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ON LOWER PALEOLITHIC COGNITIVE DEVELOPMENT

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INTRODUCTION

How should one address a subject as intractable as the cognitive development of Lower Paleolithic hominids without eliciting reproving sighs from archaeologists?

The existing literature on the subject demonstrates amply that such efforts have led to little more than contradictory hypotheses and "speculative outpourings" (Black 1989), and to long arguments about various types of supposedly indicative evidence and even what types of evidence are actually admissible. Among those applied so far to the task of shedding some light on the beginnings of consciousness, language and 'reflective thinking' have been cranial casts (e.g. Falk 1983; Broca's area in the left frontal lobes remains a popular exhibit), laryngeal structure (e.g. the futile discussion of the hyoid bone by Lieberman *et al*. 1989; Marshall 1989), self-adornment (White 1989), iconic or figurative art production (Davidson and Noble 1989, 1990; Noble and Davidson 1991), apparent technological innovations and lithic traditions, claimed burial practices, implied social structures and other archaeologically inferred phenomena (cf. Chase and Dibble 1987; for a critique see Bednarik 1992a).

Not only should archaeological interpretations be treated with the scepticism confirmationist programs generally deserve (cf. Hodder 1986; Tangri 1989; Fletcher 1991; Bednarik 1990a, 1990b, 1990c, 1991a), but in considering criteria such as those just listed we should remember that the question of what is cause and what is effect remains often unresolved. For instance, it seems more likely that cortical or speech-related structures are results, not causes, of evolutionary selection favoring speech or intelligence. Surely 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 utilizing 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 recover? How would one find and identify such traces in the archaeological record?

If the subject of cognitive development of hominids is so difficult to deal with, is it really worthwhile to try exploring it? Now that humans do possess a view of the world, is it all that important to discover how it came into being?

The cognitive development during the Lower and Middle Paleolithic provides not only the key to understanding why humans perceive reality as they do, but also to understanding the limitations, conceptual latitude and subjectivity of all human knowledge. Such a pursuit may seem pointless to someone steeped in the belief that the human intellect, cognition, experience and perception provide an objective and absolute measure of reality. However, human sensory faculties were never designed to determine how things really are in the world. Their only purpose, evidently, was the same as that of the faculties of all other organisms on the Earth: to be in tune with those aspects of reality the rest of the biomass relates to (e.g. the relationship between primates and bananas involves color vision and color change; either a predator and its prey species must be 'compatible' in terms of their sensory range, or the latter must have some other means of preserving itself, otherwise prey and predator are both doomed to extinction).

It seems most unlikely that the perception of any one organism, designed simply to ensure its individual and species-collective survival, should also provide access to 'objective reality' (assuming that such a state actually exists). There is, as Plato has pointed out millennia ago, no reason why we should assume that to be so. Moreover, it should be self-evident that

> the evolution of our sensory facilities and intellect can be assumed to have equipped us with only 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, original emphasis).

Yet naive empiricism, the prime ideological force in today's archaeology in most Western countries, has turned the rationale of true empiricism on its head and promotes the view that human experience, notably sensory experience, is the measure of how things really are in the world.

This leaves us with the following scenario: at some time in the distant past, hominids somehow managed to acquire a way of 'consciously experiencing' a form of reality, and eventually this led to the view of the world apparently held by all extant people. The paradigms of reality along this development were always anthropocentric, i.e. based on interpreting the world exclusively in terms of the human experience. What has come to be known as 'science' also remains underpinned largely by this subjective framework, epitomized, for example, in the common-sense systems of Newtonian mechanics or Euclidian geometry, even though it has long become scientifically untenable.

The obvious dilemma is that, even under the most favorable conditions, the only tools humans could possibly bring to the task of examining the origins of human cognition are the conceptual constructs that are that cognition's very own products! It should be self-evident that a conceptual model of reality cannot be confidently, effectively or objectively contemplated by recourse to the biological intelligence that is its own product. Thus the task of exploring the beginnings of human consciousness, the most challenging in the history of science, is outside the scope of traditional archaeology - but it is still archaeology which must provide the groundwork and the hard data. Doing so is, I consider, by far the most significant role of the discipline. In this paper I shall examine that role in the context of the endeavor outlined above.

ABOUT ANTHROPOCENTRIC REALITY

In the context of the cognitive development of hominids it is essential to appreciate the two antithetical concepts of reality just referred to. The first, 'anthropocentric reality', pertains to the range of realities perceived by contemporary, ethnographic and prehistoric humans, with the perceptual and conceptual means available to them. The second concept concerns the idea or abstraction of an 'objective reality' (Kant's '*Das Ding an Sich*'), which has been speculated to exist and which would do so independent of human constructs. The former of these concepts is not necessarily a reflection of the latter, but the success of the human intellect suggests that it may be in tune with *some* aspects of objective reality.

'Biological intelligence' (Jerison 1973) does not necessarily lead to a better grasp of objective reality for the species that possesses it. 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 selects in favor of more intelligent forms of life, the improvements will always be in terms of their enhancement of access to energy and nutrient resources, and of procreative potential, never in terms of facilitating a better grasp of reality. Genotypes determine the sensory faculties of an organism and changes occur only 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, is not itself genetically determined. Among highly advanced life forms, selection will favor organisms capable of the conceptual and behavioral innovations from which new behavioral modes can be constructed: *the mental faculties, not their constructs, are the selective determinant.*

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 of reinforcing itself through its own products, because it is continually validated and augmented by our material and cultural achievements (Bednarik 1985). This interdependence becomes even more sophisticated and complete when we consider 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 participation in the processes shaping it. Selection in favor of increased levels of 'intelligence' is the inevitable outcome of such interaction among percepts, concepts and behavior 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 compare the shortcomings of a cosmological construct to those of scientific constructs based on confirmation (Tangri 1989). Just as the basic defect of confirmation or induction is the inability of the inevitably subjective observer to confidently identify the one variable of the phenomenon category that determines the common characteristics we perceive as crucial (the "crucial common denominator", Bednarik 1990a, 1991a), the deficiencies of conceptual models of reality cannot possibly be explored from within such a model - which is, nevertheless, the only way in which we have been able to proceed as a species so far. 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.

THE ROLE OF ARCHAEOLOGY

The key to creating a true science would seem to lie in the question of how the anthropocentric and objective realities are related to one another. That some form of articulation does exist between them seems likely; it is difficult to see how there could be none at all (in view of the considerable input of sensory information, for instance). One potential course of action is to attempt to explore the early development of human consciousness, focusing on the period during which the cognitive niche might have been established. The question of how much we know about the cognitive development of hominids, the subject of this paper, should be the starting point of any enquiry into these matters. It would be crucial to an understanding of how human reality relates to objective reality. It seems certain that without such an understanding science can only remain subjective and fallible.

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 in the second half of this century and in the Western countries, have concentrated largely on what are believed to be valid interpretations of the ecological responses of humans, on how humans 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. Herein lies one of the reasons why archaeology finds itself in its present *cul-de-sac* (although not the most important one, which is the inaccessibility of its interpretive models to valid methods of testing, such as refutation; Tangri 1989). It has in effect tried to define 'prehistory' (itself an ethnocentric term and concept) 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 (a concept adding insult to injury for indigenous peoples throughout the world). Ecological negation of this, in my view self-evident, truth has led to many unrealistic and unscientific constructs (such as defining culture through perceived tool types, on the basis of a largely stylistic

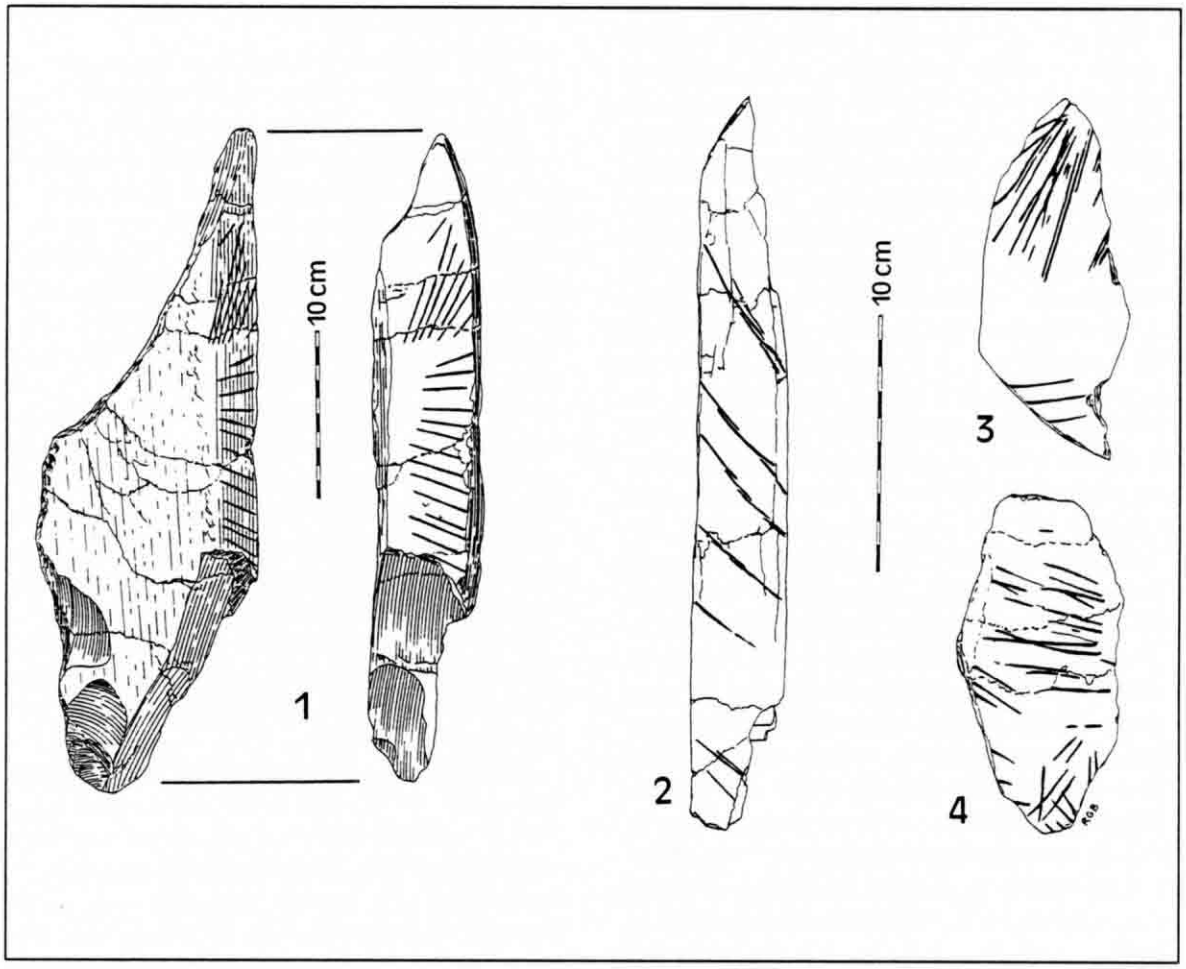

Figure 1: The four published engravings on bone artifacts from the Lower Paleolithic of Bilzingsleben, Germany. Artifacts 1 and 3 are of elephantine bone (on the order of 250,000 - 350,000 years old).

taxonomy created by the specialists of an alien society who themselves admit that they are unable to define style scientifically or agree on where it resides; cf. Conkey and Hastorf 1990).

In the specific area of intellectual evolution, ecological archaeology has provided us with only fragmentary, unreliable and sometimes irrelevant evidence. Much of the discussion has centred on the human capacity to possess advanced language (another anthropocentric notion), and the present situation shows to what a vast range of incompatible ideas an inappropriate research design 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 in fact were not humans, but animals (Davidson and Noble 1990); and on the other that they possessed well-structured grammar and syntax (cf. Falk 1987). There are of course many intermediate views (e.g. Lieberman 1984; for recent reviews see Marshack 1989, 1991; Lieberman *et al.* 1989; Marshall 1989). So in practical terms Neanderthal's linguistic ability is said to lie somewhere between that of an ape and a modern human!

Neurological research suggests an intimate relationship between speech and vision, and there appears to be a nexus between the level of visual taxonomizing ability and linguistic ability (Marshack 1988). This is supported by different types of

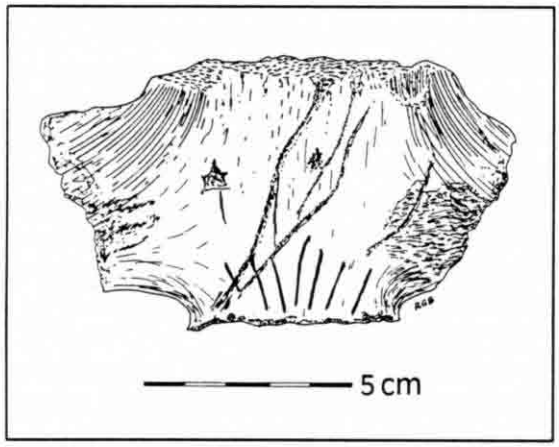

Figure 2: Elephant vertebra fragment from the Lower Paleolithic of Stránská skála, Czechoslovakia, with engravings.

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 have been the feedback relationship between hominids and their environment: as they changed it and perceived the results of their actions, this awareness contributed to creating the basis of consciousness, establishing the potential for dialectic.

The most obvious potential for cognitive development of hominids was perhaps in the area of visual stimuli. Having acquired a high degree of tactile proficiency during eons of tool making and tool use, their production of simple repetitive marks - possibly 'discovered' through the rhythmic manipulation of tools - would have resulted in permanent, visually perceptible patterns which could be examined, contemplated and duplicated. Such marking behaviour would have had a potential for expanding conceptualization and the attendant proliferation of mental constructs, and the establishment of new neural 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.

THE AVAILABLE EVIDENCE

It follows that the most archaic intentional marks produced by hominids may be among the key evidence in interpreting the early cognitive evolution of hominids. At this stage, only six Lower Paleolithic examples of intentionally engraved bone objects have been published and widely accepted by scholars. They are the four specimens from Bilzingsleben, Germany (Figure 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 (Figure 2), less than 500 km from the first site (Valoch 1987); and the engraved ox rib from Pech de l'Azé, France (Figure 3), first described by Bordes (1969) and later examined by Marshack (1977). Five of these six objects have been found only in recent years, and the hunt is now on for more examples from Acheulian and other Lower Paleolithic deposits. Further marked specimens are available from Bilzingsleben (D. Mania, personal

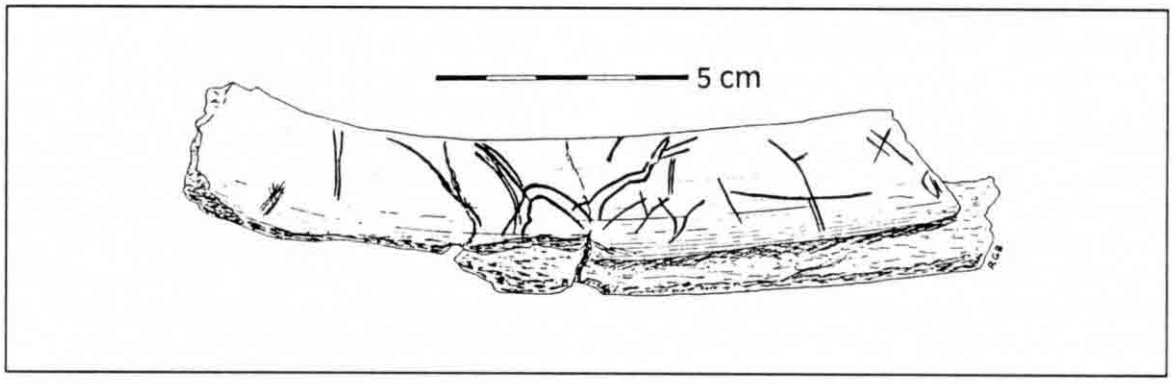

Figure 3: The engraved ox rib from the Acheulian of Pech de l'Azé, France (approximately 300,000 years old).

communication): an intricate geometric engraving on yet another elephant bone, and markings on a tiny quartzite tablet. There are a few doubtful items from Italy which are either poorly dated or lack authentication (Leonardi 1988).

It must be emphasized that remains in Pleistocene deposits (bones, ivory, teeth, stones, ostrich eggshell, antler) often bear marks of various non-anthropic origins. These include animal gnaw marks, butchering marks, incidental artificial marks, taphonomic marks; chemical corrosion marks such as those I have recently attributed to mycorrhizal processes on ivory in Siberia, ostrich eggshell in India (Bednarik 1991b) and bone in China; or simply marks caused by the movement of clastics or other sedimentary detritus, through processes such as cryoturbation, solifluction and so forth (cf. Bednarik 1991c). To be of interest to us here, marks on portable Paleolithic objects must have been engraved with stone tools and they must form an internally consistent pattern indicating their intentionality.

Some of the most recent data in the area of non-utilitarian, proto-artistic activity in the Lower Paleolithic come from the Acheulian of India. They include my discovery of ancient striations on one of the hematite pebbles from Hunsgi, Gulbarga district, Karnataka (Bednarik 1990d). Only one site with corresponding evidence of similar antiquity is known in the world: Beçov, Czechoslovakia (Marshack 1981). Non-striated ocher has been found in the Acheulian of Ambrona (Spain) and Terra Amata (France), while more recent striated ocher occurs in various parts of Africa (Middle Stone Age) and in northern Australia (Bednarik 1992a).

Other recent Indian evidence consists of the trimmed discoid sandstone object recovered from the Acheulian of Maihar, south of Satna, Madhya Pradesh (Bednarik 1992a), and the six tiny quartz crystals from the Lower Acheulian of Singi Talav, near Didwana, Rajasthan (d'Errico *et al.* 1989). These complete crystal prisms are far too small to have been used as tools, and they were probably brought to the site independently because they differ mineralogically and are not from a single crystal flower. Quartz crystals have also been observed in other early contexts, such as at Zhoukoudian in China (Pei 1931), and in the Acheulian stratum of the Gudenus Cave in Austria (Bednarik 1988a) as well as the Acheulian of Benot Ya'aqov in Israel (Goren-Inbar *et al.* 1991). Younger evidence of nonutilitarian activities (of the Middle Paleolithic of Eurasia, the Middle Stone Age of southern Africa, or the first known occupation phase in Australia) has been found in abundance, but much of it remains unpublished or has been published in places where it has escaped the attention of some commentators on the subject of early cognitive development (for review, see Bednarik 1992a).

Because nearly all of these early finds are quite recent discoveries there has been little opportunity to discuss them, their analytical interpretation and the implications they permit. 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 provide only evidence that these hominids engaged in conscious mark production (Bahn 1988; Bednarik 1988a, 1989b; Davidson 1988, 1990; Davis 1988; Gallus 1988; Halverson 1988; Habgood 1989; Marshack 1991). This finding coincides with that concerning a proto-sculpture from Berekhat Ram, Israel (Goren-Inbar 1986), which is of similar age and suggests that Lower Paleolithic people were capable of recognizing three-dimensional iconicity in a natural form (Bednarik 1989a). 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.* 1991).

DISCUSSION

In summary, the amount of reliable Lower Paleolithic evidence about cognitive development remains minute, especially as we are obliged to exclude from it data which are of some uncertainty. There are, however, alternative approaches to the subject. One of them concerns the level of taxonomizing ability evident from the artefacts themselves, irrespective of their interpretations. I regard the creation of tentative taxonomies as the crucial step towards conscious experience, and as indicating the beginnings of reflective, non-utilitarian action, leading to exploring, defining and, ultimately, naming aspects of the physical world.

Oakley (e.g. 1981) and others have for some time argued that the perfection of certain Lower Paleolithic tool types and the occasional inclusion of fossil casts in them indicates some degree of aesthetic concern in their makers, but here it seems possible that researchers merely projected their own perceptions onto the artefacts in question. The existence of rudimentary systems for taxonomizing some aspects of physical reality may provide a more reliable measure - and a refutable one. The ocher finds of the Acheulian demonstrate convincingly that the pigment was used, in some cases apparently for marking rock surfaces, and color discrimination and preference can be safely inferred from the evidence. Moreover, the crystal prisms and fossils, of which quite a number are now available from Acheulian sites, suggest that differences were perceived between common and unusual objects (Bednarik 1988a), because without such a faculty there would have been no reason to carry rare but non-utilitarian objects to the home base. The same may apply to the unusually shaped pebble from Berekhat Ram.

One could argue that these habits might have been the hominid equivalent of the behavior of certain birds, notably the bower birds of Australia, who collect brilliantly colored or reflective objects. But this is not a very convincing argument, and is in any case hardly relevant to the issue at hand. Firstly, the bower bird produces no stone tools or polished wooden planks and does not use hematite crayons or fire, nor is it likely to develop its present skills to those attributed to Middle and Upper Paleolithic humans. Secondly, it would certainly not negate the validity of a search for the origins of human cognition if it were found that such capacities stem from behavior such as that of the bower bird. This would merely introduce a new theoretical scenario, but the most profound questions remain the same: for instance, how was that conceptual artefact created which humans collectively experience as reality?

So far only one hypothesis based on the finds of the last few years has been advanced, which is my own (Bednarik 1988b). I have proposed that the most archaic graphic art in the world consists of 'responses to edges or surface aspects, enhancing them or making them more interesting' (cf. Steinbring and Granzberg 1986). I observed that natural selection would favor individuals with behavior 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.

> The 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 behavior, but inevitably also in an increasingly complex cognitive environment and in the emergence of new, taxonomizing mental processes (Bednarik 1988b).

Such behavior 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 early 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 1991a and 1992b), and it needs to be formulated in such a manner that it becomes refutable.

Nevertheless, it does indicate that the subject is being addressed in a holistic fashion. The most pressing matter in the quest to illuminate the origins of human intellect and human reality is clearly to enlarge our extremely small data base and to consolidate and rationalize all we know about the subject. We are only at the beginning of the long and arduous road to an understanding of the human origins and of the human condition. No one can know where it will lead us.

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