

Language Processing is Uniquely Human

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Abstract

There is a tacit assumption in neuroscience from the genetic to the systemic level, which holds that the biological foundations of humans are essentially similar to those of nonhuman primates, and that even human language can be understood by extending experiments with monkeys and apes. In accordance with this prevailing view, it has been assumed that language processing is, in principle, not entirely different from the combination of other cognitive functions commonly found in monkeys and humans. However, it has been known that human language is radically different from what is known as animal communication. Recently, Hauser, Chomsky, and Fitch have proposed that *recursion* is the only uniquely human component of the faculty of language ¹, which is also known as the property of *discrete infinity*, the ability to generate an infinite range of discrete expressions from a finite set of elements. Sentences are indeed such infinite expressions generated from a limited set of sounds, signs, or letters. My position is that sentence comprehension characterizes human languages, and that its neural basis is uniquely human ².

In my lecture, I will focus on three fundamental issues concerning language processing in the human brain, and update recent advances made by functional mapping studies of language. First, I will provide the first experimental evidence that the neural basis of sentence comprehension is indeed specialized. Specifically, our recent functional magnetic resonance imaging (fMRI) and transcranial magnetic stimulation (TMS) studies have proved that the left dorsal inferior frontal gyrus (IFG) is more specialized in the syntactic processes of sentence comprehension than other domain-general processes such as short-term memory ^{3,4}. These results suggest that the left IFG is specialized in grammatical processing, which is thus referred to as the "grammar center". Second, we have recently discovered that the activation increases of the grammar center were positively correlated with individual performance improvements in second language acquisition ⁵. Third,

although the ability of reading letters is considered secondary to language function, we have recently demonstrated that the "letter center" is specialized in forming a link between orthography and phonology⁶. The approach to evaluate learning processes in terms of not only indirect behavioral changes but direct functional brain changes takes a first step toward a new era in the neuroscience of education.

References

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