

Review

# Interaction between lexical and grammatical language systems in the brain

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## Abstract

This review concentrates on two different language dimensions: lexical/semantic and grammatical. This distinction between a lexical/semantic system and a grammatical system is well known in linguistics, but in cognitive neurosciences it has been obscured by the assumption that there are several forms of language disturbances associated with focal brain damage and hence language includes a diversity of functions (phoneme discrimination, lexical memory, grammar, repetition, language initiation ability, etc.), each one associated with the activity of a specific brain area. The clinical observation of patients with cerebral pathology shows that there are indeed only two different forms of language disturbances (disturbances in the lexical/semantic system and disturbances in the grammatical system); these two language dimensions are supported by different brain areas (temporal and frontal) in the left hemisphere. Furthermore, these two aspects of the language are developed at different ages during child's language acquisition, and they probably appeared at different historical moments during human evolution. Mechanisms of learning are different for both language systems: whereas the lexical/semantic knowledge is based in a declarative memory, grammatical knowledge corresponds to a procedural type of memory. Recognizing these two language dimensions can be crucial in understanding language evolution and human cognition.

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## Contents

1. Introduction	199
2. Clinical evidence	200
2.1. Wernicke aphasia: grammar without content	201
2.2. Broca aphasia: content without grammar	201
3. Linguistic evidence	202
4. Learning evidence	202
5. Anatomical evidence	203

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5.1.	The lexical/semantic system . . . . .	203
5.2.	Understanding Broca's area . . . . .	204
5.3.	Brain organization of nouns and verbs . . . . .	206
6.	Developmental evidence . . . . .	206
7.	Understanding language evolution . . . . .	207
7.1.	Initial communication systems . . . . .	208
7.2.	Lexical/semantic communication systems . . . . .	208
7.3.	Grammatical communication systems . . . . .	209
8.	Conclusions . . . . .	210
	Acknowledgement . . . . .	210
	References . . . . .	210

## 1. Introduction

It is generally supposed that language presents a continuous progression in complexity, so during child language development, as throughout human history [16,30,69]. Thus, it is accepted that normally the child learns the first words about the age of 12 months [104]. Around this age the child acquires a new ability that he or she previously did not have: the ability to repeat. This ability to repeat correlates with the maturation of the arcuate fasciculus [109]. So-called Broca's area corresponds to the region of the left hemisphere involved in language production; it corresponds to the third frontal gyrus, located anterior to the face area of the motor cortex and above the Sylvian fissure. Damage in this area results in the language disturbance known as Broca aphasia. Wernicke's area is located in the posterior and superior part of the temporal lobe (first and second temporal gyri) of the left hemisphere, corresponding to the auditory association area of the left hemisphere. Damage in this area results in the language disturbance known as Wernicke aphasia. The arcuate fasciculus is the neural pathway connecting the posterior part of the temporoparietal junction (Wernicke's area) with the frontal cortex (Fig. 1).

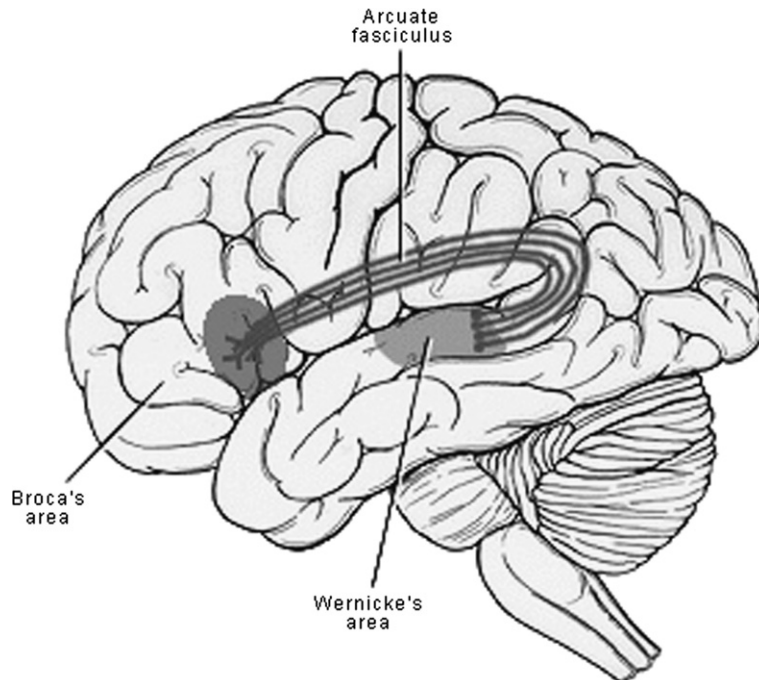


Fig. 1. Traditionally it has been accepted that there are two major areas involved in language: frontal Broca's area and temporal Wernicke's area. It has been assumed that the arcuate fasciculus connects these two cortical areas.

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