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The Evolution of Human Language: Biolinguistic Perspectives
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Introduction

*The Evolution of Human Language: Biolinguistic Perspectives* is a book with a collection of contributions from distinguished scholars in biology, psychology, neuroscience, and anthropology. The HCF's paper is introduced in the introduction as a foundation to understand other viewpoints from different perspectives. Part I: Language Architecture addresses how different language theories arise. Part 2: Language and Interface Systems analyze the significant forces behind the evolution of language. Part 3: Biological and neurological foundations explores the evolution of language from biology and neuroscience. Part 4: Anthropological Context discusses the theories and language evolution from the perspective of anthropology.

The book is organized and informative but like many other books it has limitations in its scope. For instance, the information about FOXP2 is not detailed enough and most updated. Meanwhile, since the book is erudite across different fields, readers can get lost sometimes without referring to the details of the authors' original works or other existing sources in the literature. The book is based on a paper entitled, "The Faculty of Language: What Is It, Who Has It, and How Did It Evolve?" written by Hauser, Chomsky, and Fitch (HCF) published in *Science* in 2002. Despite many
debates and controversies among scholars outside the field of linguistics, the HCF paper presents powerful arguments and ambitious theories about how language has evolved, particularly the faculty of language in the narrow sense (FLN). Overall, the debates and controversies are centered on two major issues: Is FLN a unique feature that distinguishes humans from nonhuman animals? Is FLN an end product of a history of natural selection for the purpose of language adaptation, or is FLN the computational mechanism of recursion, recently evolved and unique to humans?

Regardless of whether there are enough empirical data to support the debates and controversies over the two major issues, studying the nature of the evolution of human language represents a significant challenge and dilemma. It is similar to the following questions: 1) Where is life from? 2) Which one comes first, the chicken or the egg? 3) Is learning before development or development before learning? and 4) Is nature more important than nurture or vice versa? Accordingly, understanding the process of evolution is a prerequisite for solving the puzzle of the two issues.

**The Process of Evolution**

It is a known scientific indisputable notion that an organism's genotype (genetic makeup) and the environment can influence the expression of the organism's phenotype (physical appearance and behavior). To be specific, the types of genes that an organism carries can determine how an organism looks and functions. For example, horses reproduce horses which can gallop but can't fly; whereas, birds reproduce birds which can fly but can't gallop though both horses and birds are homologous. Additionally, how an organism looks and functions can be affected by the environment. For instance, the rabbits living in a warm climate have long ears (for dissipating heat easily) as opposed to the rabbits living in a cold climate with short ears (for trapping heat in the body). These variations are due to selective pressures from the natural environment in order to survive and reproduce. Over long periods of geological time, through successful variations passed on to later generations, a new species may evolve and appear in time (Jurmain, Kilgore, Trevathan, & Ciochon, 2008). Accordingly, an organism's genotype defines its phenotype of which the manifestation is influenced by its genotype and environment. On the other hand, since the environment has an impact on an organism's phenotype and through successful adaptations and natural selection over long periods of time, a new species can eventually appear. The genotype is thus influenced by the
environment through the process of evolution. Simultaneously, through interaction with the environment, genes can mutate. If genes mutate, so does the genotype which is ultimately changed by the environment as well.

**Is FLN a unique feature that distinguishes humans from nonhuman animals?**

Whether a chicken comes before an egg or vice versa is a futile debate before the advent of scientific evidence for the origin of life. It is, however, evident that both nature and nurture are important co-players. There is a correlation between capacity and performance. The higher level of performance requires greater and more complex capacity though in very few rare cases nurture may overcome nature. For example, it will be impossible or extremely difficult to take photos with a cell phone without a built-in camera or necessary accessories. Likewise, an organism's capacity (innate features - nature) can affect its performance and functioning (learning and later development - nurture). Undoubtedly, an organism's biological designs can result in varied types and different levels of quality performance.

Accordingly, is FLN a unique human design which contributes to language that eventually distinguishes humans from nonhuman animals? Scientists have been looking for the answer for decades. However, it was not until recently that a specific gene, FOXP2, first found in the British KE family, was identified to play important roles in language and speech (Enard, Przeworski, Fisher, Lai, Wiebe, Kitano, Monaco, and Pääbo, 2002). The highly conservative FOXP2 gene shared by many animals with their own versions today evolved before the dinosaurs. FOXP2 is a transcriptional regulator which can control neuron pathways and the coordination of the face and mouth muscle. FOXP2 can also switch on and off the coordination of the expression of many others genes. Konopka (2009) studied the FOXP2 gene expression in humans and chimpanzees and discovered that humans differ from chimpanzees by two amino acids of a total of 715 and from mice by three amino acids. This suggests that the first FOXP2 mutation occurred 130 million years ago and the last two FOXP2 mutations occurred abruptly and rapidly around the time of language emergence in humans dating back 100,000 to 200,000 years ago, and even earlier (400,000 years ago) when Neanderthals lived. According to anthropologists, Neanderthals used symbolic language and might have speech since Neanderthals had the modern version of FOXP2 with a vocal tract like us. However, the brain size was smaller and the body was shorter and bigger. Although Neanderthals
might not have talked like us, there were many other genes involved in speech that we don't know yet about Neanderthals (Pääbo, 2002).

Fisher and Scharff (2009) and Vernes, et al (2011) further evidenced the importance of FOXP2 protein in guiding the growth of neuronal neurites and modulating the synaptic plasticity of relevant neural circuits in the brain, such as the basal ganglia and striatum, contributing to human language and speech where memory, learning, and motor skills are involved. For example, songbirds demonstrated disruptive vocal learning and mice exhibited abnormal synaptic plasticity and impaired motor skill learning when both species were administered a reduced FOXP2 dosage.

Notwithstanding many unsolved mysteries about FOXP2, this protein is a key player underpinning our understanding about why human language and speech are so different and complicated. HCF (2002) asserted that there must be "some biological capacity which allows us (and not, for example, chimpanzees) to readily master any human language without explicit instruction. FLB includes this capacity but excludes other organism internal systems that are necessary but not sufficient for language" (p. 1571). HCF further argued that FLN develops for communication and others. So far, HCF's argument seems closer to what scientists have discovered about FOXP2 today.

**Is FLN an end product of a history of natural selection for the purpose of language adaptations or is FLN, the computational mechanism of recursion, recently evolved and unique to humans?**

Based on the scientific reason discussed above about FOXP2, the capacity of FLN could have arisen saltatively (nature, the innate capacity for language, HCF) and develop afterwards (nurture, natural adaptation; Jackendoff & Pinker, 2005; derived language, Bickerton, 2007). For example, children are good and fast in picking up the 1st and 2nd languages and through the growing process by interacting with caregivers or adults, they learn to refine their language to fit in their cultural context. According to HCF (2002), "FLN is a computational system (narrow syntax) that generates internal representations and maps them into the sensory-motor interface by the phonological system, and into the conceptual-intentional interface by the (formal) semantic system" (p. 1571). Almost every language has grammatical rules with a certain number of phonemes (sounds) and morphemes (root words, prefixes, suffixes, etc.). For example, English has 15 vowels
and 24 consonants and every word can break down into different morphemes. Whereas, Chinese has 14 vowels and 22 consonants and every written character can be broken down into different strokes. FLN has the capacity to recursively combine different sounds by following the grammatical rules within a language system to form meaningful words, phrases, and sentences.

The capacity of FLN generates discrete infinite expressions which are passed to the sensory-motor and conceptual-intentional systems in the use of language. Accordingly, each expression is a pairing of sound and meaning. Theoretically, FLN seems to have the capacity to generate infinite expressions to pair sounds and meanings. However, FLN requires "input" in order for "output." Alternatively speaking, FLN requires enough information, cues and entries (words, lexicons, etc.), in the database to execute its capacity (Jackendoff & Pinker, 2005). Meanwhile, in the FLN information processing period, learners adapt what they learn through assimilation and accommodation (according to Piaget) in the form of language. The learning process requires both nature and nurture instead of solely depending on "design" or "adaptation." It must be a combination of both for FLN to function and carry out massive kinship-independent social cooperation (Bingham, 1999) because different capacity results in different levels of social cooperation.

Accordingly, FLN seems to be the computational mechanism of recursion, recently evolved, adapted, and unique to humans for the purpose of communication and others (navigation, architecture, reasoning, etc.). The birth and growth of FLN is binary and synchronous.

References


