly useful in exploring objective reality. What we can state categorically is that anthropocentricity governs all human consciousness, and that this knowledge has been with us for over two millennia at least: it is quite clear from Plato's simile of the cave that he, for instance, understood the concept of anthropocentricity. Developments in the twentieth century, in philosophy and theoretical physics, have begun to erode beliefs in the common-sense world epitomised by Newton and Euclid, and the transient, ever-evolving nature of anthropocentricity has become more apparent since we have realised how many of even the supposedly most solid tenets have fallen by the wayside. As we approach the third millennium we realise at last the scientific enlightenment humans thought was within their grasp turned out to be a mirage,

while the horizons of knowledge seem to be forever retreating from us. Science itself continues to occupy a position that is for the most part within the human model of reality. It is therefore fundamentally subjective, its rules may be valid only within its own frame of reference. This is of course quite adequate in terms of the demands made of it, as long as science is not expected to lead us to objective reality.

Progress towards more realistic knowledge will probably not be in the form of sudden, major breakthroughs, but will occur in the course of continuing intellectual and cognitive evolution. Malik's (1989) eloquently argued proposal that a conscious effort on the part of individuals would expedite this process is most relevant. Mental constructs or ideas are ephemeral elements, being continually re-formed, modified and re-cast in the creative learning processes of individuals. It may not be realistic to expect a significant change in human cosmology over the next few centuries, even though over the last century we have gained an unprecedented understanding of the influence of certain factors on the phylogenetic processes of cognitive evolution, on how the continual reshaping of world view and heuristic history has prompted an acceleration in the production of new conceptual and behavioural innovations, and on the roles played by identifiable elements in generating cultural dynamics. Yet even this significant broadening of the perceptual base will not by itself suffice to elicit more than a gradual development towards better understanding, as it will still be within the parameters of anthropocentricity.

One potential course is to attempt to explore the early development of human consciousness, focusing on the period during which the cognitive niche might have been established. If valid information about the underlying processes could be secured this might lead to the formulation of hypotheses about the origins of our anthropocentricity. While this would of course not by itself provide any access to objective reality, it might permit realistic inferences about the articulation between anthropocentric and objective reality. That some form of such an articulation does exist seems likely, it is difficult to see how there could be none at all. If one could explain the mental and cognitive processes involved, one might not only find it possible to consider the neural developments required and the biochemistry to account for them, but one might also find it possible to tackle the ultimate challenge: to explore reality outside that which is perceptually and conceptually accessible to humans.

While it is likely to take us thousands of years to achieve this, I feel that the formula as such might be quite simple. If one could explain how the cognitive basis of our world view was acquired - by quantifying, or at least defining, the processes involved - one ought to be able to speculate about the selective forces involved, how they

contributed to the outcome, and how others would have altered the same. Such random forays into extra-human reality would lead to a fading of the boundaries separating it from anthropocentric reality.

The question of how much do we know about the cognitive development of hominids, the subject of this paper, is obviously the starting point of any enquiry into these profound matters. How much do we actually know about the intellectual evolution of early humans, how reliable is it, what is it based on, and what are the reasons for the gaps in our knowledge?

Archaeological studies, especially of the second half of this century and in the Western countries, have concentrated almost entirely on what are believed to be valid interpretations of the ecological responses of humans, on how they may have adapted to changing environments, how they may have extracted their subsistence, how they are thought to have survived in their physical environment. Their intellectual environment has been almost completely ignored in the heuristic dynamics of this discipline, as it were. Herein lies one of the reasons why archaeology finds itself in its present cul-de-sac, although not the most important one: the inaccessibility of its interpretive models to scientifically valid methods of testing (Tangri 1989). It has in effect tried to define prehistory in terms of deconstructing culture, yet the development of humanity is based on cultural and cognitive factors, not on genetically determined abilities to improve access to resources. Ecological negation of this self-evident truth has led to many unrealistic and unscientific constructs. In the specific area of intellectual evolution, ecological archaeology has provided us with only fragmentary, unreliable and sometimes downright irrelevant evidence. Much of the discussion has centred on the human capacity to possess advanced language (itself a patently ethnocentric notion), and the present situation shown to what a vast range of incompatible ideas an inappropriate research program can lead. For instance, in respect of the Neanderthals we have the extreme views that on the one hand they were totally incapable of reflective language (e.g. Davidson and Noble 1989), and on the other that they were capable of well-structured grammar and syntax (Falk 1987), and there are of course intermediate views (e.g. Lieberman 1984). So in practical terms Neanderthal's linguistic ability must lie somewhere between that of an animal and a modern human! One does not need archaeologists or anthropologists to arrive at such a view. Similarly, the beginnings of complex language could be anywhere between 35,000 and some millions of years ago, according to the various competing theories!

The types of evidence brought to the task of solving the problem include the cortical development inferred from cranial casts (Falk 1983), and the still continuing, unproductive speculation concerning the fossil laryngeal structure

and the role of the hyoid bone (Marshall 1989), all of which is tenuous and far from unequivocal. But cortical or speech-related structures surely are results, not causes, of evolutionary selection favouring speech or intelligence: a selection criterion needs to be established before it can affect phenotypic selection of genes. The reasons for the type of cortical developments we are interested in are not to be found in secondary symptoms, and by utilising these in their hypotheses archaeologists have merely substituted symptoms for causes. What we need to ask is what could have been the true causes and dynamics in the cognitive developments that provided the new traits for selection, and which ones could have left detectable traces for us to discover? How would one find and identify such traces in the archaeological record?

A Discussion of the Evidence

Neurological research suggests an intimate relationship between speech and vision, and there appears to be a nexus between the level of visual taxonomising ability and linguistic ability (Marshack 1988). This is supported by different types of evidence, such as the means by which the human infant acquires language (Lock 1980), or the effects of neurological impairments (Vellutino 1987). A crucial contributing factor in creating the conditions for cognitive development must be the feedback relationship between a hominid and his environment: as he changes it and perceives the results of his actions, his awareness contributes to creating the basis of consciousness, establishing the potential for dialectic. The most obvious potential was in the area of visual stimuli. Having acquired a high degree of tactile proficiency during eons of tool making and tool use, the production of simple marks - possibly 'discovered' through the rhythmic manipulation of tools (Vatsyayan pers. comm.) - would have resulted in a permanent, visually perceptible pattern which could be duplicated, examined and contemplated. Such marking behaviour would have a potential for expanding conceptualisation and the attendant proliferation of mental constructs, and the establishment of new mental structures.

I propose that of all the potential sources of information about the intellectual advances heralding human consciousness, very early intentional markings are by far the most promising. Certainly, evidence of such advances will continue to elude us in cranial casts, laryngeal structures, self-adornment, figurative art production, technological innovations, burial practices, implied social structures, or any other archaeologically inferred phenomenon (Chase and Dibble 1987). Not only should we treat archaeological interpretations with more scepticism in view of archaeology's declining credibility (Hodder 1986; Tangri 1989; Bednarik 1990), such developments are far more a product of cognitive evolution than a source of it.

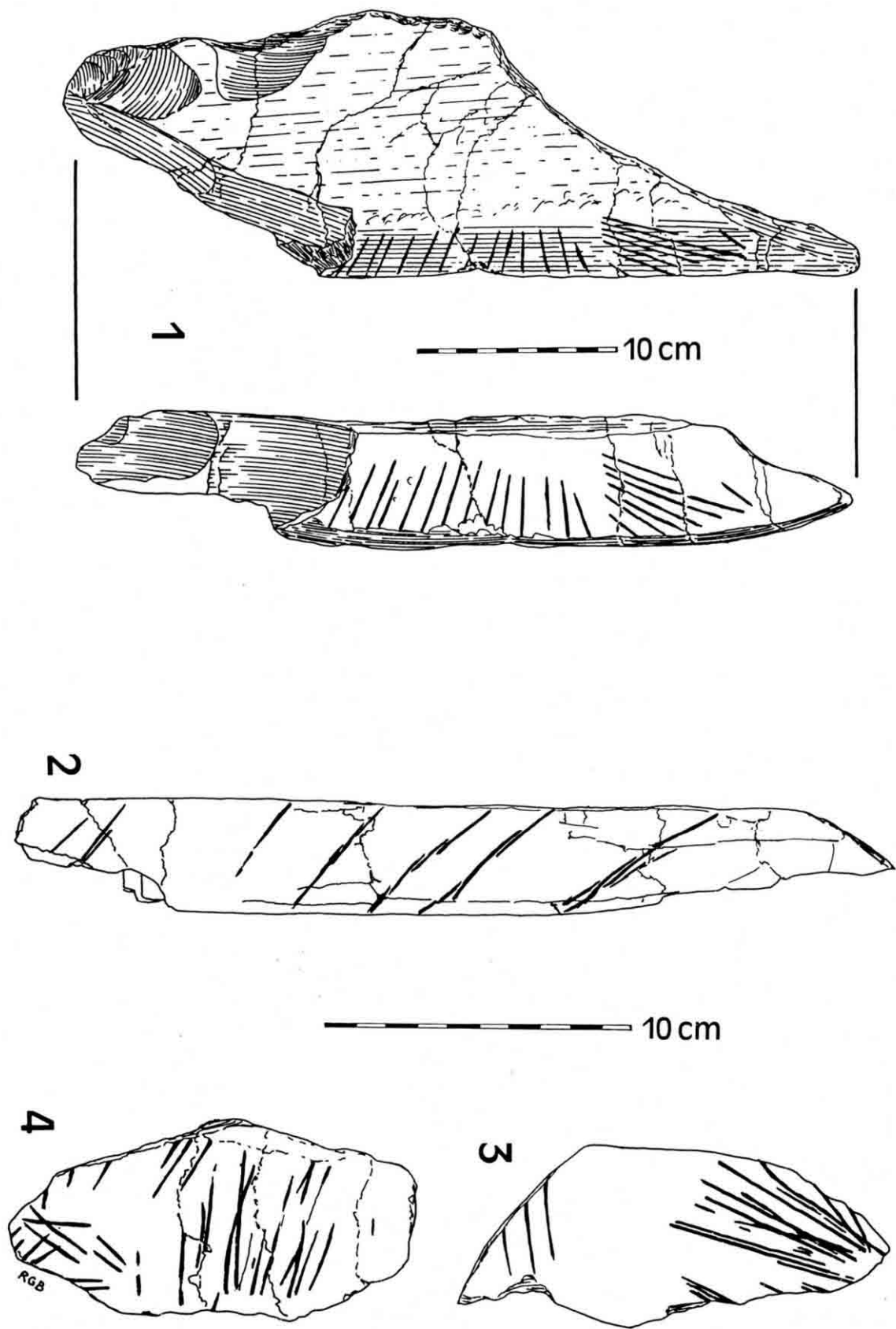


Fig. 1: The four published engravings on bone artefacts from the Lower Palaeolithic of Bilzingsleben, East Germany. Artefacts 1 and 3 are of elephantine bone. (After Mania and Mania 1988)

It follows that the most archaic intentional marks may be the key evidence in interpreting the early cognitive evolution of hominids. At this stage only six Lower Palaeolithic examples of intentionally engraved bone objects have been published and widely accepted by scholars. They are the four specimens from Bilzingsleben, East Germany (Fig. 1), at least two of which were engraved on bones of the extinct forest elephant (*Mania* and *Mania* 1988); the engraved elephantine vertebra from Stránská skála, Czechoslovakia (Fig. 2), less than 500 km from the first site (Valoch 1987); and the engraved ox rib from Pech de l'Azé, France (Fig. 3), first described by Bordes (1969) and later examined by Marshack (1977). Five of these six objects have only been found in very recent years, and the hunt is now on for more examples from Acheulian and other Lower Palaeolithic deposits. There are a few doubtful items from Italy which are either poorly dated or lack authentication (Leonardi 1988). I consider it highly possible that such important evidence could be found in India, although there is a scarcity of osteal material from the Acheulian. It must be also emphasised that Pleistocene bone remains often bear marks of various non-anthropogenic origins. These include animal gnaw marks, butchering marks, taphonomic marks, chemical corrosion marks, or

simply marks caused by the movement of clastics, through processes such as cryoturbation, solifluction and so forth. To be of interest to us, marks on bone or ivory objects must have been engraved with pointed stone tools, and they must form an internally consistent pattern indicating their intentionality.

The most recent developments in the area of non-utilitarian, proto-artistic activity in the Lower Palaeolithic come in fact from the Acheulian of India. They include my discovery of ancient striations on one of the haematite pebbles from Hunsgi, Gulbarga District, Karnataka (Paddy in prep.) - only one site with corresponding evidence is known in the world: Bečov, Czechoslovakia (Marshack 1981), while non-striated ochre has been found in the Acheulian of Ambrona (Spain) and Terra Amata (France). Other recent evidence consists of the trimmed, discoid sandstone object recovered from the Acheulian of Maihar, south of Satna, Madhya Pradesh (Pal in prep.), and the six quartz crystals from the Lower Acheulian of Singi Talav, near Didwana, Rajasthan (D'Errico, Gaillard and Misra 1989); quartz crystals have been previously observed in early deposits, such as at Choukoutien in China (Pei 1931) and at the Acheulian site Gudenus Cave in Austria (Bednarik 1988a). More recent evidence of non-utilitarian activities (Middle Palaeolithic in Europe, Middle Stone Age in southern Africa) has been found in abundance, but much of it is unpublished, or published in places where it has escaped the attention of specialists. In my view, India is a key region in the emerging field of cognitive epistemology, and possesses ample potential for important finds in this field. The focus of attention is the middle or late Acheulian, and India has a wealth of sites of that period, in addition to a crucial geographical location.

Because nearly all of these early finds are very recent discoveries, there has been little opportunity to discuss them, their analytical interpretation and their implications. The discoverers of the Bilzingsleben specimens have proposed that their finds indicate abstract thinking in late *Homo erectus* of 350,000 years ago, as well as language. Both claims have been rejected by an international panel of specialists, who concurred that the finds only provide evidence that these hominids engaged in conscious mark production. This finding coincides with that concerning a

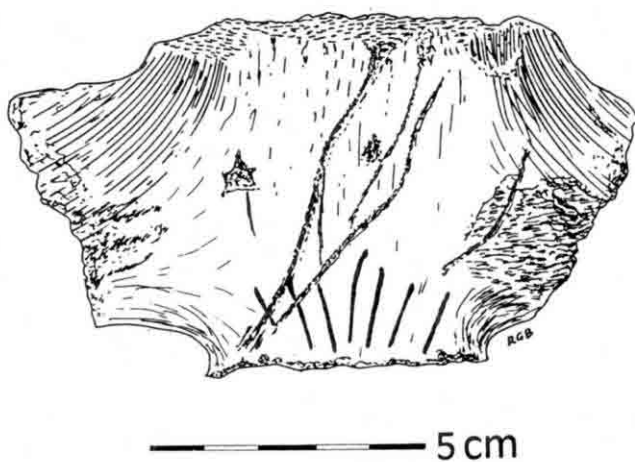


Fig. 2: Elephant vertebra fragment from the Lower Palaeolithic of Stránská skála, Czechoslovakia, with engravings. (After Valoch 1987)

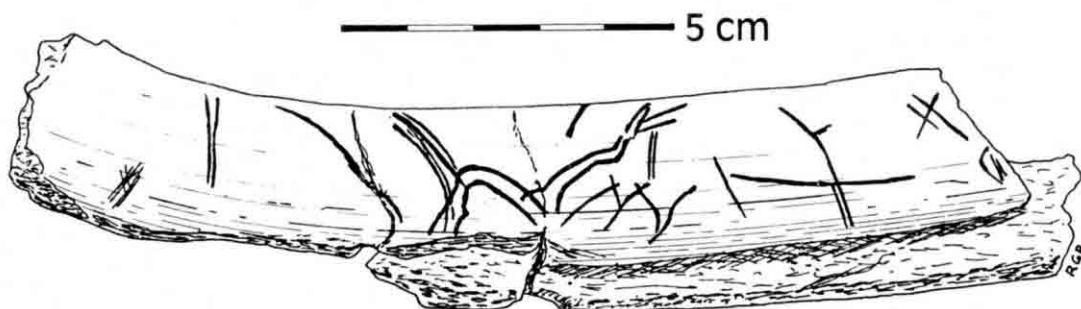


Fig. 3: The engraved ox rib from the Acheulian of Pech de l'Azé, France. (Adapted from Bordes 1969 and Marshack 1977)

protosculpture from Berekhat Ram, Israel, which is of similar age and suggests that Lower Palaeolithic people were capable of recognising three-dimensional iconicity (Goren-Inbar 1986). Relevant is also the recent discovery of a polished wooden plank in the Acheulian deposit of Gesher Benot Ya'aqov, also in Israel (Belitzky *et al.* in press).

So far only one hypothesis based on the new finds has been advanced, which is my own. I have proposed (Bednarik 1988b) that the most archaic art in the world consists of 'responses to edges or surface aspects, enhancing them or making them more interesting'. I observed that selection would favour strategies providing optimal arousal, and that stimulus-seeking behavior (Berlyne 1960) is therefore a biological imperative, providing cybernetic feedback and a more stimulating visual environment. 'This reshaping of salient aspects of the physical world not only resulted in an increasing consciousness of the physical reality and a feedback on the mark making behaviour, but inevitably also in an increasingly complex cognitive environment and in the emergence of new, taxonomising mental processes'. Such behaviour would seem to result in a proliferation of new neural pathways, in the establishment of new associative percepts, and therefore in a comparatively rapid enlargement of the conceptual base.

This very preliminary (and certainly incomplete) model of the cognitive development of hominids remains without competing hypotheses. It is no more than a draft, requiring considerably more detailed explanation (much of which is contained in Bednarik in press), and it needs to be formulated in such a manner that it becomes fully refutable. Nevertheless, it indicates that the subject is being addressed in a holistic fashion. But I stress that we are only at the beginning of a long and arduous road; where it leads no-one really knows. But as we take this road we must first consolidate and rationalise all we know about the subject, and try to increase our extremely small data base. This, without a doubt, is the most pressing matter in the quest to find the origins of human intellect and human reality.

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