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Lecture No. 5. **The evidence of language origins**

Human language

Culture refers to the individually acquired system of 'understanding' which reflects the distinctive life trajectory of the organism in question. It refers to socially rather than genetically transmitted behaviour patterns and their products. 'Cultural dynamics', therefore, are the processes by which the intelligent organism alters its perceptible reality through its dialectic participation in the processes shaping it (Bednarik 1990). Since the inevitable outcome of such interaction between percepts, concepts and behaviour patterns is selection in favour of increased level of 'intelligence', it is to be expected to result in forms of 'consciousness', such as those of humans. The process is reified through the perceptible (perceptible, for instance, to humans) externalizations of a species' concepts onto physical reality (art, in the case of humans), which renders possible the reality constructs of the species, because the neural structures supporting such concepts become available for processing natural sensory stimuli in a taxonomizing format (Bednarik 1995: 628). Since this is the basis of human consciousness, it would be pointless trying to understand human constructs of reality without considering this evolutionary context, or their nexus with cognitive evolution.

The purpose of this lecture is to examine the origins of human language ability itself, but this involves visiting several other issues, as well as considering a variety of potential explanations. There is no consensus on this subject at all, and the hypotheses we have range from one extreme to the other. According to the spectrum of current hypotheses, the advent of language occurred at some point between 3.5 million and 32,000 years ago. Another proposition all experts would agree on is that the Neanderthals' language ability was somewhere between that of an ape and that of a modern human. It is fair to say that we do not need experts to arrive at such propositions, any reasonably educated member of the general public would have been able to do so without expert help. This illustrates the impotence of archaeology in resolving such simple topics. If we then consider the seafaring abilities of the early human inhabitants of Flores and other Indonesian islands around a million years ago, and accept with me a key proposition of my principal opponents in this debate, Noble and Davidson (1996), that seafaring colonization presupposes language use, we are more than justified in questioning the knowledge or motivation of all those who have in recent decades placed the advent of language in the Late Pleistocene (including Noble and Davidson). But we have also succeeded, in a single stroke, of placing this development into the late Pliocene or Early Pleistocene.

The history of modeling human beginnings has been confined largely to disciplines and schools of thought dominated by Classical and Judeo-Christian biases, however subtle these might be. This continues to be the case in contemporary archaeology, which is one of several reasons why it fails consistently. There is an undertow in archaeology driving a partially subconscious desire to maintain a separation between humans and other animals, which finds expression in the continual redesign of that ideological boundary. A gestural origin of language was first proposed in the 18th century. By the middle of the 19th century, language hypotheses had become so rampant in Europe that in 1866 the Société de Linguistique de Paris saw itself obliged to ban the topic from its meetings and publications altogether. The theories then in circulation included the "bow-wow", "ding-dong" and "heave-ho" versions, purely speculative, essentially onomatopoeic hypotheses. Nevertheless, the positing of naïve and unfounded archaeological hypotheses about language origins has continued right up to the late 20th century, with such examples as the hypothesis of Noble and Davidson (1996). Their idea, first enunciated by them in 1989, is that language was only possible after the advent of iconography, i.e. the production of figurative art. It posits that language began after drawings of objects were made, because these were needed to communicate meaning. It is now generally assumed that iconic images commence around 32,000 years ago in southwestern Europe, although there are several problems even with this. First, my discovery of a much older figurative engraving from a German site, Oldisleben, contradicts the proposition. But, more importantly, there is almost no evidence of figurative Pleistocene rock art outside of Europe, although non-figurative rock art certainly occurs widely. According to Davidson and Noble's notion, these countless traditions for which we have no evidence of figurative art production have also failed to provide evidence of language, because without iconography they could not have had language. This is obviously absurd, and is contradicted by their own footnote to their hypothesis, that seafaring does prove the use of language (Davidson and Noble 1992). The Tasmanians, for instance, have never had any tradition of iconic art, 60,000 years after their ancestors crossed the sea to reach Greater Australia and, according to Davidson and Noble themselves, had language. Finally, Davidson and Noble's whole idea has no basis in archaeology or in any other discipline. It is one of the most naïve theories on language origins ever proposed.

Better-based proposals emphasize the gestural primacy of language beginnings, arguing that gestural communication would have been facilitated by the introduction of upright walking. Manual dexterity certainly would have increased gradually over the entire Lower Paleolithic period, and it has been suggested that predominant right-handedness is related to the left-lateralization of speech in the human brain. The idea that some fictional "cultural

revolution" at the beginning of the Upper Paleolithic marks the advent of human language is again shown to be simply without archaeological or other evidence. It is far more productive to turn to ethology.

Non-human language

Language use is a skill widely found in the animal kingdom and by use of numerous communication media other than speech, body language or gestural symbol systems. Such means of communication include chemicals, smells, pheromones, complex visual signals (e.g. octopus), light signal frequencies (e.g. fire flies) and many others. Some evidence has been presented that even plants 'communicate' at a rudimentary level. Most of the communication systems that exist on our planet may well not have been detected by our science so far, being at this stage beyond our perceptual or technological capacities.

If we focus on just the other primates, we observe relatively complex communication systems, and the extant Homininae and Pongidae can use symbol systems of some complexity. Extensive laboratory research has been conducted since the work of Jane Goodall, particularly with chimpanzees and bonobos, our closest living relatives. Even rudimentary grammar has been proposed to exist in the communication of some apes. The bonobo (*Pan paniscus*), in particular, seems able to make the transfer between comprehension and production of symbols more readily than any other extant non-human primate. One of the best-known examples of this burgeoning primate research is the work of Duane M. Rumbaugh at the Language Research Center, Georgia State University, established in 1981. Rumbaugh, a professor in comparative psychology, discovered almost by accident the abilities of bonobo Kanzi. Aged two-and-a-half, Kanzi began spontaneously to use another animal's keyboard to express what he wanted, without having been taught sign language. It was found that he also understood spoken English, eventually recognizing 2000 words. His younger sister Panbanisha even managed a vocabulary of 3000 words. Primates other than chimpanzees and bonobos have been the target of less intensive research in the past, but this is changing. The orangutan Chantek, raised by Lyn Miles, paints, uses sign language competently, and has taught himself to tie knots. Interestingly, most archaeologists still deny *Homo erectus* the ability of knotting cordage, which is a prerequisite for the construction of rafts. This illustrates well the deep chasm that exists between a science such as ethology and the belief system created by Pleistocene archaeology. It is not new that apes in the wild produce rudimentary knots, for instance in their construction of sleeping platforms (Warner and Bednarik 1996). Sanderson (1937) noted that some wild gorillas made complete knots, mostly granny knots but rarely reef knots, when constructing their nests. MacKinnon (1978) noticed a captive orangutan make a sort of rope out of its bedding material and swing from it. Perhaps more interesting is an observation made in 1996 (McGrew and Marchant 2006). A group of chimpanzees killed and ate a red colobus monkey one afternoon. The next morning, observers noted one of the juvenile females playing with a strip of colobus skin, and 'grooming' it. It was then 'stolen' from her by a juvenile male. The next morning a young adult female was observed wearing the skin strip draped around her neck. When she discarded it later that day the investigators found that the skin was tied in a single overhand knot, forming a simple necklace. It is suggested that the young adult female sought to enhance her appearance and/or status by adorning herself with the remains of a highly valued kill. If this were correct, it would point in the direction of early body decoration, and a possible origin of it. Again, it shows that archaeologists need to take an interest in primate ethology.

Cognitive studies with a great variety of animals have yielded many indications of complexity (attribution of intentionality, rapid learning abilities, tool using and making, etc.) in many species, including birds (e.g. ravens, parrots) and mammals (sea-lions, dolphins). Symbol use and category formation (taxonomization) are also not unique to primates, which shows that they are not attributable to some organization of the brain that is specific to them. An example is provided by Alex, an African gray parrot studied by Irene Pepperberg (1999). Ethology can be expected to become more involved in creating a scientific basis of the 'paleo-ethology' of early hominins as this field gradually evolves. This is certainly much more relevant than the stale minimalist contributions archaeology has made to this discussion so far.

The study of other primates has contributed much more to our increasing understanding of the patterns and potential of communication codes among our own ancestors. Non-verbal communication or transmission of information is certainly still in use by humans today, in the forms of face and body gestures, proxemics and kinesics, but it has probably been largely displaced by speech during human evolution. Therefore the question for the origins of human language needs to be re-focused on the question of when human speech began to develop. This is not an issue that cannot be addressed on the basis of current knowledge. A number of possible approaches to this are considered next.

Ontogeny and phylogeny

One legitimate approach to the issue of language origins is best defined as the ontogenic principle, essentially perceiving the way human infants master language and non-verbal communication as a kind of approximate recapitulation of the phylogenic development of hominins. There are many other indications of such recapitulation, for instance in the development of the human fetus, and particularly in the progressive fetal development of the brain. We have currently three main schools of thought concerning the acquisition of language by infants, described as the 'interactive', the 'cognitive' and the 'autonomous' principles. The first sees language learning within the context of language use. The 'cognitive' school perceives it as part of the general symbolic development in the child. The 'autonomous' model emphasizes the independence of the study of grammatical competence from both language use and

general principles of cognitive developments. Moreover, the process of learning language or speech is considered from several perspectives, particularly from phonological, lexical, morphological, syntactic, and pragmatic acquisition. In the modern human infant, the verbal mode of communication is preceded by gestural communication, beginning about nine months after birth. Rudimentary word-like expressions appear from about one year of age, but a proper vocabulary begins to be developed six months later. However, it remains to be established how the child learns to relate words to concepts, and clear criteria for when word-like verbal expressions of the infant become symbolic. To resolve this, however, a better resolution of the definition of symbolism may be requisite.

In the very young infant's production of sound there is continuity from the initial babbling period into early phonetics and phonemics. Words rather than phonological details seem to emerge first, whereas 'reflection' about the component phonemes begins only between the ages of two and four. Progress follows no universal pattern and there can be phases of regression. The stage of developing syntax lasts usually from the ages of two to five, developing alongside phonology. It is preceded by pre-syntactic word combinations of three types. Of importance is the relatively rapid learning of the rules of syntax, which is widely believed to indicate that spoken language is 'mapped' onto pre-existing neural structures — one of the strongest evidences that speech is a phylogenetically early development. Errors in learning imply that morphological acquisition perhaps occurs through probabilistic mechanisms of limited possibilities.

However, to what extent ontogenic language acquisition can serve as a model of phylogenic development remains the subject of much debate, and it is presented here only as one of various possibilities. Limited recapitulation, it is thought, does characterize human neural maturation. The late maturation of the neocortical association areas is considered to have demonstrated the greatest phylogenetic expansion. Phylogenetically, it is considered that language matured in tandem with object-manipulation skills and social behaviour, each factor facilitating the development of the others. Theoreticians on these issues inevitably return to the 'soft' evidence provided by archaeology, concerning cultural and social evidence, which shows that the questions have not been satisfactorily dealt with by the cognitive sciences. Unfortunately, much of the information provided by archaeology is tainted by theory, and dialogue remains severely affected by such problems. Cognitive, neurological and ethological evidence all suggest that language evolved gradually, and over a period of millions of years rather then tens of millennia, as contended by most archaeological commentators. While neuropsychology suggests that, as in ontogeny, language evolution began in mother-child dyads with the communication of simple needs and desires, archaeology presents a totally different model, connecting language origins with the appearance of what is widely but falsely considered the appearance of modern humans (see Lecture 2).

Essentially, language can be defined as a system based on semantic analogies and analogies in phonological, morphological and syntactic formulations. It creates new and unlimited meanings through a process of metaphorical extension. While there is good evidence for the development of languages over the last two to three millennia, this is much less clear for the preceding times. For instance, nearly all modern European languages can be traced back to a few pre-Historic groups: the Balto-Slavic, Germanic, Celtic, Italic and Hellenic roots. These are thought to all have developed from a Proto-Indo-European language used in Neolithic times, which also produced the Anatolian, Indo-Iranian and Tocharian families, besides the minor branches of the Illyrian, Thracian, Albanian, Armenian and Phrygian. However, beyond that we enter pure speculation, and there has been a great deal of it. Some indications do exist that a single prototype could have existed in Late Pleistocene times, and there is unexpected support for some degree of uniformity in the apparent global universality of especially Middle Palaeolithic symbol systems. To what extent that universality can be translated into similarity of language, however, is the subject of ongoing and certainly inconclusive discussion. The issue of monogenetic language origins is, however, a most interesting subject.

The relevance of brain size

Much less vague than the previous considerations is the subject of the gradual increase of the human brain. It is my contention that the most powerful and decisive perspective we currently have on the question of language origins relates to the issue of encephalization in hominin evolution, which we first visited at the end of the first lecture. We then noted that the enlargement of the human brain, unprecedented at least in mammalian evolution, came at enormous evolutionary costs. First, the brain is by far the most energy-hungry organ in a human, consuming roughly a fifth of our energy without even having any 'moving parts'. Secondly, there is the natal cost it dictates to both the females and their societies (see below).

It is unlikely that the proposition, that there was an extraordinary increase in brain size over the past three million years, will ever be refuted. In comparison to the more or less speculative bases of the various other approaches we have now reviewed it is solid evidence. As we have seen in the first lecture, this increase has occurred throughout hominin development, at a perhaps somewhat accelerated rate around the middle of the Pleistocene. It peaked in the 'Neanderthals' and then, rather suddenly, declined by somewhere in the order of 10 %, during the second half of the Late Pleistocene. Oddly enough, the latter phenomenon coincides with a period believed to be marked by extraordinary new demands on intelligence and cognition. Moreover, it coincides with a parallel reduction in other key features, such as a very substantial reduction in muscle power and skeletal robusticity. This development has been inadequately researched and explained, but it is not of immediate concern here — except to note that it would be very strange if the emergence of human language coincided with a significant decrease in brain size (which is what most archaeologists

claim). We shall focus on the preceding encephalization and its significance to evolutionary fitness of the hominins concerned.

In an evolutionary context it is simply inconceivable that an organism should have experienced such a dramatic change without adequate justification. The greatest disadvantages of the enlarging brain are in the obstetric demand of birth and in the subsequent significantly prolonged period of infancy. The length of the period of pregnancy, in any mammalian species, is a compromise between the demands of the need to expel the young as developed as possible, versus the vulnerability of the mother and the physiological limitation placed on the size of the birth canal. The larger the young is to be at birth, the greater the necessary pelvic space, which affects locomotion of the mother adversely, increases her dependency on the support of others, and further factors still. Since the fetus is essentially a parasitic organism that severely stresses the mother's body resources through its relentless demands, a longer pregnancy not only reduces the number of likely conceptions during her fertile life period, it also prolongs these physiological strains on the body of the mother. On the other hand, any shortening of the pregnancy would greatly prolong the dependency of the infant after birth, which may not only impair further breeding, but place additional demands on both the mother and the group. Both these factors impact greatly on evolutionary fitness: a reduction of the number of pregnancies over the fertile period of the female reduces overall reproductive success of the species, and the additional demands on the breeding group made by longer periods of weaning and other dependency (e.g. the need to be carried) further reduces the group's effectiveness. The most significant factor in this is brain size, the brain and thus the cranium being relatively larger than other body parts at birth. Therefore the price paid in evolutionary terms for the cortical enlargement in hominins was very substantial indeed. Moreover, the fact that the possible alternative of significant post-natal brain development was eschewed by evolution tells us something about the need of the infant to make use of this organ's capacities as soon as possible after birth.

The pivotal issue then is this: if hominins paid such a high price for their encephalization, it is extremely unlikely that their brains were not used, and were not used a good deal soon after birth, or were not used 'at full capacity'. This is the most fundamental issue in understanding cognitive evolution. Most especially, those parts of the brain that had only been added in recent phylogenetic history must have been of particular importance to the species' success. There can be no doubt that these concerned primarily the areas responsible for social complexity (such as communication), problem solving, and other cognitive areas. Similarly, there can be no doubt that the principal reason for the enlargement of the human brain, at any stage of this process, was that the functions added to it were *being used*. Evolution cannot select in favour of some future benefit, it selects in favour of immediate advantages. 'Evolution' is not some thinking entity that plans ahead; it is merely a process of natural selection acting on randomly occurring mutations. Therefore we can quite categorically state that the archaeological model of the evolution of hominin cognition and language must be false. That model states, essentially, that these faculties are only present when archaeologists can 'discern' them on what is euphemistically called the 'archaeological record' (a meaningless concept of circularity). On that basis, archaeology claims that 'modernity' appears only in the Late Pleistocene, and in Europe only around 40,000 years ago, and that it was preceded by vastly inferior abilities in humans. This is squarely contradicted by the principle that advanced cognitive abilities must be assumed to have developed at roughly the same rate as the human brain grew in size and complexity, and as the number and depth of its creases and convolutions also increased. We have a good idea of this rate of increase from endocasts of dated fossil specimens, hence we have a good idea of the rate of development. It is totally different from what archaeology believes. Archaeology, the discipline that has the distinction of 'getting it wrong' more often than any other, got it wrong once again, and this time most spectacularly so. Unless we completely reject the fundamental principles of biology and evolutionary theory, this is what we must conclude. Biology and orthodox Pleistocene archaeology are totally at loggerheads, they are two entirely incompatible approaches and paradigms.

This does not answer the question of language beginnings, because rate of encephalization probably does not match rate of language evolution. Obviously, the newly developed brain structures were used for other tasks besides language. Nevertheless, as a general indicator it is reasonable to consider the evidence for the presence of Broca's area in the endocasts of *Homo rudolfensis* and *Homo habilis*. This area is related to the motor control of speech, and unless we were to propose that such an area was developed but not used, we have little choice but to assume that these species were capable of some form of verbal communication. They lived between 2.5 to 1.9 and 2.3 to 1.6 million years ago respectively, which suggests that speech may well have been one of the early developments in cognitive evolution, when the hominin brain was roughly half the present size. We might next consider that about a million years after the heyday of *H. rudolfensis*, colonizing parties of *H. erectus* managed to cross the sea repeatedly, a feat that most certainly involved language and long-term forward planning (Bednarik 2003). Another half a million years later, archaic *H. sapiens* engaged in creating palaeoart and used beads. From these indicators we can develop a model that is not based on some a priori dogmatic view yearning for a division 'between man and beast', but derives from a critical assessment of the relevant evidence — a model that can account for the incredible enlargement of the human brain.

Discussion

The short-term model of cognitive human evolution, already rejected in the second lecture on genetic, technological and palaeoanthropological grounds, and in the third lecture on the basis of palaeoart evidence, is therefore highly implausible even on the basis of simple biological and linguistic considerations (Bradshaw and Rogers 1993). The

human system of producing verbal sounds differs profoundly from that of all other terrestrial mammals in one striking way. Darwin (1959) already observed "the strange fact that every particle of food and drink which we swallow has to pass over the orifice of the trachea, with some risk of falling into the lungs". Every year, thousands of humans choke to death on their food, whereas other mammals have separate pathways for breathing and feeding or drinking. Moreover, the problem is limited to human *adults*, being caused by the relatively low position of the adult human larynx, an ontogenic development. This appears to be an evolutionary trade-off, indicating a significant advantage in having complex oral sound production, the prerequisite for verbal communication. Our relatively short palate and lower jaw are less efficient for chewing than those of non-human primates and hominins and they provide less space for teeth. However, the design of the human mouth and throat provides optimum conditions for differentiated sound production. The large size of the supralaryngeal tract allows us to modulate and filter the frequencies of the sounds we make, in combination with the tongue and lips. These physical attributes are essential for the production of all human languages, and their consideration is essential for any discussion of the origins of language. Moreover, here again we see that in human evolution there occurred trade-offs between adaptations that seemingly reduced evolutionary fitness, but favored increased cultural complexity. Thus cognition and culture became primary drivers in hominin evolution, tolerating several physiological 'maladaptions', such as oversized brains and badly designed throats.

The second component of language evolution involved the physiological brain structures responsible for the 'voluntary', 'intentional' control of speech (Bradshaw and Rogers 1993). In this respect, humans again differ significantly from other primates, even chimpanzees have great difficulty controlling their verbal expression (e.g. concealing pleasure). Chimpanzees and bonobos, however, do possess a rudimentary ability to deceive (Byrne and Whiten 1988), also exhibited by the orangutan Chantek. But in the area of deceptive behavior, humans are the undisputed masters. This, certainly, involves self-reflection and great neural control over the speech production centers. Lieberman (1991) attributes our control over language to certain changes in the brain, including the evolution of what is referred to as Broca's area, as well as the enlargement of the prefrontal cortex and a rewiring of concentrations of neurons, the basal ganglia.

What renders the short-term model of language evolution particularly absurd are its biological implausibility (e.g. encephalization is more pronounced from hominids to the first hominins, than during subsequent human evolution) and its inability to account for several simple observations. For instance, children are born with a genetic predisposition towards language acquisition, with an innate syntactic mechanism that appears to be biologically determined by neural structures. As Bickerton (1990) observed, there are 3,628,800 ways in which ten words can be arranged in a sentence. Take the sentence, "Try to arrange any ordinary sentence consisting of ten words": only one sequence provides a correct and meaningful message, 3,628,799 variations are ungrammatical. Yet humans develop the correct understanding of syntax and grammar so rapidly, within the first years of their life. If ontogenic development were an approximate recapitulation of phylogenic evolution (which is not necessarily a valid measure, but does seem to provide a rough guide), language acquisition would precede iconic production and would develop along with tactile precision and discovery of the self's identity.

The involvement of so many cortical zones in speech production, with all their interconnections, render the evolution of this system within some tens of millennia, as demanded by the short-range proponents (Davidson and Noble passim), biologically most improbable. Broca's and Wernicke's areas, which have both been claimed to be detectable on cranial endocasts of *Homo habilis*, may not necessarily be reliable indicators of language ability, but their very early presence may indicate that some of the required structures were available to habilines. Similarly, the debates over the hyoid Neanderthal bone from Kebara Cave (Arensburg et al. 1989) and similar issues have remained unproductive. Other aspects of hominin physical morphology have not contributed to resolving the question of language beginnings, nor are they likely to be a decisive factor. The major recent syntheses on the subject tend to return to linguistic and archaeological perspectives (Bickerton 1996; Dunbar 1996; Aitchison 1996), and their authors arrive at the same basic finding: human language is such a complex phenomenon that its evolution, in every sense, must have been a lengthy process. It must have developed from some form of proto-language, which in turn would have been derived from still more rudimentary beginnings. This, in effect, is consistent with the archaeological record, contrary to what the many short-range commentators have perceived. During the last few decades there has been a growing willingness of archaeology to be led by their simplistic reductionist models and attention-grabbing slogans, and I regard recent language origin models by archaeologists as symptomatic of this trend.

The linguistic approach to the question is considerably more productive, but it will unfortunately always remain ambiguous, especially in a chronological sense. Any tentative time frames applied to it are very doubtful and untestable. This leaves us with just one alternative, and it is the one I prefer. Reliable pronouncements can be secured from archaeology, by inferring hominin capacities from archaeological indices that have been subjected to taphonomic logic, the most powerful interpretational tool in archaeology (Bednarik 1994). To illustrate this approach I prefer to refer to one class of objects, beads.

Beads and pendants, we have seen in the previous lesson, provide a great deal of technological and cognitive information about their makers and users. Their non-utilitarian status is in most cases beyond dispute. We can safely assume that drilled ostrich eggshell discs, modified and heavily worn spherical fossils or a drilled wolf's canine, all from the Lower Palaeolithic, were not utilitarian objects. Some of these beads are deliberate technological masterworks, exploring the limits of the methods available to hominins at the time. These objects were not just non-utilitarian, they

represent *statements of excellence* (as, indeed, developed handaxes often appear to do). Their specific qualities demand the existence of a socially shared and communicated value system, which would necessarily involve reflective communication. In fact, any use of beads and pendants must involve a sophisticated social system, a system of enculturated values.

Irrespective of what the actual cultural meanings of beads were, such meanings demand that these objects were made in some considerable numbers. *This is because it is repeated and socially 'structured' use that confers meaning on symbolic artifacts.* Without such a mechanism, beads are meaningless, and the extraordinary manual effort that went into their manufacture would have been perfectly pointless. Short-range advocates have not understood this fundamental point, which prevents them also from understanding that the small number of instances discovered so far is irrelevant. Moreover, I have argued in the third lecture that the advent of modern human behaviour is marked by the evidence of external storage of symbolic meaning. Once this was achieved, humans were 'modern', and it is irrelevant how many instances of this are observed on what is misleadingly called the 'archaeological record'. It is the purpose of taphonomic logic (Bednarik 1994) to deal with the quantitative aspects of Pleistocene archaeology, but unfortunately nearly all Pleistocene archaeologists seem incapable of understanding taphonomic logic. At this point we begin to appreciate that the short-range model is the result of archaeological deficiencies, in data, method and theory.

Beads are one of the most concentrated forms of external storage of symbolic meaning we can expect to find in the Lower or Middle Palaeolithic. If we should seek some general indication of the complexity of communication, we only need to examine what might be *the minimum cultural, social and linguistic complexity required to support a system of using beads*. Quantification of such complexity seems possible. Once formulated, it can easily be checked against the archaeological record to provide us with the first realistic indication of how advanced human cognition and symboling must have been at a given point in time. Needless to say, this would also provide a convincing measure of language ability. Nothing of this kind has been attempted so far, primarily because most archaeologists have not known about the Middle Pleistocene evidence of bead use. This shows, once again, how dominant models in archaeology are predicated mostly on archaeological lack of knowledge by the orthodox archaeological establishment.

So far we have not even considered the technological aspects of such sophisticated artifacts as beads, including those of procuring and selecting the raw materials (drills, grinding stones, strings, bead material), the required variety of manufacturing processes (re-sharpening of drills, making of knots), the ability of forward planning, or the multiplicity of skills involved in the production of beads (see Bednarik 1997a). Nor should we need to: the social context they demand for their very existence is sufficient to show the need for complex communication, of a form capable of conveying nuances such as 'quality', 'quantity', 'perfection', 'status', or whatever else a wearer or user of beads sought to communicate. That such properties were communicated we can be certain of, because if they had not, no beads would have been made or used. The technology merely provides further indications of the culture concerned. The perforation of a bead or pendant has but one purpose: to thread it onto some kind of string. This in turn almost demands the use of knots, and we can thus begin to unravel the technology of the period in question. Every aspect of it points to a great degree of sophistication, approaching that which we have become accustomed to attribute to the Upper rather than the Lower Palaeolithic.

There are still more pertinent questions to ask: why did hominins suddenly, it appears, leave Africa and so rapidly colonize many parts of the Old World in such a short time? This phenomenal expansion, unequalled among mammalian species, cries out for a rational explanation. If there had been a hominid predisposition to expand, to colonize, then earlier species could have done so. Yet around two million years ago, apparently within a geological instant, hominins occupied many new environments outside of Africa and developed adaptations to occupy unfamiliar ecological niches, and a high tolerance to climatic diversity. Biologically this demands a strong explanation: what happened, in evolutionary terms, that could have made this possible? Clearly, a major change occurred, and it can only have been a cultural change, making possible adaptations to thrive in colder climates. A million years later, maritime navigational ability was such that humans could successfully colonize islands and establish flourishing populations on them. There should be no doubt that, by that time, still well before the appearance of beads, hominin language ability was sufficiently developed to organize successful ocean crossings (Bednarik 1997b, 1999, 2003; Bednarik and Kuckenburg 1999). I have demonstrated that this involved a great many cultural abilities in procuring, curating, treating, modifying, storing and combining many types of materials, for drinking water transport, lashings, waterproofing and so forth. It also involved forward planning for at least six months, because the material almost certainly used in the first sea-going rafts was bamboo. This material is easily worked with stone implements when green, but poorly suited in that condition as a floatation device. Instead, it must be cured for several months after felling, dried without direct exposure to insolation, and without being infected by bamboo beetles. The facility of such forward planning clearly tells us a great deal about the cognitive abilities of the people concerned, and about the ability of individuals to convince others to participate in what must have seemed a very bold and dangerous undertaking.

At this stage we are beginning to see the rough outline of a time frame for language beginnings emerge, which operates very differently from the largely arbitrary speculations so far based on archaeological dogma. Towards the end of the Pliocene, two million years ago, we should expect a communication ability making possible a level of culture underpinning the colonization of inhospitable environments by a creature of the tropics. Towards the end of the Early Pleistocene, a million years ago, the sophistication of culture and communication had to be adequate to enable maritime colonization. All we need to do is determine what is the minimal capability to underwrite such quests, and we have a

realistic outline of the course of non-physical human evolution. By around half a million years ago, we have ample evidence that symbolic means, such as language, were not only used, they were stored outside the brain, in objects that had no other purpose, or perhaps also in other objects that had utilitarian purposes as well (such as tools). This, in a nutshell, is the answer to the question, when did language or speech-like communication of hominins begin. The reliable information we have about human evolution is perfectly adequate to provide such a rough outline about language origins — provided we read it carefully instead of starting from a priori dogma, as archaeology has consistently done for the two centuries it has had to form society's beliefs about the early human past.

The final word in the discussion of language origins should be had by the main founder of evolutionary theory, Charles Darwin, and his words sum it all up:

> Man has an instinctive tendency to speak, as we see in the babble of our young children; while no child has an instinctive tendency to brew, bake, or write. Moreover, no philologist now supposes that any language has been deliberately invented; it has been slowly and unconsciously developed by many steps.

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