

THE AGE OF SPOKEN LANGUAGES
An interdisciplinary approach

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ABSTRACT: The problem of the age of spoken languages has always been a much-debated question. This is no wonder, since Mankind can be traced back millions of years whereas spoken language can be traced back only some thousands of years. The reason is simple: language in its oldest concrete, scrutinable form has been preserved only in the stiffened cast of writing. Consequently, every theory on the subject must rest on more or less qualified plausibilities bolstered by comparatively few facts. My own hypothesis is no exception: It presents some arguments for the coming into existence of languages independent of each other in several places on the earth and about the same time, that is, at least 1 million years ago. The hypothesis further assumes that these languages already from the beginning had to be complex and abstract entities and that it is implausible that spoken language, with its interdependent complexity, could have evolved in a slow, gradual process. A final argument is that spoken language first emerged with Homo erectus.

The argumentation rests on the interpretation of various elements taken partly from structural linguistics, partly from paleoanthropology.

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Spoken language can be viewed in several different ways: as a formal-linguistic structure and, from a biological point of view, as a result of the evolution of the mode of communication in man. One formal way of analysing language is on the basis of written language, examining grammar, i.e. morphology and syntax, its historical development including the phonetic side, such as this can be traced from the orthographical development etc. All this is usually done without considering the physiological and anatomical basis of spoken language. Another formal way of viewing language is that of structural linguistics. The structuralistic approach gets some of its results by resolving a given language into its smallest distinguishable elements, named morphemes and phonemes. It is a characteristic of both formal approaches that they take the anatomical basis of morpheme and phoneme production for granted.

This paper primarily deals with the spoken language from a biological point of view, i.e. spoken language is viewed as a means of communication between the various members of a species for improvement of their chances of survival under existing or changed ecological conditions. However, the study of the evolutionary history of spoken languages may receive valuable impulses from the principle of arbitrariness of structural linguistics (0) and its concepts of morphemes and phonemes, this principle being related to the mode of operation of the human voice, as will be seen.

MORPHEMES AND PHONEMES

A morpheme is the smallest part of a (compound) word which includes both content and expression.

To express oneself in the form of speech means that one is able to articulate morphemes, or, phonetically, that one is able to articulate the phonemes which the morphemes consist of. In every individual language the morphemes are the code which the language-user must be capable of expressing

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in rapid, short, and contrasting sounds. A phoneme is the smallest distinguishable element in a given language. Phonemes are classified as vowels, which can form a syllable all by themselves, and as consonants, which cannot. In most cases the morphemes consist of phonemes which separately have only a plane of expression but no plane of content. In Danish this is the case for all consonants, but a few vowels such as *ø* and *å* - meaning 'island' and 'small river', respectively - are phonemes which also have a plane of content, so that a single phoneme can also act as a morpheme.

A particular language consists of codes which phonetically are distinguishable in relation to one another; otherwise they would not be able to function at the semantic level. The original creation of a single language must have followed the principle of arbitrariness, but once created, it constituted a fixed structure, a permanent system of codes capable of being increased as occasion required. That this was actually the case can be seen from the fact that other languages consist of other codes, which function just as well for those using them. What is required is the ability to perceive, understand and reproduce the rapid sequences of short, contrasting sounds that a given language consists of, i.e. without being distracted by irrelevant sounds, which in this connection are perceived as unstructured noise. No nonhuman animal is capable of doing all three things. Even chimpanzees can only with the greatest difficulty learn to vocally reproduce a very few simple words, even if they may be able to perceive and learn the meaning of several words. Conversely, some birds can learn to reproduce words vocally, but they are unable to understand their meaning. On the phonetic level the faculty of speech asserts itself in the ability to articulate short, contrasting sounds, i.e. sounds which are well-defined in relation to one another. This is the plane of expression. The plane of content, i.e. the semantic level, is structured as a function of the plane of expression, so that the meaning of the individual morpheme is always brought to contrast with the meaning of other morphemes. The meaning of a word emerges only if it is brought to contrast with the meaning of other words. This is most easily seen in adjectives which express properties. 'Short' gets its meaning only via its opposite: 'long'.

It is presupposed that meaningful thinking can exist and has existed before the possibility of its being expressed, i.e. by being articulated in the form of morphemes. A chimpanzee can use a stick as a tool in a meaningful and intelligent way, without being able to express any universals in connection with the stick. (Universals are substantives denoting general concepts). The chimpanzee is unable to express the concept of a stick in the form of a substantive meaning stick, just as it is unable to use adjectives expressing the properties of a stick. The signal-language of the anthropoid ape is simply not capable of expressing abstractions of this kind. Apes are capable of expressing both short and long sounds, but they cannot do so in a uniform and contrasting way. Thus spoken language presupposes the ability to delimit sounds to phonemes, which in turn are put together to form morphemes. But to consider morphemes as unique phenomena is meaningless; they presuppose the knowledge and use of other morphemes. The only function of a morpheme is that it is meaningful in the context; phonetically speaking, it means that it is discernible from other morphemes. If this condition is met, it is possible to construct a new language consisting of arbitrarily chosen morphemes. And that is what the principle of arbitrariness is all about: it rests on the assumption that there is an arbitrary relationship between a morpheme and its content of meaning.

THE INTERDEPENDENT COMPLEXITY OF A SPOKEN LANGUAGE

Substantives are either proper nouns or universals. Universals consist of the sum of their properties as expressed in individual words consisting of one or more morphemes. A universal presupposes knowledge of its properties as expressed in its adjectives. Substantives and adjectives presuppose each other: none of them can be understood independent of each other. But many properties may change without the

substantives to which the adjectives are attached changing their identity for that reason: a leaf is still a leaf, even if its colour changes. But the condition of being able to identify the leaf in numerical terms as the same leaf (i.e. of being able to establish numerical and not only qualitative identity) is both to understand the time-factor and to be able to express this understanding in spoken language. And here the verbs enter the picture. Change in all the meanings of this word can be expressed only with the aid of verbs (and verb phrases): the leaf is brown now, whereas it was formerly green. The leaf is green now but it will be brown sometime in the future. But a leaf is only incompletely described and understood as a concept if its position in space - or changing position in relation to other objects - cannot be expressed in words which determine the specific relationship: in the tree, on the earth, in the air, under the water etc. In other words, prepositions are also indispensable elements of the spoken language. Thus, most of the ordinary word classes of the known languages will be necessary conditions if a spoken language is to function at all. This renders it difficult for me to imagine that a spoken language has come into existence gradually and over a long period of time.

The idea that languages have started as 'pointer-language', i.e. as a language of denotations, is not likely. A 'pointer-language' can hardly be used for other purposes than just naming individuals or individual things. The act of pointing out an animal as a member of a species, i.e. differing from other species, is tantamount to making a classification. And this in itself represents an abstraction which presupposes other abstractions in order to make sense. Every classification rests on comparison and requires the ability of perceiving differences and similarities in broad outline, without letting oneself be distracted by individual variations. The result of a classification makes up the basis of a logical inference. It is possible to draw a conclusion without recourse to spoken language, but it is not possible to communicate the conclusion to one's fellow humans without using language (1).

The spoken language must therefore be conceived as a complex entity whose single elements by and large are equivalent in a functional sense. They must consequently have come into existence at about the same time in order to function as a whole. From a phylogenetic point of view, the emergence of spoken language presupposes a simultaneous development of the speech organs, first and foremost the larynx, pharynx, tongue, lips and the neocortex. To conclude: the selection pressure must be viewed as the driving force behind the morphological changes; when the bodily conditions were at hand, the spoken language quickly emerged with all its complexity.

SIMULTANEOUS DEVELOPMENT

Under selection pressure morphological changes may have taken place in simultaneous development, so that the cause-effect and chronological sequence of classical logic cannot be established any longer. The goal - or the result - of such changes may for instance have been that members of a species succeeded in improving their means of getting a more varied diet under certain ecological conditions. A retrospective summing-up of several successive developments may at times produce an illusion of a teleological kind. But it is actually a matter of several, independent developments, based on selection pressures separated chronologically.

To take an example: the transition of certain hominoids from quadrupedal to bipedal gait is bound to have taken place as a simultaneous development of several organs. The most important changes concerning the pelvis, the transition of the feet to heel-walking with all five toes together and the novel power and precision grip of the hands must have taken place simultaneously, governed by the purpose of freeing and changing the forelimbs into hands with versatile functions such as tool-making - an important advance in the search for a more

balanced diet. The emergence of spoken language has been made possible by the simultaneous development of orthognathy, the larynx-pharynx and the neocortex. (Orthognathy is not enough; several nonhuman primates have it, but their vocalizations are only signals, stemming mainly from the limbic system and the brain stem).

In retrospect it may appear that the development of the erect gait and man's faculty of speech were the predetermined goal of the evolutionary process that in the end led to man.

But this need not be the case; the australopithecines had an erect gait, but I think they were hardly able to communicate except by signal-language, as will be seen. It should be noticed that simultaneous development is not an explanatory concept but a descriptive one based on the principle of exclusion, i.e. when other possibilities do not seem to be at hand.

The concept of simultaneous development can also be used to preclude misunderstandings such as conceiving certain anatomical innovations as a specialization instead of a generalization. The development of the power and precision grip of the human hand is not necessarily to be looked upon as a specialization; on the contrary, it could well represent a generalization because the result was a creation of an organ with a more all-around function. The condition for the function of the human hand is the erect gait, which has required anatomical changes of the pelvis and the foot, the foramen magnum being placed more in the middle of the base of the cranium etc. The opposite development is true of the feet of the orang-utan, which have become 'hands' specialized for climbing trees. The hands of such an ape do not allow for a power and precision grip.

Therefore: the transition from a more one-sided function into a more all-around one has necessitated a generalization-process requiring the simultaneous development of several elements of the anatomy of an organism. Conversely, the change of a single anatomical detail means a specialization for the purpose of establishing a more one-sided function. The evolution of the beak of the finches studied by Darwin is a good example of such a development. Specialization will always result in an immediate advantage in the adaptation to a particular environment, but in the long run the danger is obvious: adaptation to future changes of the environment is made difficult with increasing specialization.

SIGNAL-LANGUAGE AND INTELLIGENT BEHAVIOUR

Higher animals such as the primates communicate by signals consisting of body-language, olfactory cues and sounds, which for them are immediately intelligible as expressions of agitation and mood (2). The signals are used for intraspecific communication, especially as a means of threatening, warning or calling together. They are literally operating in the 'present tense' since they express the needs and urges of the moment. Signal communication is more or less innate and may also reflect some learning, but it cannot be interpreted as referring to the past or the future (3). For that reason, coordinated behaviour between animals for instance during a hunt, is a business of here and now, controlled by innate behaviour patterns. Like all other organisms, the higher animals are dependent on their senses in order to orientate themselves in their environment and survive. For that purpose signals are normally sufficient. Only to be in possession of signals as a means of communication is certainly no obstacle to intelligent behaviour (4). (In this context intelligence is defined as the ability to coordinate the impressions of several senses for the purpose of making a choice if options are at hand - a choice which in the most energy-conserving way may lead to the goal). However, signal-communication restricts intelligent behaviour to a very narrow span of time, usually determined by the 24-hour-rhythm and the seasons of the year. Within this limited framework, which applies to all animals, evolution has taken its course - evolution in its

Darwinian sense of a mutation-propelled adaptation to the possibilities of finding food in changing environments.

THE SIGNAL-LANGUAGE OF THE GREAT APES AND THE SPOKEN LANGUAGES OF MAN

The protracted and painstaking experiments that have been carried out with chimpanzees - animals which from the point of view of molecular biology are very close to man - have clearly demonstrated that for anatomical and physiological reasons, these animals are unable to produce more than a few simple spoken words; further, that they are not motivated for doing so, because naturally they are in no need of a spoken language (5). The chimpanzee is a much more specialized animal than man and therefore considerably more limited with regard to possibilities of survival. One may question if the chimpanzee in its present form is an animal particularly well adapted to its environment. It spends much of its time on the ground, but it is highly dependent on trees for food and protection. It is quite good at moving about in trees, but its size and heaviness demand a considerable amount of energy for staying there long. Moreover, its relative dependence on trees has the effect that it moves awkwardly and not too fast on the ground. It is a knuckle-walker, but it is capable, for a shorter stretch, of walking - or rather half-trotting - on its two legs. In order not to use too much energy, it is forced to support its heavy upper part of the body and long arms with the knuckles, because the legs are too short and its pelvis is not adapted to an erect gait. It feeds primarily on forest plants, but occasionally also on meat, which, however, amounts to only a few per cent of its total diet. For this reason it cannot be said to be omnivorous if this term means an approximately equal distribution between plants and meat. The comparatively easy way in which it obtains its food, and the amount of time it spends on eating and digesting food, in common with all herbivores, have not demanded a need to communicate with its own species beyond the use of signal-language. If its habitat diminishes, which is actually happening now, it will rapidly become extinct if it is left to itself.

Man, on the other hand, is a much more 'generalized' creature. His fore- and hindlimbs are about the same length, he is evidently five-toed and five-fingered, and his teeth show him to be omnivorous. Even though man walks erect, is endowed with a large brain-capacity and is able to talk, he is a much less specialized creature than his closest relative, the chimpanzee. He has a much larger 'open programme' (6) than any other animal, and this is actually his most generalized trait. The more open his programme, the more versatile his possibilities of making the most favourable choice when the options are open - an ability which has made man surpass all other creatures. Man's open programme is so large that he has been able to change his environment and not just been forced to adapt to it as best he could. And when a novel environment has been created, the adaptation of new generations to it has more consisted in education (socialization) than in morphological changes. By this, of course, is meant visible changes; one may easily imagine that changes have occurred in the organization of the brain as a result of the need for new operational fields. A condition for being able to utilize the large open programme is the spoken language. Humans can talk because they have developed the anatomical and physiological preconditions of speech, which the great apes have not. This would be a rather commonplace assertion, but from a gradualistic view it is a very problematic statement because a slow gradual development of the peripheral speech organs and neocortex would be a decisive obstacle to the function of spoken language. This is, as earlier mentioned, phonetically structured by way of phonemes, because it is in this way that speech organs function. All the necessary word classes are structured according to this principle, which is actually quite simple. Consequently, no spoken language is able to function without the most important word classes. To this must be added that the strong increase of the volume of the brain, especially during the last 1½ million

years, would have been an incomprehensible phenomenon unless this increase was 'meant' to serve the emergence of the spoken language. The brain volume of Homo sapiens sapiens is on an average about 1350 cm³. Compared to man's body-weight it is about three times as big as the chimpanzee's. Much of this increase is on account of the neocortex, but also the subcortical parts of the human brain have increased proportionally, for example the thalamus (7). It is in the neocortex that the motor function of the speech organs is placed, i.e. in Broca's area, just as this goes for the area of Wernicke and the areas of planning and coordination. The peripheral speech organs consist of the larynx, pharynx, the proper oral cavity, the tongue and the lips - and, not to forget, the orthognathism of the human cranium. In contrast, the cranium of the chimpanzee is prognathic, which, among other things, means that it has a long, flat tongue that is not as movable as man's, which is more short and rounded. Therefore man is endowed with a more spacious pharynx (8). Since the chimpanzee cannot talk, it seems quite clear that this fact is due to quantitative (and probably also qualitative) differences between the brain of man and that of the chimpanzee, and also due to the structure and function of its vocal tract, including the lips.

AMONG WHICH KINDS OF HOMINIDS APPEARED SPOKEN LANGUAGE ?

This problem would have been somewhat easier to solve if the speech organs had been preserved in the hominid fossils. As it is, it is only the crania, with or without mandibles, and in fortunate cases some of the cervical vertebrae, which are at hand. These fossils have to be compared with the relevant parts of the now living apes and humans, after which inferences can be drawn as to the arrangement and form of the speech organs of the hominids. This, of course, has occasioned lengthy and often somewhat confusing discussions (9).

However, I think it is reasonable to assert that hominids with chimp-like crania cannot have possessed a spoken language, whereas they may have been capable of using a well-developed signal-language.

The question is now: when did one or more hominid species evolve crania which made speech possible? From the discussion up till now it seems to be a rather uncertain enterprise to try to establish the position of the larynx on a fossil (but an interesting one!). For the moment, the only safe approach appears to be the establishment of the form of the cranium and, in connection with this, the volume of the brain (preferably in proportion to the assumed weight of the body); and, further, the establishment of the development of orthognathy. In this field there are certain possibilities. A profitable avenue of approach is that of establishing a difference between the Australopithecines and Homo habilis on the one hand and Homo erectus on the other. A basic assumption is that of man's origin in Africa. Molecular biology in its various forms has demonstrated that it is the African anthropoid apes - gorillas and chimps - which are closest to Homo sapiens sapiens, with the chimp (both Pan troglodytes and Pan paniscus) as the closest relative of the two (10). However, it has to be emphasized that it is the degree of relationship which has convincingly been demonstrated, not the time when the apes and the various hominids diverged from one another. And finally it must be remembered that no fossil can yet be examined by molecular-biological methods. I think that Australopithecus afarensis was not able to talk; the form of its cranium, its prognathism and brain volume are very like the chimp's (11), as is also its body-weight. In this connection it has to be noticed that A. afarensis was a fully erect creature and that its foramen magnum was positioned more towards the middle of the base of the cranium than is the case in the apes. This could very well mean that the position of the larynx was a little more caudal than in the chimp (12). It could also mean that the organisation of the brain was more advanced than that of the apes, and that its signal-language was more complex. A qualitatively more advanced brain would also fit in with the possibility of better control of the hand, which was very similar to man's if we can judge from the

fossil skeletons. Also, there is no reason to assume that other or later australopithecines were able to talk, regardless of their mutual phylogenetic relations. No single variety of the australopithecines meets the necessary conditions; even if some of the gracile ones can be assumed to have possessed a brain volume and a body-weight proportional to man's, their prognathism and brain volume measured in absolute figures would argue against speech. As far as some of the robust (probably orthognathic) australopithecines are concerned, their brain volume was too small. Their orthognathism, besides, has another background (13).

We now come to Homo habilis, which is a problem in itself. Until the find of OH 62 in 1986, anthropologists had only more-or-less intact habiline crania from which to draw their inferences. Their volume have been estimated at 510 to 750 cm³ i.e. on average above those of the australopithecines. Habilis was also more orthognathic than the australopithecines. Among the best-known is KNM-ER 1470, found at Koobi Fora in 1972, and KNM-ER 1813, found in 1973 at the same place. 1470 is orthognathic with a brain volume of about 750 cm³ and with an age of about 1.9 million years. 1813 is about 1.7 million years old, the cranium a bit smaller and also less orthognathic. Some anthropologists are of the opinion that the fossils actually represent a male and a female of the same species, while others have advanced the theory that they may represent two subspecies of Homo habilis. Naturally, it has been supposed that the skeleton as a whole represents an evolutionary stage between that of the australopithecines and that of Homo erectus.

Then OH 62 turned up in 1986, found by Tim D.White and Donald C.Johanson at Olduvai Gorge in Tanzania (14). Parts of its cranium, humerus, radius, ulna, femur and tibia have been preserved, and they all seem to belong to the same adult female. At once a number of surprises turned up. Firstly, it is likely that it is the smallest hominid ever found, her height being estimated at about 3½ feet (107 cm). Secondly, the post-cranial skeleton is very much like that of the famous Lucy, and of particular interest is the fact that her arms were comparatively longer than Lucy's, which again were relatively longer than those of Homo sapiens; thus the arms were more ape-like than even those belonging to the australopithecines! Thirdly, the face, the palate and the dentition have been understood as absolutely habilis-like, a realization which has not been doubted by critics (15), even though the maxilla has been estimated as moderately prognathic. The age is about 1.8 million years. Whatever one might think of the fossil from a phylogenetic point of view, one thing seems quite clear: none of the hominids that up till now have been conceived of as belonging to Homo habilis can have possessed a spoken language.

Once again it must be emphasized that either you have a spoken language, which on the whole is as complex as all known languages are, or you have no language at all! (16).

Finally we come to Homo erectus, which in this context is an interesting creature for several reasons. In the first place because of its brain volume and form of cranium; in the second place because of body-size and form; and, last but not least, because of the migration of the species. By H.erectus is meant a hominid which lived from 1.6 million until about 300,000 years ago and is supposed to have spread from Africa to the rest of the Old World between 1.5 and 1 million years ago. A part of the population stayed in Africa. There has been - and there still is - a lot of discussion about the delimitation of erectus as a species because of the not inconsiderable variations among the crania and cranial parts, which until August 1984 provided the only material available. At that time the team led by Richard Leakey found at the river of Nariokotome west of Lake Turkana in Kenya not only a cranium but also considerable parts of the skeleton of a boy, 12-13 years of age and about 1.6 million years old. Still, in August 1985 no estimate of the brain volume was available (17). The height is estimated to be about 165 cm, and if he had grown up he might have reached 180 cm, which is surprising, especially in comparison with the supposed Homo habilis OH 62, which

is only a couple of hundred thousand years older. It is possible, of course, that OH 62, which is an adult female, may not be representative of her species, just as WT 15,000 (which is the official name of the erectus boy) may not be representative of his. But the find of this creature is thought-provoking and may indicate that drastic changes could have taken place in a very short span of time. The matter becomes no less interesting if one compares WT 15,000 with other, authentic specimens of Homo erectus. In 1975 a member of Richard Leakey's team found at Koobi Fora a well-preserved cranium of H. erectus, baptized KNM-ER 3733, its age estimated at 1.6-1.5 million years, its brain volume at 830 cm³ (18). Another erectus-cranium, named OH 9, had been found by Louis and Mary Leakey at Olduvai Gorge in 1960, its age estimated about 1.2 million years and its brain volume estimated at 1067 cm³ (19). The latter approximately corresponds to the average 1040 cm³ of the late Choukoutien population in China, of about 300,000-500,000 years ago. The average of the somewhat elder Trinil population from Java is about 900 cm³ (age from 500,000 to 700,000 years). Whatever may be said about these figures (which are not easy to interpret), one thing at least seems certain: the volume of the Homo erectus brain was drastically larger compared with that of other, earlier hominids - and this development happened fast. An accelerated selection pressure must therefore have taken place and it is possible to advance plausible explanations in favour of such a hypothesis. First of all, what is the use of a larger brain volume for a hominid which already is erect and has hands with power and precision grip?

Here I can imagine only one answer: a need for a spoken language. A need which even a well-developed signal-language has not been able to meet. This new need emerged as a consequence of the deterioration of climate and the migration over great distances which was forced on the population in the wake of this development. For an anthropoid ape or an early australopithecine which lived in Africa about 3-4 million years ago in a fairly stable, tropical or subtropical climate, life may have been a monotonous but also a rather foreseeable affair; even the changing seasons of the year did not differ so much from each other that the concept of tomorrow could arise as a fully conscious and deliberate problem, something that had to be carefully planned in time. But about 2 million years ago the situation began to change: the climate became drier and chillier. Gradually the larger or smaller groups of hominids which formed a community had to give up a permanent settlement and so were forced to constant wanderings from place to place, depending on the shifting possibilities of finding food (20). They had to take what they could get; they had to be omnivorous, if they were not so already. In such a situation planning is a necessity of life, and the need for a better way of communication than that of signal-language became obvious; today, tomorrow and yesterday suddenly became highly concrete concepts clamouring for expression.

The voice could and must be used in another way than before: the language code based on phonemes gathering into morphemes sprang up simultaneously with the faculty of expressing short, contrasting sounds.

Here some obvious questions demand an explanation: could brain expansion not be related to, say, tool-making, fire use and house construction? In principle, the answer is yes, but as for tool-making the power and precision grip, already possessed by the australopithecines, indicates that this in itself was hardly the driving force behind the brain expansion mentioned. The same applies for fire use and house construction: it cannot be ruled out that these activities were already started by australopithecines (21).

This is, I hope, a plausible theory of the origin of a single spoken language in a group of hominids. But history and the present time show a number of languages which are not similar to one another. The most widely held view concerning the cause of this phenomenon is a gradualistic one: it explains the dissimilarities of existing languages by assuming that time and isolation in the end have made the differences so great that the original relationship no longer can be recognized. This interpretation cannot be ruled out. But the logical

consequence of this kind of explanation is a cul-de-sac: every possibility of other explanations is blocked up forever. The fact is that the only way language can be preserved for linguistic scrutiny is the written language. This means that scrutiny is dependent on morphology (in the linguistic sense of the term), which at best dates back to ten thousand years b.p. To this must be added that historical linguistics has never proved or even made it plausible to assume that all existing languages stem from a single root (22).

In this context I suggest another explanation: the reason for the dissimilarities of the existing languages (or rather families of languages) is that they have come into being at different places and independently of one another. In other words: originally the language codes developed in an arbitrary manner. But once established, they only underwent small and imperceptible changes as long as there was a continuity between the language-forming nucleus group and its successors.

From this thesis follow two possibilities concerning the reason for the dissimilarities: they can have come into being independent of one another among different Homo erectus groups wandering around in Africa, isolated from one another. Some of these groups may have migrated from Africa - still in isolated groups - and in possession of a language of their own. It is also possible that the development of the spoken language took place a little later, that is, after the migration out of Africa had taken place as a direct consequence of the accelerating selection pressure which the novel and more dangerous wandering life had led to. The erectus-groups which stayed at home may also have developed spoken languages as conditions grew harsher there. Therefore: Spoken language first arose among the hominids who had developed an adequate brain-capacity simultaneously with the development of the speech organs. This, presumably, happened to several isolated groups among the H. erectus at a time when the deterioration of the climate provided the background for long migrations, which in themselves accelerated the selection pressure.

CONCLUDING REMARKS

I think that it would be wise to remember that in dealing with the problem of the origin and age of spoken languages, nobody is able to prove anything in the Popperian meaning of the term for the simple reason that the morphology of language can be traced back only a few thousand years. And from that fact it follows that a theory going beyond that time cannot be falsified.

As a result, the only possibility left to the scientist is to make plausible theories, and a plausibility can only be evaluated in proportion to its ability to explain more than other plausibilities.

The reason why I think that my hypothesis is a little better than the traditional one is that it explains more: With the help of elements of structural linguistics it has been possible to suggest a consistent hypothesis about the cause of the dissimilarities of the existing languages. Further, I have presented the reasons for assuming that spoken language began with Homo erectus.

For safety's sake I repeat that the long wanderings of H. erectus did not in itself create spoken language, but just that wandering may have precipitated the selection pressure; H. erectus might have been in possession of spoken language even before he departed from Africa.

REFERENCES AND NOTES

- (0) The principle of arbitrariness originates from the Swiss Ferdinand de Saussure (1857-1913) and has at some points been refined by the Dane Louis Hjelmslev (1899-1965). Hjelmslev's treatise from 1943: *Omkring sprogteoriens grundlæggelse*, has formed the basis of my interpretation of the concept. An American translation appeared in 1953. (Louis Hjelmslev. *Prolegomena to a*

- Theory of Language. Bloomington, Ind.: Indiana University Press).
- (1) To avoid misunderstandings, I have to emphasize that some well-known behaviour patterns in chimpanzees and Japanese macaques are not necessarily due to communication with or without use of language. A chimpanzee using a stick or straw for termite-fishing or a macaque washing batatas before eating them may not have any intentions to communicate at all: the behaviour patterns pass on to other members of their troops by direct observation and imitation without the need for abstract conclusions.
 - (2) I prefer these expressions to the ordinarily used emotions or emotional states. The expressions are taken from, and used in the same meaning as in, Gilbert Ryle. 1949. *The Concept of Mind*. London: Hutchinson. Chapt.IV: Emotion.
 - (3) Claire Russell and W.M.S.Russell. 1973. Language and animal signals. In Noel Mimmis, ed., *Linguistics at Large*. St. Albans: Paladin, pp 166-167.
 - (4) The notion of intelligence used in this paper is taken from Gilbert Ryle, o.c., Chapt.II: Knowing how and knowing that.
 - (5) It is evident from the studies of the wild-living apes that they are in no need of a spoken language. See Jane van Lawick-Goodall. 1971. *In the Shadow of Man*. London: Collins, p 243 ff and John MacKinnon. 1978. *The Ape within us*. Passim.
 - (6) For a closer look at the notions of 'open programme' and 'closed programme', see Ernst Mayr. 1974. Behavior Programs and Evolutionary Strategies. In *American Scientist* vol.62, November-December 1974, pp 650-659.
 - (7) S.L.Washburn and Shirley C.Strum. 1972. Concluding Comments. In S.L.Washburn and Phyllis Dolhinow, eds., *Perspectives on Human Evolution* 2, p 471 f.
 - (8) William Orr Dingwall. 1979. *The Evolution of Human Communication Systems*. In *Studies in Neurolinguistics*, vol.4, New York: Academic Press, p 42 ff.
 - (9) For this discussion it is of interest to read V.E.Negus. 1949. *The Comparative Anatomy and Physiology of the Larynx*. London: Heinemann, p 200. He considers that 'early Man', among whom he meant Neandertal man, from an anatomical point of view had the necessary prerequisites for spoken language, but that his intelligence was not sufficiently developed to enable him to utilize the opportunity. Philip Lieberman in numerous publications, (among others *The Origins of Language*. New York: Macmillan, 1975) has claimed that Neandertal man (and the hominids before him) did not possess spoken language in the true sense of the word, if any at all, because the larynx in his opinion was positioned too high, almost on the level of the mandible. His arguments for this opinion have often been strongly criticised; thus D.B.Burr in *Neandertal Vocal Tract Reconstructions: A Critical Appraisal* (*J.of Hum. Evol.*5, 1976, pp 285-290) has asserted that the reconstructions of Lieberman have been made on the basis of too poor reconstructions or casts of crania, which in themselves were badly preserved. William Orr Dingwall in *The Evolution of Human Communication Systems* (see note 8) has expressed a similar criticism (p 46 ff), just as he attacks the so-called 'motor theory of speech perception', which Lieberman uses in support of his opinion. See also Dean Falk. 1975. *Comparative Anatomy of the Larynx in Man and the Chimpanzee: Implications for Language in Neandertal*. In *Am.J. of Phys. Anthropology*, vol. 43, July,September,November 1975, pp 123-132. Conversely, Washburn and Strum in *Concluding Comments* (see note 7) p 475 have suggested that even chimpanzees could be able of talking (though slowly), that is, if only their brains were capable of engaging in such an activity (!).
 - (10) See e.g. the summary by V.M.Sarich. 1983. Appendix: Retrospective on Hominoid Macromolecular Systematics. In R.L. Ciochon and R.S.Corrucini, eds., *New Interpretations of Ape and Human Ancestry*. New York: Plenum Press, pp 137-150.
 - (11) Yoel Rak. 1983. *The Australopithecine Face*. New York: Academic Press, p 83 and passim.
 - (12) Cf. William Orr Dingwall, o.c., figure 1.11 (p 44).

- (13) The dental arch in some robust australopithecines did not become smaller in spite of the marked orthognathism of the cranium; it is just recessed, while the orthognathism in Homo sapiens is due to a reduction of the dental arch as a whole. As concerns the australopithecines, this does not mean a change of the length of the palate compared to other, prognathic, australopithecines, so their tongues presumably are fairly equal in length and flatness compared to Homo sapiens sapiens. See Yoel Rak, o.c., figure 29, p 145 and p 83 f.
- (14) Nature, vol.327, 21 May 1987, pp 205-209. See also Time, June 1, 1987, No.22, p 45. -
- (15) Bernard Wood in Nature, vol.327, 21 May 1987, pp 187-188.
- (16) This also applies to the languages of the so-called primitive peoples. Concerning this, J.C.Marshall says in his paper 'The Biology of Communication in Man and Animals' in John Lyons, ed., New Horizons in Linguistics, Penguin Books 1973, p 230: 'Careful descriptive work by anthropological linguists showed that there are no extant 'primitive' languages, but only complex languages spoken by technologically primitive peoples. Similarly, whilst languages are subject to historical change, there is no evidence to suggest that such change results in their becoming more complex in any general sense. Of course the span of time for which pertinent data are available is very brief. There is no evolutionary or cultural record of the development of communication from hominids to reconstructions of proto-Indo-European. Fossil evidence concerning the size and shape of jaw and cranium in extinct higher primates tells us little or nothing about their mode of communication'.
- (17) F.Brown, J.Harris, R.Leakey and A.Walker. Early Homo erectus skeleton from West Lake Turkana, Kenya. In Nature, vol.316, 29 August 1985, pp 788-792. See also Sarah Burney. Our most complete ancestor. In New Scientist, 5 September 1985, p 29. A thorough survey of the whole complex of problems concerning Homo erectus (until 1980) is found in W.W.Howells. 1980. Homo erectus - Who, When and Where: A Survey. Yearbook of Physical Anthropology 23:1-23.
- (18) W.W.Howells, o.c., p 11.
- (19) See note 18.
- (20) Naturally, an existence of constant wandering did not exclude such a community from occupying base camps for shorter or longer spans of time.
- (21) About fire use, see C.K.Brain and A.Sillen in Nature, vol.336, 1 December 1988, pp 464-466 and the references included. As to house reconstruction, see G.E.Kennedy. 1980. Paleoanthropology. New York: McGraw-Hill Book Company, p 272 ff with references.
- (22) Jared M.Diamond in Nature, vol.336, 15 December 1988, pp 622-623.