Academic Journal of Modern Philology

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ISSN 2299–7164
Vol. 12 (2021)
Special Issue
s. 229–238

On the Contemporary Theories of the Development of Human Language

Abstract

Language does not leave a fossil we can put under a microscope; there is no living witness to its origin, early functions and its stages of evolution. Thus, the study of language origin and development is based mostly on speculations or guesses we need to take in order to see the big picture and to try to solve some of the greatest mysteries of human history – a jigsaw puzzle made out of millions of pieces scattered around the world. So as to fully explore and grasp the notion of language, it appears fundamental to start from dissecting and putting under a microscope all components, properties, processes and manifestations of language, a selection of which has been offered throughout this paper. There are very few certainties in this field; however, it has been established that certain properties and aspects of language had to coincide for it to originate, *viz*. the descent of the larynx, the growth and reshaping of the brain and skull, changes of speech apparatus and finally the emergence of syntax. First though, a collective shift in thinking must have occurred, generating the mental readiness for language capacity and the need to expand the existing communication system. Once the requirement was established, human anatomy must have eventually followed. Consequently, the process of externalization was activated, engineered by the consistent and coherent socio-cultural transmission, which redesigned human interaction, communication and social organisation. Scientific evidence, presented in this paper, suggests that language could not have emerged as a result of a sudden shift, on the contrary, it must have been a result of complex processes, mental and biological on one level and social and psychological on the other.

Keywords: syntax, semantics, mentalising, Broca's area, Dunbar's theory, prefrontal cortex, neocortex, FoxP2 gene, evolutionary psychology

doi:10.34616/ajmp.2021.12

The aim of the research

The main objective of the research paper is to study and investigate human language origin and development, which serves as a platform to analyse a wider selection of contemporary theories on the subject, with the main focus on Robin Dunbar's (1996) theory. To attempt to fully comprehend the birth of language means to realise the phenomena's complexity, properties and nature. I offer an analysis of

selective human language properties and present their aspects through the prism of rational enquiry, the approach of "natural sciences" as Noam Chomsky (2000: 2) would call it in, amongst other publications, his collection of lectures under the title *The Architecture of Language*. Conveying the evidence that language developed by humans is exclusively a property of our species, the human language faculty is further explored in terms of its distinguishing properties – semantics, pragmatics, syntax and the Theory of Mind network – albeit some forms of them are shared with other species. Then, language is examined as a product of our brain functions and intelligence, and its correlation to the brain size. Lastly, an overview of the notion of pre-language is discussed, which serves as a platform to explore selected contemporary views on emergence of language in hominin lineage. In the process of analysis, I refer, amongst other sciences, to evolutionary psychology, neuroscience, genetics and archaeology, which provide the key evidence in the research, helping to sieve what is known from what remains a speculation.

1. A selective outline of universal properties of human language

a. Semantics and pragmatics

In order to fully grasp the language phenomenon, linguists like Sapir (1921), Chomsky (1959), Pinker (1994) and Bickerton (1990) amongst many others, have been endeavoring to recognize and describe its semantic components, just like a chef would try to distinguish all ingredients in order to comprehend, recreate and preserve a dish. This most present and observable ingredient of language that has attracted vast attention due to its empirical notion is lexicon. Tallerman (2012: 444–445) distinguishes three unique characteristics of human lexicon. To begin with, the number of lexical entries is staggering – an average adult human stores about 50, 000 of them. Secondly, even though there are several critical periods in the process of acquiring syntax, phonology and morphology, new lexical items can be learned throughout life. Lastly, there are two classes of lexicon in human languages: lexical categories meaning "content words" and grammatical elements meaning functional categories. Interestingly, as Tallerman (2012: 444–445) puts it, this lexical/functional division is present in all known languages and means the categories are usually open-classes and new items can be added. Semantics, broadly speaking, describes what words mean, however, when our focus drifts towards the meanings the speaker intended, we enter the field of pragmatics, bridging the concept with its phonological and syntactic references in a language. Fitch (2010: 131–132) suggests that pragmatics consists of at least three components: context-driven inference, Theory of Mind and *mitteilungsbedurfnis* – a hypertrophied inclination to signal and talk about our inner worlds with others.

b. Syntax

As Maggie Tallerman (2012: 445–446) observes, when words from different semantic classes re-appear arranged in predictable ways, consistent with their dependents, we can say that syntax is born. In search of the origin of language it is crucial to distinguish the specifics to syntactic components of the human communication – its characteristics and roles but also rules and conditions that make them work this way and no other way. Krzeszowski (2014: 115–116) sums up the cognitive model of structural and functional

properties of language and narrows down to eight such properties: duality, productivity/recursiveness, arbitrariness, interchangeability, specialization, displacement, reflexivity, cultural transmission. Krzeszowski (2014: 115–116) notes after Hockett (1958: 574) that although these properties are present as a set only in human languages, they are not present as a whole set in non-human languages, they can recur separately in some methods of communication *e.g.* bee dancing or calls of gibbons. There has been a vivid discourse, referred to in *How Language Began* by Daniel L. Everett (2017: 108–118) around the presence of recursiveness in human languages, which according to Noam Chomsky (publishing since the late fifties), recalled by Everett in his book, is defining and therefore inclusive of all existing human languages. This statement has been opposed by Daniel Everett (2017: 108–118) who supports his view with years of empirical studies of Pirahã language, which as he discovered does not possess the property of recursiveness, probably due to specific conditions present in the Pirahã environment, which might be limiting the language production.

c. Mentalising and the Theory of Mind network

While non-human languages can possess semantic and primitive syntactic structures, mentalising, is exclusively human. Jeremy Holmes and Arietta Slade (2018: 180–181) add their definition of mentalising as "(…) the ability to see oneself from the outside and others from the inside." Dunbar (2014a: 60–62), for that instance, when referring to empirical sciences, notices that since the development of neuroscience (Wernicke 1906, Broca 1861) and its modern tools, experiments and studies of brain activity show that mentalising, most probably, takes place in specific parts of the brain. The parts of the brain are known as the Theory of Mind (ToM) network, and the cerebral areas involved are *viz*. the prefrontal cortex and temporal lobes, with the main activity noticed in the frontal pole and the temporo-pariental junction. Consequently, Dunbar (2014a: 60–62) suggests, the sign of more developed areas of ToM engagement indicate greater deal of acquiring and processing the social skills and information necessary to "navigate our complex social worlds." This very link, Dunbar (2014a: 60–62) continues, enables us to estimate the mentalising competences for varied species of early humans and consequently, on this very basis, it can be speculated when pre-language appeared and when language became a human capacity.

2. The correlation of intelligence and brain size as evidence for Dunbar's theory

Contemporary view on intelligence is constructed on the widely recognized concept of multiple intelligence, after developmental psychologist Howard Gardner's theory described in his famous book *Frames of Mind: The Theory of Multiple Intelligences*, published in 1983, where apart from the six core types of intelligence, he proposed eight criteria that can be used to establish the dominant type of intelligence for an individual (Brody [1976] 1992: 34–36). Whatever a definition of intelligence may be, one thing is to define it, another to measure it. Dunbar ([1996] 2011: 56–57) recalls Henry Jerison, who published his first observations and conclusions on this notion in *Brain and Body Ratios in the Evolution of Intelligence* in 1955, where he discerns that brain size is not enough to measure the intelligence capacity and the interspecies differences. Jerison (1973), as cited in Dunbar ([1996] 2011: 56–57), points out that the

core of the examination is to calculate what proportion of the brain tissue is used to maintain the basic functioning of the animal and what there is left to be used for functions not paramount for survival.

Dunbar (2010: 25–26) seeks a correlation between the unusual brain size and human social evolution and finds that scientific domains provide the evidence that amongst primates' species, the more support a female receives the better the survival rate of her offspring. As a consequence, the female neocortex is much more developed than the one of the male representatives of the same species. On the other hand, the male limbic system is the area of male dominance, achieved by the focus on the fight. Dunbar (2010: 25–26) further explains that the better social relationship a female has with other females of her tribe and the better her negotiation skills, the more successful she is going to be receiving more support for herself and her child. This view has been strongly supported by observations of a population of baboons in Kenya, which showed that the more developed the social skills of the females are, the larger the number of surviving offspring at the end of their lifetime. Dunbar (2014a: 60) concludes that, taking all evidence into account, there is no surprise that the main change phase of neuroanatomy for brain size and vocal control overlaps with the major shift in social time requirement.

There are two main hypotheses regarding the reason behind the extraordinarily large brain in humans: *ecological* hypotheses and *Machiavellian* intelligence hypotheses. According to Machiavellian intelligence hypothesis, considered to be the alternative hypothesis, the exceptionally large brain in primates is a result of their complex systems of societies and knowledge about them (Byrne and Whiten (1988) as cited in Dunbar 1998: 178 and 2011: 60). On the other hand, the ecological hypothesis, raised in the 70s, attributes the brain size to the diet, suggesting that it is due to the period when our ancestors lived on fruit, which involved more complex cognitive processes to keep track of everyday life matters. It involved developing a better colour-vision, better communication skills and memory. Also, it has been suggested, as Dunbar (1998: 178–179) recalls, that frugivorous as opposed to folivorous animals have richer diet and have more spare energy to spend on growth of brain, which in fact grows mostly prenatally. The ecological hypothesis was widely accepted due to its empirical force based on an observation that fruit-eating primates had larger brains and furthermore, lived on a larger territory. New empirical data proves that "(…) although there is a correlation between the relative size of the visual cortex and group size in anthropoid primates, the fit is much poorer, and the slope significantly shallower than that between the non-visual cortex and group size" (Dunbar 1998: 184). In his 1998 paper, Dunbar's says that "(…) the volume of the lateral geniculate nucleus, the major subcortical way station in visual processing, does not correlate with group size at all, indicating that pattern recognition per se is unlikely to be the issue." In the article *The Social Brain Hypothesis*, Dunbar (1998: 178) concludes that although ecological strategies seem to involve more complex problem-solving and may be applicable in some species, they still do not explain why all primates, including the folivorous ones require bigger brains than other mammals. On the contrary, comparative studies focused on the behavioural patterns of humans and other mammals led to the conclusion that primates are the only species that use social skills and knowledge about each other's everyday lives (Dunbar 2014: 60–61).

For many years Machiavellian intelligence hypothesis was not enthusiastically accepted but rather rejected due to no supporting evidence, which on the other hand was widely present in the traditional hypothesis. However, the latest data, presented in bulk by Dunbar (1998: 178–179) *et al.*, show that the social brain hypothesis has been supported by strong empirical evidence (Barton and Purvis 1994; Stephan and Frahm 1981, Sawaguchi and Kudo 1990). Moreover, Dunbar (1998: 178–188) *et*

al. conducted further experiments aimed at testing between the two theories and concluded that the ecological hypothesis could have been a kick-starter of the evolution, however it is the social brain hypothesis that is supported by the science.

3. On the pre-language[1] and the evidence of its existence in early hominins

According to Tecumseh W. Fitch and Gesche Westphal Fitch (2012: 4) the early hominins communicated using "pre-language" or "protolanguage" – a simplified version of what we today consider language. The word "protolanguage" was introduced by an anthropologist Gordon Hewes (as cited in Fitch & Fitch 2012: 4), when describing his hypothesized gestural "protolanguage" and was further popularized by Derek Bickerton, in the early 1990s. Michael A. Arbib (2003: 185–186) in favour of the gestural protolanguage hypothesis, gives a definition of protolanguage which in general is a sequence of gestures, short utterances, calls similar to the ones we can observe in the modern primates' communication. The ambiguous nature of "protolanguage" provokes scholars (Bickerton, Harari *et al.*) to focus on particular language components *e.g.* concerning speech, syntax or semantics, and their time of appearance and evolution. In this regard, Bickerton (1990, as cited in Krzeszowski 2014: 121) allegedly suggested that:

> [...] there are no substantive formal differences between the utterances of trained apes and the utterances of children under two. The evidence of children's speech could thus be treated as consistent with the hypothesis that the ontogenetic development of language partially replicates its phylogenetic development. The speech of under-twos would then resemble a stage in the development of the hominid line between remote, speechless ancestors and ancestors with languages much like those today.

Fitch and Fitch (2012: 2) also point out that "protolanguage" is an "(…) intermediate stage of human evolution in which one or other component of language was present, while others were absent." There has been a dispute aiming at distinguishing properties belonging truly to either language or protolanguage and marking their differences. In the volume *Language Origins,* edited by Maggie Tallerman in 2005, Arbib (2005: 27–28) emphasises that there is a significant distinction between language readiness to produce protolanguage, based on the brain innate capability to acquire language and achieved through a biological selection, and what Arbib (2005: 27–28) calls *true language*, a capability developed through a *historical accumulation* rather than a biological change. Consequently, Arbib (2005: 28–30) proposes the language properties supporting both of the approaches – starting with the features of "protolanguage" – he offers: symbolization, intentionality and parity (mirror property), and continues describing more general properties present in language development and production: from hierarchical structuring to temporal ordering; beyond the here-and-now; paedomorphy and sociality. And consequently, adds the properties of true language as: symbolization and compositionality; syntax, semantics, and recursion.

1 Terminological note: the concept of "pre-language" has been fairly recently effectively and consistently fighting the term "protolanguage" after Krzeszowski (2014: 105–123). Nevertheless, in this paper, most of the referred views of authors were conceptualised in the era of protolanguage, hence the appearance of the term has been used in accordance with the source and the authors' decisions, and thus has not been changed due to the rules of referencing.

One thing is to define pre-language with its universal properties, and another is to comprehend the processes which led to its appearance. In search for the answer, James Hurford (2003: 41–42) reviews cognitive pre-adaptations that must have taken place in order to pave the way for a language-ready brain. The pre-adaptations in form of capacities and dispositions Hurford (2003: 41–42) distinguishes are as follows:

a. A pre-phonetic capacity to perform speech sounds or manual gestures.
b. A pre-syntactic capacity to organize longer sequences of sounds or gestures.
c. Pre-semantic capacities: to form basic concepts; to construct more complex concepts; to carry out mental calculations over complex concepts.
d. Pre-pragmatic capacities: to infer what mental calculations others can carry out; to act cooperatively; to attend to the same external situations as others; to accept symbolic action as a surrogate for symbolic action.
e. An elementary symbolic capacity to link sounds or gestures arbitrarily with basic concepts, such that perception of the action activates the concept, and attention to the concept may initiate the sound or gesture.

In the same volume, Hurford (2003: 41–42) further explains that pre-adaptive processes prepare a system for an upcoming change, however, are not adaptive themselves, *e.g.* bipedalism would be the trigger for the changes in vocal tract and as such can be considered a pre-adaptive state for speech. Hurford here uses the term speech, however it is crucial, as Bickerton (2003: 80) reminds us, to keep the terminological discrepancies limited to none and explains that this may have led to the extreme time range of language origin being pointed to have happened between 2 million and 100 thousand years ago. Bickerton (2003: 80) emphasises that the terms "speech" and "language" should not be used as synonyms and adds, that it is again possible, that as long as the early hominins had speech capacity, they still may have not possessed the ability to use language-as-we-know-it. Bickerton (2003: 80) further claims that one cannot presume that the appearance of speech triggers the rest of language components to follow.

4. Evidence from the past with multidisciplinary approach from genetics, palaeontology, and neuroanatomy

Modern genetics has been involved in solving the puzzle of protolanguage and language development since the discovery of chromosome at the end of the 19th century, and its role in determining heredity. Robin Dunbar (2014a: 57–58) presents a collective analyses of the findings in *e.g. Ways to Protolanguages 3*, where he reports that there have been two genes found associated with production of speech, gene FoxP2 and most recently, mentioned earlier, MYH16 (myocin gene), which is believed to have appeared in the human linear path around 60kya, which conveniently precedes the appearance of the symbolic art from the Upper Palaeolithic Revolution, which was instantly read as evidence of language origin. Nevertheless, the same gene was also discovered 800kya, in the Neanderthal genome, just at the time when human species' paths further parted. Dunbar (2014a: 57–58) acknowledges that the gene can be connected with the appearance of capacity of producing speech but not necessary a language and can simply relate to a change of diet. Henceforth, in regards to the timeline of the emergence of human language, Berwick and Chomsky (2016: 4–5) recall and agree with the view represented by Lenneberg (1967: 266), who

suggests that "(…) the identical capacity for language among all races suggests that this phenomenon must have existed before racial diversification (…)". Berwick and Chomsky additionally claim that even though there might have been an *internal trait* of language capacity before the diaspora out of Africa, externalization began only about 60kya (Berwick and Chomsky 2016: 54, 70, 164). On the contrary, the hypothesis that *H. erectus* had language is strongly regarded by Daniel L. Everett (2017: 11–13, 20–22) who acknowledges considerable evidence that *Homo erectus* pioneered adventurous voyages over vast lands and seas, produced tools and had culture, not to mention the invention of fire and symbols, which altogether suggest the presence of language.

Although Dunbar (2014a: 58–61) recognises the evidence for more complex communication system in early hominins, he further claims that only anatomically modern humans could produce language-as-we-know-it, and this could have taken place not earlier than 200kya years ago. However, palaeontology and its discoveries, keeps the discussion vivid and open. Although speech or language do not fossilise, each evidence palaeontology provides, brings potentially significant information, e.g. a discovery and examination of a foot, a piece of a pelvis or a leg can indicate whether an individual was *e.g.* bipedal, which in fact was one of the main discoveries when in 1974 "Lucy", the oldest australopithecine, was found in the Ethiopian Hararghe region (Fitch 2012: 275). Eight years later, in the Mousterian layers of the Kebara cave, Israel, a discovery was made of a highly delicate hyoid bone present in fossils of a male Neanderthal (Middle Palaeolithic), meaning his tongue's base must have been connected to the top of the larynx, which is present in anatomy of human lineage respectively, excluding *e.g.* chimpanzees, and is crucial in producing human-like speech (Dunbar 2014a: 59). Although this does not prove the existence of language in the times of the Neanderthal, as it does not suffice as an isolated component in speech production, it became another piece of a bigger jigsaw puzzle scientific world had to accept.

Dunbar calls neuroanatomy for more evidence. Neuroanatomy, in this respect, helps to investigate the development of language in three approaches which Dunbar (2014a: 58–62) offers:

- Neuroanatomical evidence for the control over the vocal apparatus;
- social time demands across hominin evolutionary history;
- pattern of evolving mentalising skills.

Although, as Dunbar (2014a: 59) concludes, the above approaches may not be convincing on their own, when merged together, they make a significant point. Looking at the evidence provided by neuroanatomy, there again, Dunbar (2014a: 59) offers two forms, where "(…) one concerns the size of the spinal cord in the thoracic region in the chest (in effect, the nerves that control the diaphragm and chest wall muscles) (MacLarnon and Hewitt 1999); the other concerns the size of the hypoglossal canal in the base of the skull (the aperture through which cranial nerve XII, which innervates the tongue and mouth, passes (Key *et al*. 1998)." Modern humans can appreciate the effects of enlargement of both of the anatomical features associated with speech and articulatory space. Since this link has been made, scientists have been attempting to find the forms of anatomical development in other human species, with some success. They have been confirmed in sparse fossils of *australopithecines*, and H. *heidelberg* and the Neanderthals (Dunbar 2014a: 59). In the same volume, Dunbar (2014a: 59) further concludes that the anatomical changes observed in the human lineage overlap with the increase of hominins' group sizes and consequently increase of time devoted to grooming as the bigger group requires more grooming time spent on fewer individuals, where bonding and acts of reciprocity take place.

5. Conclusions

In order for language to originate, several conditions must be met. Firstly, the significant social change where complex verbal communication with others would be a necessity as bigger brain means more energy consumption. Secondly, cerebral development and mental shift – the appearance of ToM – would have to occur in order to comprehend and endeavour to meet the social requirements. Lastly, vocal apparatus had to be ready, which could have been a biproduct of new gait and growing body mass in early hominins. After meeting the conditions, the first syntactic items would appear. Consequently, other language properties would emerge, including displacement, embedding and merging, which without externalisation, as *e.g.* Berwick and Chomsky (2016: 164) add, *internal mental tool* would remain only *internal trait*. There are still speculations and open discussions about the universal properties of human language where some are proven to be more universal than others. However, one is certain – verbal language had to start from simple syntactic forms, even if only constructed from clusters of quantal vowels and only after achieving that stage it could have gotten to form semantic formations.

Alongside the speculations regarding the staging of the language evolution another question has been equally explored – the question about the reason to have language at all. According to Robin Dunbar's theory (1996), language came to existence as a more time efficient tool of grooming and was a result of growing human societies. One of the main arguments in Dunbar's theory is the size of neocortex in primates, the part, which is responsible for reasoning and language, proved to be large proportionally to the size of the groups, both of which have shown overlapping time of growth in early hominins. Dunbar provided myriad evidence to support his theory and it seems hard to find its weak points, however, one may argue that Dunbar does not paint a clear picture of what triggered cognitive pre-adaptive mental processes necessary for complex concepts and then language to appear in hominid lineage. Dunbar gives us some clues regarding this issue, suggesting that the awareness of a developing surrounding world must have triggered the theory of mind and from then on, the process of brain rapid evolution might have been a chain reaction, however, this speculation does not seem to suffice as has no scientific evidence. Moreover, recent studies (Fedorenko and Thompson-Shill 2014) of language related brain functions show that human language processing and production involve more than the regions of Wernicke (1906) and Broca (1861) and work as interactive *networks* or *functional systems* on wider spectrum than earlier presumed. These new discoveries on language neurobiology entail and oblige revisiting the theories which rely on those regions in their speculations.

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Received:
22.10.2020
Accepted:
12.10.2021