REVISTA DA **ABRALIN**

REVIEW

The language system in the human mind and brain

Paloma Batista CARDOSO
Federal University of Sergipe (UFS)

ABSTRACT

In this text, we review the conference given by Evelina Fedorenko, entitled "The language system in the human mind and brain", given on May 6th, 2020 as part of the activities of the Abralin live event - linguists online. In her speech, the referred researcher discusses language processing, considering its physiological and cognitive aspects. Fedorenko defends the existence of the language network, which encompasses the surface of the frontal, temporal and parietal cortex; which function is language processing. This region of the brain responds, with a major or minor degree of intensity; to semantic and syntactic stimuli to compose meanings that are acceptable to speakers.

RESUMO

Neste texto, resenhamos a conferência ministrada por Evelina Fedorenko, intitulada "*The language system in the human mind and brain*", que ocorreu em 6 de maio de 2020, como parte das atividades do evento Abralin ao vivo – *linguists online*. Em sua fala, a referida pesquisadora discorre sobre o processamento da linguagem, considerando seus aspectos fisiológicos e cognitivos. Fedorenko defende a existência *da language network*, que engloba a superfície do córtex frontal, temporal e parietal, tendo como função o processamento da linguagem. Essa região do cérebro responde, com maior ou menor grau de intensidade; a estímulos semânticos e sintáticos, a fim de compor sentidos que sejam aceitáveis para os falantes.

KEYWORDS

Cognitive linguistics. Language processing. Language system.

PALAVRAS-CHAVE

Linguística cognitiva. Processamento da linguagem. Sistema da linguagem.

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Language can be understood as a means for telepathy or, in other words, as a window to the mind. It is from this statement that Fedorenko develops her speech.

Language has two dimensions: production and processing. The first one allows us to encode thoughts and express utterances. To do this, we need to know the language phonemes, how they can be organized to form acceptable words, phrases, and sentences. The second one allows that our listener, by an audible input, understands what we say and have a glimpse of what we think.

From a cognitive point of view, production and processing are executed by what Fedorenko calls the language network, which encompasses the surface of frontal, temporal and parietal cortex; responsible for semantic, syntactic processing and, according to the literature; resolution of arithmetic exercises, musical perception and social cognition.

The surface of the frontal, temporal and parietal cortex forms an integrated network, which functions at multiple levels of cognition and allows the expression and understanding of highly complex thoughts. Given the complexity of the processes involved in linguistic production and processing, Fedorenko, in this conference, emphasizes processing. Studies on this dimension of language have been carried out in different approaches: magnetic resonance, intracranial records, genetic analysis and computational modeling. The evidence obtained suggests that language activates multiple areas of the brain that respond strongly to linguistic stimuli.

Despite the evidence of brain activity related to processing, we don't know much about how we understand language: whether by the meaning of each word or by the sentence as a whole. Another factor related to processing is how we build meanings including elements that are not part of the linguistic code, such as intonation and facial expressions, associated with cognitive processes in other levels that reflect the social dimension of language.

After outlining the dimensions of language and presenting its network from a physiological point of view, Fedorenko presents three research questions:

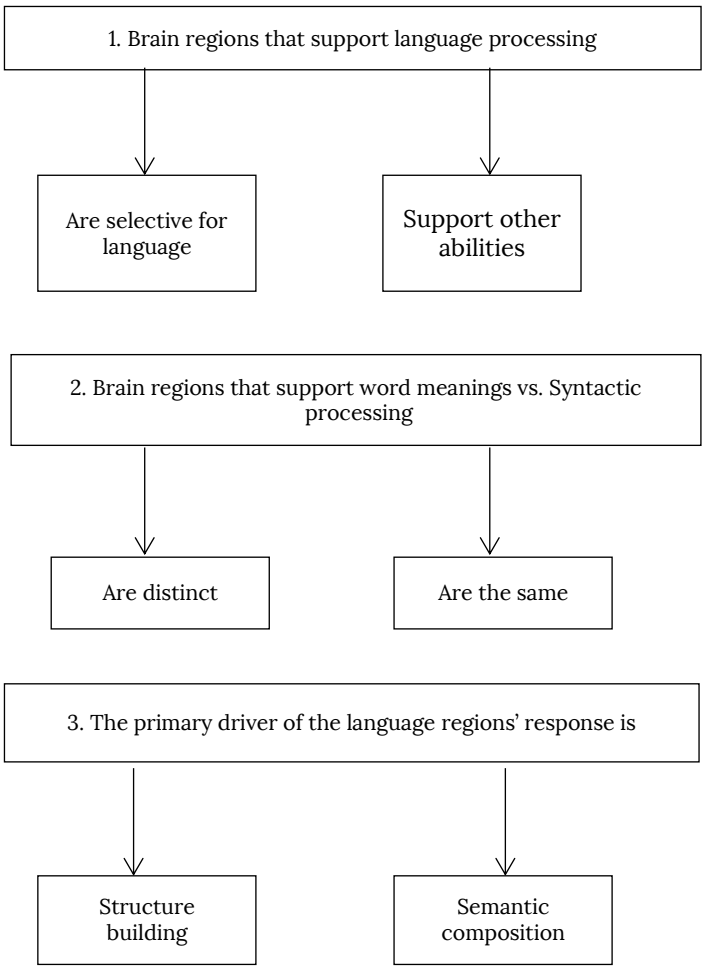

FIGURE 1 - Research questions

To answer the first one, the researcher presents brain activity mapping data obtained by magnetic resonances, while the individuals were performing arithmetic activities. The results show that the areas activated during the execution of these activities are not the same activated by the input of linguistic stimuli, which suggests that the regions of the brain that support language are highly specific.

Despite the cognitive specificity of language, to Fedorenko it is not innate. When we learn a language, we learn the meanings of words and constructions. This link between form and meaning is stored throughout our experiences and used by our brains as responses to linguistic input.

Regarding semantic and syntactic processing, Fedorenko points out that when we process sentences, we compute the individual meaning of each word and its category to understand the meaning that they form as a sentence. Our grammatical knowledge does not operate only on general categories, such as names and verbs, but on how each item selects arguments and structures sentences. One example is the verb to comfort. As speakers, we know that comforting requires an agent and a patient to form an acceptable sentence, such as "I comforted my friend".

Intracranial records indicate that syntactic processing does not occur only in Broca's area: the central posterior cortex is also activated when individuals process sentences. These same regions are also activated during word processing, which suggests that the areas of the brain that support syntactic and semantic processing are the same.

However, even though the same areas are activated during the processing of sentences and words, their degree of activity is not the same. Brain activity mappings indicate that sentences trigger stronger responses than word lists. Fedorenko hypothesizes that this happens because when individuals are exposed to the first type of input, they seek to establish meanings by semantic composition.

The semantic composition is influenced by the building effect. As speakers, we intuit in which contexts two words may or may not be used. In this sense, in "xxxxxxxx eating xxxxxx apple", it is quite likely that we will try to organize the spaces in a way to form a plausible sentence, as "my friend is eating an apple". Based on this statement, Fedorenko presents a test in which twelve sentences suffered seven types of manipulation, each. In the latter, they were destroyed to the point that they were closer to being lists of disconnected words.

The results showed that even when manipulations caused syntax errors, when the arrangement of sentences allowed a plausible meaning the individuals presented stronger cognitive responses, which suggests that the primary function of language network is semantic composition.

The data and arguments presented by Fedorenko make clear how complex human language is. For production, the speaker must mobilize a series of linguistic knowledge; for processing, he must capture the meanings of words and sentences. How this happens remains a mystery.

However, evidence suggests that linguistic production and processing are performed in a wide area of the brain, acts at different levels, and also are influenced by social factors. Therefore, elements such as intonation and facial expressions contribute to the semantic composition. The functioning of the language network indicates that diverse brain activities interact with each other, which points to how we organize our thoughts.

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