

The Role of Language in Human Evolution

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Abstract

In spite of its daily usage, the importance of language is not stressed enough in the economy of our evolution. In the absence of language, the modern human world would not have existed. However, the emergence of language in humans is based on chance as everything is in the context of natural selection, yet this doesn't shrink the marvel of the story about how language emerged, developed and proliferated in the human brain. This paper intends to bring forth the linguistic journey of Homo Sapiens, tapping into the doctrines of biolinguistics and neurolinguistics to better understand the hidden mechanisms that set language in motion. All this, however, not before diving into the evolutionary tale about how our species ruptured itself from the mundane fate of other primates and ascended to the elevated beings we are today. Last but not least, the paper offers a brief glimpse into the future of language in the era of AI.

Keywords: language, evolution, biolinguistics, neurolinguistics, LLM (large language model)

Introduction

Sometime between 60,000 and 90,000 years ago, our ancestors left their African cradle and embarked on the odyssey to conquering planet Earth. Today, *Homo Sapiens* stands as the most powerful animal on this planet, and the pivotal factor that launched this species on its evolutionary leap was language. Language is responsible for our intricate social networks, for our structured thinking and our flexibility in assimilating new concepts useful for adaptation and survival. This essay discusses the evolutionary importance of language in three main parts. First, it takes an approach to how language might have occurred and developed through the means of natural selection. In the second part, the doctrine of biolinguistics will be explored so as to shed more light on how language functions. Lastly, the discussion will consider the potential future of human language in the age of large language models.

1. Natural Selection at Its Finest

It is posited that language appeared at some point in the development of genus *Homo*. Scientists speculate that the first sprouts of a protolanguage might have existed as far back as *Homo Erectus*, which is the precursor of *Homo Sapiens*. But why did our language occur at all? And in what manner did it develop so as to constitute the complex code we use today? To form proper insight into the occurrence and development of language, the reader should be informed about how natural selection works.

Natural selection is the evolutionary theory developed by Charles Darwin and it describes,

The process through which populations of living organisms adapt and change. Individuals in a population are naturally variable, meaning they are all different in some ways. This variation means that some individuals have traits better suited to the environment than others. (“Natural Selection”)

The individuals with enhanced traits have a greater chance to survive and reproduce, hence natural selection encourages the multiplication of these enhanced traits, leading to the survival of certain individuals and the perishing of other less adapted individuals. Adaptation can occur either from spontaneous genetic mutations or gradual changes triggered by environmental and circumstantial factors. However, most often, these two causes co-work simultaneously. Natural selection,

Can also lead to speciation, where one species gives rise to a new and distinctly different species. It is one of the processes that drive evolution and helps to explain the diversity of life on Earth. (“Natural Selection”)

The human language is unique in its complexity and flexibility and it is these two characteristics that deem the origins of language so mesmerising, yet utterly mystifying. Nevertheless, it is known that in order to acquire a better understanding of the origins of language, a broader spectrum of disciplines must be consulted. In this case it is advisable to first consider the archaeological evidence gleaned about our ancestors, so as to better comprehend the biological alterations that might have stood at the dawn of human language.

Along the duration of its evolution, *genus Homo* must have acquired a certain faculty that ultimately led to the birth of a rudimentary language, a protolanguage that commenced the linguistic journey this species embarked on. One presupposition is that language evolved once the brain went through a gradual change that affected its size and ability to process more complex thoughts. This evolutionary stage is known as the “Cognitive Revolution”. It

is assumed that this mental upgrade took place after genus *Homo* discovered how to harness fire and use it for cooking. Researcher Richard Wrangham champions the theory according to which,

Cooking is the key to the human evolution, a thesis that also states that the moment when we developed our upgraded brains, which are associated with the faculty of thought and language, is the moment when we uncovered the craft of using fire for cooking food. (qtd. in Johansson 123)

Indeed, until humans learned how to employ fire so as to improve the nutritional contents of food, they had stood at the middle of the food chain, hence living off plants and sometimes even carrion leftovers, as professor Yuval Noah Harari argues in his book, *Sapiens*,

This is key to understanding our history and psychology. Genus *Homo*'s position in the food chain was, until quite recently, solidly in the middle. For millions of years, humans hunted smaller creatures and gathered what they could, all the while being hunted by larger predators. It was only 400,000 years ago that several species of man began to hunt large game on a regular basis, and only in the last 100,000 years – with the rise of *Homo Sapiens* – that man jumped to the top of the food chain. (Harari 12)

Once humans improved their nutrition by using fire, a trait rather unique to this species, their biology underwent a drastic change. Food was easier to digest, therefore the nutritional energy formerly employed in the digestive process was now being converted to develop a larger and more efficient brain,

Some scholars believe there is a direct link between the advent of cooking, the shortening of the human intestinal tract, and the growth of the human brain. Since long intestines and large brains are both massive energy consumers, it's hard to have both. By shortening intestines and decreasing their energy consumption, cooking inadvertently opened the way to the jumbo brains of Neanderthals and *Sapiens*. (Harari 14)

After acquiring an enhanced brain as a consequence of this fateful, yet hazardous incident, genus *Homo*'s capacity of thought underwent a significant alteration. This change materialised in the humans' ability to manufacture weapons and tools of a certain complexity, unbeknown to other species. It is also the remnants of some of these weapons that tell that our ancestors had the ability to plan and to communicate knowledge from generation to generation because the weapons are standardised and have a mutual shape that can't be gained by random chopping,

The tomahawks show that *Homo erectus* was capable to plan. The fact that the tomahawks have remained standardised for a prolonged time confirms that *Homo Erectus* was able to transmit knowledge among generations in an efficient and stable fashion. The offspring must have learnt from the elder how to make and recognise a good tomahawk, because otherwise the tomahawks would have varied greatly in terms of shape. (Johansson 115)

The ability to plan and memory caused our ancestors to develop intricate techniques for hunting that required synchronisation and efficient coordination of limbs. Neurophysiologist William H. Calvin describes the complexity of throwing a spear properly in his book, *A Brief History of the Mind*,

You must plan the coordination for the fingers, hand joints, elbow, shoulder and torso, until you get the right symphony of all parts involved (according to your memories about similar, but not identical situations). Even if there are certain combinations that would be sufficient for the positioning of a certain trajectory, they have to be assembled properly, otherwise you will miss your target and will remain hungry. In other words, you need a coherent plan: all the parts (and there are roughly 100 muscles involved) must create an action plan in which all parts must cooperate. (Calvin 129)

Therefore, considering the evolutionary implications of consuming cooked food and the development of more advanced mental faculties, such as planning and memory, it is evident that genus *Homo* started developing structured thinking, which is key to the development of an intricate verbal coding system.

Structured thinking is mirrored by the social structure our ancestors begot. At first there were the hunter-gatherer societies. One hallmark of these societies was their capability to cooperate more efficiently than other animals. Humans faced the necessity for efficient collaboration and coordination of the group, for their power lay in this technique rather than in brute power. But to collaborate efficiently, humans needed to share invaluable information with one another. This information included mostly parameters for hunting such as the location of the hunt, the techniques employed and the role of each participant in the hunting session. Additionally, humans needed increased trust in each other in order for proper collaboration to occur, therefore they needed to be able to share information about one another. This need for proper communication was most likely met by a then elevated communicational system that might have stood at the foundation of complex language. Regarding the importance of language in these primitive communities, professor Yuval Noah Harari states that,

The most common answer is that our language is amazingly supple. We can connect a limited number of sounds and signs to produce an infinite number of sentences,

each with a distinct meaning. We can thereby ingest, store and communicate a prodigious amount of information about the surrounding world. (Harari 24)

Moreover, with the dawn of the “Agricultural Revolution”, human societies expanded and became even more complex. This is one of the turning points in our evolution that commenced our journey to becoming the dominant species of this planet. Societies were now comprised of more individuals than our biological construct allows us to know intimately, therefore, there was the need for a social coherency factor, other than our knowledge about other fellows. And this factor was materialised in our capacity of storytelling. Humans invented linguistic-imaginary realities not only to augment the present, but also to bring hordes of individuals to cooperate even when there was not enough personal information to enable mutual trust. To expand this linguistic trait, it is necessary to mention the notion of *off-line thinking*. (Johansson 230) Off-line thinking is the ability to think and speak about entities or objects that are not present at the current moment, but it requires more than just remembering absent concepts,

It requires the capacity to construct concepts from scratch and to mentally build relational networks among them, without any previous experience with which those concepts can be associated. (Johansson 230)

Consequently, language enabled *Homo Sapiens* to augment reality via its imagination because of this specific ability to think and communicate about absent or even non-existent realities. Storytelling enables humans to create fictitious realities that can replace personal intimacy in that they create groups of people that believe in the same story. Thus, belonging to and collaboration with a large group is ensured by the mutual belief in a given fictional reality,

However, fiction has enabled us not merely to imagine things, but to do so collectively. We can weave common myths of Aboriginal Indians, and the national myths of modern states. Such myths give *Homo Sapiens* the unprecedented ability to cooperate flexibly in large numbers. (Harari 27)

Nevertheless, humans’ need to cooperate might have developed before they were able to concoct complex stories that hold together large societies. And the ability to create such linguistic realities might have occurred later as a consequence of this need for cooperation. Moreover, cooperation would not be possible without trust, which served as one of the key ingredients in the development of human language. Nonetheless, so as to understand why humans have a greater tendency for cooperation and more trust in fellow individuals compared to other animals, it is necessary to delve even deeper into our biological evolution.

When the ancestors of genus *Homo* developed a bipedal walking posture, the body underwent certain alterations as a result of this adaptation. One important such alteration is the narrowing of the pelvis,

The pelvis modifications occurred rather early in the human evolution. Three to four million years ago, *Australopithecus* was already walking on two feet similarly to us and had a pelvis about as narrow as the one in modern humans. (Johansson 250)

The narrow pelvis had an impactful effect on childbirth – it made the labour harsher and more difficult. The increased cranial diameter in the genus *Homo* successors did not help in this regard. Additionally, chimpanzees can help themselves during childbirth thanks to their elongated arms, but genus *Homo* no longer disposed of such a luxury, hence human females were in dire need of help at childbirth. This biological context led to increased trust in human fellows, especially relatives. Unlike chimpanzees, humans can entrust their offspring to other fellow humans.

One more biological fact that fortifies humans' ability for trust and cooperation is their developmental pattern. Unlike other species, genus *Homo* reaches maturity considerably later, fact that prompts the community to take care of the offspring for an extensive time span because it is not able to fend for itself. This trait dates back to the hunter-gatherers and anthropologists have conducted multiple studies regarding the quantity of food hunter-gatherers managed to amass and this is what they uncovered:

An obvious tendency was especially for hunters to reach their peak shape later in life, at 35 to 40 years old, and then to remain extremely productive for another decade or two before age got the better of them. But a young and unexperienced hunter, about 20 years of age, can merely gather roughly enough food to sustain himself. Similarly, the productivity of the gatherer increases with age, even if not to this extent. (Johansson 252)

This meant that a longer life span and an extended childhood were important for gaining enough experience that later led to increased productivity, which paid off in the long run.

Structured thinking and the need for effective collaboration are, thus, two main factors that may encapsulate the root of human language. Besides them, there are two more factors that could have contributed to the rise of language. It is postulated that language evolved from primitive musical sounds. It is one of Darwin's hypotheses that, in its evolution, genus *Homo* used songs much like other species of animals. These songs did not harbour any meaning, but were employed as a mere means for attracting the attention of potential mates and for reproduction. Another theory regarding the natural utility for language is that it has evolved so that individuals can more efficiently acquire social status. This aspect is quite ubiquitous even in today's humans. People

have an inclination towards attracting as many listeners as possible and become the centre of a discussion, and hence gain a better social status,

When we talk, we compete to find listeners. There is a vigorous competition for the vocal space in almost any human meeting, but very rarely is there a competition for the listening space. (Johansson 297)

This theory ties in well with language's role in sharing useful information. In this light, it is posited that our language has evolved to help humans gossip, "Our language evolved as a way of gossiping". (Harari 25) This stands to reason when considering that gossip is actually a means of acquiring information about other individuals so as to learn whether they are trustworthy, useful and faithful to the community or not.

Subsequently, the entirety of the above hypotheses can work together and form an intricate mosaic as to what biological factors and external contexts contributed to the emergence of complex human language. It is important to keep in mind that the doctrine of uncovering the roots of language is not yet completely mapped out and there is still demand for extensive research and better technology.

2. The Biology of Language: Biolinguistics

When considering research into the faculty of language, it is advisable to consult a multifarious panel of subjects and perspectives. This is why adopting the perspective employed by the faculty of language in a broad sense (FLB) is an optimal starting point in discussing the doctrine of biolinguistics. FLB encompasses multiple factors that might have contributed to the development of language,

The purpose of this term is to cast the net widely, and not prejudge the degree to which any mechanism is or is not „special to“ language. If the primate color vision system, through its influence on color cognition and linguistic color classifiers, has a role in language, then it is one of the components of FLB. (Fitch 21)

Biolinguistics is the study of language in the context of an interwoven network of multiple domains such as psychology, anthropology, neurolinguistics and mathematics. To a certain degree, certain lines of research in biolinguistics proceed on the assumption that language is "a domain-specific biologically based system, a cognitive „organ“ of the mind that interchanges specific forms of „information“ with other mental systems". (McGilvray 22)

Being an organ of the mind implies that language must be innate, at least to a certain extent. However, what fraction of language is encoded in the

brain and what fraction of it is acquired from the outer environment, is still open to debate among scientists. Infants are a relevant object for observation when attempting to assess what components of language are innate and which ones are acquired. It is obvious that human children are equipped with abilities that help them assimilate human language. One of these abilities is the filtering of human speech from any other noise,

Audition is oriented towards filtering human noises in contrast to other sounds and filtering language in contrast to other human noises. This latter ability of the filter must have evolved in connection with the development of language and, because it is active in new-borns, this filter must be innate. (Johansson 193)

Joint attention is another ability that motivates the acquisition of language in infants and it comes built in the human brain,

An early social ability that has utmost importance for language is joint attention: the situation in which two people direct their attention simultaneously towards the same object. (Johansson 198)

This ability is key when learning new words because it aids the infant in letting the adults know what is the infant's object of attention, then adults can utter the word associated with the given object of attention. Thus, the infant acquires a new word through video and auditory stimuli.

The grammatical module is considered innate since individuals don't need a detailed amount of grammatical knowledge in order to form coherent sentences. Grammar is employed more or less unconsciously in quotidian speech, "When we speak, we employ grammar in a completely unconscious manner. And yet, most often we do so correctly". (Johansson 56)

But these abilities are not enough for infants to develop language,

Although every normal human is born with the capacity to acquire language, considerable external input is necessary to activate and utilize this capacity. Second, human language learning abilities are not as well developed in adults as in children: there is a sensitive period for fluent language learning that begins to wane after puberty. (Fitch 74)

This fact has been demonstrated by numerous cases where children were denied proper human communication and were secluded from human society. These children never managed to later learn to speak properly. One famous case is Genie,

Who grew up isolated and immobilised. Her parents locked her up in their house when she was small, before she started speaking. They fed her, but she never had any connection with the external world and never heard anyone talking, being

punished if she herself produced any sound. She was found when she was thirteen and she did not know how to talk at all. (Johansson 182)

Moreover, for language to be innate and easily transmitted from generation to generation, it should have a plateau of complexity. Language should have a base set of features accessible for an infant's brain and its whole structure should be simple enough for an adult to speak it fairly naturally. This means that language's level of complexity is proportionate with the mental abilities of the speaker.

Consequently, it can be stated that language exists as a special mental wiring that is transmitted from generation to generation, but that also needs external stimuli, or external input so as to become functional. This can serve as a pertinent biological explanation as to why there is such a multitude of different languages. Individuals are equipped with the necessary standardised program needed to learn and produce language, but this program has certain functions that have to be filled with differing external code, or input. It is similar to a computer program that can take in various types of code.

In spite of being considered an organ of the brain, language does not have a specific region of the cortex that is attributed only to the faculty of language. Rather, it exists as the interaction of multiple mental modules that co-work to create language. Neurolinguistics is a subbranch of biolinguistics and it cartographs the brain activity engaged in language usage. Language occurs to some extent in both hemispheres of the cortex. Areas in the left half of the cortex are responsible for written and spoken language,

Most of the parts of your brain that are crucial for both spoken and written language are in the left side of the cortex of your brain (the left hemisphere), regardless of what language you read and how it is written. We know this because aphasia is almost always caused by left hemisphere injury, not by right hemisphere injury, no matter what language you speak or read, or whether you can read at all. (LSA Home Page)

The left hemisphere is also the part of the cortex where Wernicke's and Broca's areas are located. These two areas cooperate closely and play a paramount role in language. Wernicke's area "Contains motor neurons involved in comprehension of speech" ("Wernicke's Area"), while Broca's area is a:

Key component of a complex speech network, interacting with the flow of sensory information from the temporal cortex, devising a plan for speaking and passing that plan along to the motor cortex, which controls the movement of the mouth. (John Hopkins Medicine Home Page)

The right hemisphere contains areas that are essential for “communicating effectively and for understanding the point of what people are saying”. (LSA Home Page)

The faculty of language might be spread across the cortex due to the fact that language may have certain functions that had initially been assigned for other tasks than communication. Certain functions that had served other purposes might have been recycled in the development of language, “various features can be perceived also as by-products, inadvertent consequences of an evolutionary alteration”. (Johansson 176) Thus, these readapted functions are found in varying areas across the cortex rather than in one unitary module. A relevant instance of such genetic recycling is the function of vocal cords. These cords might have been developed for singing or calling for reproductive purposes, much like in birds, however, over time genus *Homo* began employing vocal sound formation in a rudimentary version of communication, fact that led to the alteration of the vocal chords and the repurposing of these chords for the production of more intricate sounds.

Occasionally, genetic mutations occur after a certain behaviour has been patterned, meaning that behaviour prompts genetic mutations and not the reverse. In this regard, the adaptation of the vocal cords for a primitive language led to the cords’ genetic alteration alongside the development of the early linguistic faculty, hence early humans began their journey to mastering the language we possess today,

From an evolutionary view, it is more reasonable to adopt the hypothesis of a parallel development of language and the faculty of language, so that the protolanguage might have bestowed the driving force for genetic adaptations, that in return enabled the development of a more efficient language, that in return prompted supplemental genetic adaptations and so on. (Johansson 210)

Neurological adaptations contributed to and were influenced by psychological factors that served as one of the main drivers for the development of complex language. In a conversation, the speaker attributes consciousness and a mental map to its listener in a phenomenon that is termed the “theory of mind”, which

Refers to the capacity to understand other people by ascribing mental states to them (that is, surmising what is happening in their mind). This includes the knowledge that others’ mental states may be different from one’s own states. (Apperly 116)

This psychological mechanism confers language its mosaic-like communicational function, in that the emitter does not need to tell the receiver all the components of its message’s meaning, for the receiver is capable of reconstructing the whole meaning by using a limited number of

hints. In other words, the speaker knows how to structure its message so as the receiver can complete it by interpretation because the speaker surmises the potential mental states and abilities of the listener. In this light, it can be said that language is codified by the emitter and decodified by the receiver. Moreover, this linguistic feature was adapted to serve more than plain informational exchange. According to researcher Daniel Dor, we use language as a “social technology, a tool used in thought transfer” (Johansson 308), this technology, however, is implemented not only for plain interchange of thoughts, but also for manipulation, “The speaker’s aim is not to communicate a message, but to make the listener to contrive a certain thought”. (Johansson 308) This phenomenon is encountered in everyday life, as well as in politics.

Complex language has emerged on the foundation of structured thinking, which enabled genus *Homo* to create logical networks of information and output them to generate an outcome. This pattern for mental processes also founded the basis for symbolical thinking, which interlaces with off-line thinking. These two combined wired humans’ brains for creating and comprehending concepts in a complex mesh of conceptual realities. This upgrade is evident in language for there is a considerable number of words that have no factual concept behind them, rather these words can only exist in certain contexts, such as prepositions that help a sentence to confer a cohesive message. Subsequently, this fact indicates that a “brain wired for symbols represents a significant asset in the development of a brain wired for language”. (Johansson 333) There are numerous archaeological findings that suggest the presence of some form of culture in primitive humans, be it sculptures or the more famous cave paintings, they indicate that genus *Homo* nurtured an inclination towards creating symbolical networks of meaning, an ability necessary in the manoeuvre of language.

Additionally, these faculties of thought have been implemented in various contexts by genus *Homo*, fact that might actually explain why humans have evolved such intricate language, while other species have not. While other animals use their innate skills, such as communication, in a limited fashion and unique contexts, humans have been able to recycle their genetic capabilities and employ them more flexibly, being “capable to generalise and use their instruments of thought in new contexts”. (Johansson 372) In this light, the evolution of grammar is more palpable and etched out since in grammar a number of elements are used interchangeably to output infinite combinations of meaning.

Consequently, the development of structured thinking and the coinage of symbols and networks of conceptual realities based on these symbols, which ultimately led the human mind to higher realms of thought, had given birth to our modern human world. States, technology, science and every

single human creation is the outcome of these conceptual realities we have envisioned through language, a language that has fortified our imagination, and built through one human attribute that set us first in the race for adaptation: flexibility of thought. Our ability to use our instrument of thought in new contexts gave us perspective and this was enough to spur *Homo Sapiens*' mind into the process of creation.

Taking into consideration the entirety of the aforementioned biological aspects required for the faculty of language, the following conclusions can be drawn regarding language's functionality. First and foremost, language is closely entwined with humans' cognitive abilities, these include structured thinking, imagination and mental flexibility. Without these, language would be stern and extremely limited in concepts and combinations. Secondly, language is an open system, implying it is adaptive and developing similarly to an organism. This feature can be adjudged to be a reflexion of the adaptability and flexibility of the brain itself. Thirdly, Language has evolved alongside humans' need for extensive collaboration and social status. Hence, language was grammaticalized to enable the creation of great stories with multiple sentences and to lead the way to more efficient communication.

3. The Future of Language: When Computers Talk

Language has been a humanly unique attribute so far. But with the rise of the large language models (LLM), this status quo is changing. LLMs are computer programs that ingest a gigantic text database, and learn to recognise patterns in this given database,

LLMs are trained with immense amounts of data and use self-supervised learning to predict the next token in a sentence, given the surrounding context. The process is repeated over and over until the model reaches an acceptable level of accuracy. ("Large Language Model")

Once the pattern is assimilated, the computer can guess what word would come in a string of words and thus it can generate text of various kinds and make it sound human-like. In this regard, computers rather imitate language than conceptually understand it. Yet this still begs the question whether the acquisition of this artificial language will play the same role in AI evolution as the acquisition of natural language had in the human evolution. The materialisation of this prospect still remains to be seen.

Conclusion

The rise of the “Cognitive revolution” gave birth to an upgraded biological machine, capable of producing the protolanguage that was to flourish into the code that rendered genus *Homo* the conqueror of planet Earth. Humans developed language primarily as a means of survival, a versatile tool that enabled them to think multifariously, to collaborate in large numbers efficiently, to augment reality with fiction so as to open new means of ingenuity and to create an intricate social hierarchy. Ultimately, language has been the main utensil that has been used in crafting the human world. Today, language has achieved its purpose in the perpetual game of survival and it is time for it to ascend to higher targets. Just as its cognitive counterpart, the rise of the technological revolution promises to give birth to yet another upgrade, this time outside the human skull and inside artificial electric circuits. And language is a key part in the economy of this upgrade too. As it has constructed the human legacy, so language is now on its way to engineering the posthuman legacy.

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