# EVOLUTION OF LANGUAGE FROM THE APHASIA PERSPECTIVE

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Despite the potential significance aphasia research and knowledge has towards understanding the origin of human language, there is limited interest in the use of the aphasia model to approach language evolution (Code, 2011). Some authors (e.g., Bickerton, 2007) have emphasized that there are two central issues in language evolution: (a) how symbolic units (words or manual signs) evolve, (b) how syntax evolve. It has been suggested that symbolic units (i.e. lexicon) and syntax (i.e. grammar) are the only real novelties in human communication systems, and are therefore the most important points to approach in a theory on language evolution. That is, a theory of language evolution should explain how the lexicon and how the grammar appeared in human history.

Aphasia is generally defined as the loss or impairment of language caused by brain damage (Benson & Ardila, 1996). Different subtypes of aphasia syndromes are often mentioned in neurology and cognitive neurosciences, including: Broca's aphasia, Wernicke's aphasia, conduction aphasia, amnesic aphasia, transcortical aphasia, etc. The exact number of aphasia subtypes depend on the particular classification, but usually ranges between four to seven. Seemingly, this suggested diversity of aphasic syndromes has obscured the major and basic distinction in aphasia: there are only two major aphasic syndromes (Ardila, 2010).

These two fundamental aphasic syndromes are associated with a disturbance at the level of the language elements (lexical/semantic) in the Wernicke's aphasia, or at the level of the association between the language elements (grammatical) in Broca's aphasia. It has been further observed that these two basic dimensions of language (lexical/semantic and grammatical) are related to two basic linguistic operations: *selecting* (that means, the language as a paradigm) and *sequencing* (that means, language as syntagm) (Jakobson & Halle, 1956). Lexicon and grammar not only depend on different brain circuitries and areas (temporal and frontal-subcortical) (Ardila, Bernal & Rosselli, 2016), as well as are impaired by different brain pathologies (Wernicke's and Broca's aphasia), but also are mediated by different types of learning (declarative and procedural) (Ullman, 2004).

During child's initial language development, language appears as a lexical/semantic system. Grammar begins with the ability to combine two words to create a new higher level unit (a syntagm, two or more linguistic elements that occur sequentially in the chain of speech and have a specific relationship). Analyzing language development in children, Brown (1973) proposed that most of the utterances when beginning grammar development could be described by a small set of functional relationships between words, such as "agent + action" (baby kiss), "action + object" (pull car), and "agent + object" (daddy ball).

Essentially, three stages of language evolution could be distinguished: (a) Primitive communication systems similar to those observed in other animals, including non-human primates; (b) initial communication systems using sound combinations (lexicon), probably appearing thousands and even millions of years ago, correlated with the enlargement of the temporal lobe; (c) complex communication systems including not only a lexicon but also word-combinations (grammar) (Ardila, 2015).

**Origins of the Lexical/Semantic System.** To understand the origins of language, it is crucial to consider the evolution of the brain areas involved in language processing, such as the temporal lobe (lexical/semantic system). It is known that in monkeys, the temporal lobes participate in recognizing the sounds and calls of their own species (Taglialatela et al., 2009). Hence, the temporal lobe plays a crucial role in auditory communication not only in humans but also in nonhuman primates. The increase of the temporal lobe's dimensions may be related to the complexity of the human auditory communication system. It is interesting to note that the temporal lobe directly participates in the recognition of the own species sounds, and the superior temporal gyrus contains neurons that are tuned to species-specific calls. It has been further suggested that temporal lobe differences between humans and nonhuman primates relate to the temporal lobe volume (Rilling & Seligman, 2002).

**Origins of the Grammatical System.** It has been suggested that verbs, grammar, and speech praxis (generated spatiotemporal specifications for skilled purposeful articulatory movements) appeared simultaneously in history (Ardila, 2009). Interestingly, grammar, speech praxis, and the ability to use verbs are simultaneously impaired in cases of Broca's area damage, suggesting a common neural activity. So, the origin of grammar is directly linked to the ability to use verbs and the ability to produce certain articulatory movements.

Observations with children's language development and experiments with nonhuman primates demonstrate that language initially appears as a lexical/semantic system. Grammar, on the other hand, is correlated with the ability to use verbs and represent actions. This is an ability that depends on, the so-called Broca's area and related brain circuits. Most likely, this last stage in language evolution is only observed in *Homo sapiens*. Grammar probably originated from the internal representation of actions, resulting in the creation of verbs.

Clinical observations demonstrate that the ability to use and understand grammar is impaired in cases of the so-called Broca aphasia (e.g., Papathanasiou, Coppens & Potagas, 2012). This disturbance in the use of grammar is known as **agrammatism**. Agrammatism is also observed in language understanding; these patients have difficulties understanding sentences whose meanings depend on their syntax. We can consequently assume that grammar is supported by certain specific brain areas and brain circuits that are precisely impaired in Broca aphasia.

It has been further suggested that grammar may represent the basic ability for the development of metacognitive executive functions (such as abstracting, problem solving, metacognition, temporality of behavior, etc.) (Ardila, 2008).

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