

Neurolinguistic Approach to the Study of Aphasia

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Abstract:

The article examines the brain mechanisms underlying speech activity and the neurolinguistic aspects of aphasia. Particular attention is paid to the history of the formation of neurolinguistics as a scientific discipline, its relationship with neuroscience, and key discoveries in the field of localization of speech functions. The works of Franz Joseph Gall, Paul Broca, Carl Wernicke and other researchers who made a significant contribution to the study of aphasia are analyzed. The issues of functional asymmetry of the brain and the interaction of speech centers with other areas of the cortex are covered. Modern approaches to mapping language processes and prospects for further research in the field of neurolinguistics are presented.

Keywords: neurolinguistics, aphasia, brain mechanisms of speech, Broca's area, Wernicke's area, functional asymmetry of the brain, localizationism.

Aphasia is a complex disorder of speech activity that occurs as a result of local damage to the brain. In recent decades, neurolinguistics has been actively studying the mechanisms of aphasia, analyzing how damage to various brain structures affects speech function. Modern research shows that speech disorders in aphasia cover different levels of the language system - from phonetic to syntactic. Understanding the brain mechanisms of aphasia allows not only to clarify diagnostics, but also to develop more effective methods of patient rehabilitation.

The purpose of this article is to examine the neurolinguistic features of aphasia, to identify patterns of speech disorders and their connection with damage to specific brain structures.

The neuropsycholinguistic approach to the study of aphasia is an interdisciplinary direction that combines knowledge of neuropsychology, linguistics and psycholinguistics to study the brain principles of speech activity and the expansion of speech that arise as a result of local brain damage. This approach allows for a deeper understanding of the nature of aphasia and the development of effective methods for diagnosing and rehabilitating patients with speech disorders.

Neurolinguistics as a scientific direction was formed in the late 1950s - early 1960s in foreign science. It is an interdisciplinary field of research located at the intersection of neurology, psychology and linguistics, and studies the neurophysiological foundations of speech activity. The emergence of neurolinguistics was due to the needs of aphasiology - a section of medicine dealing with the diagnosis, study and therapy of speech disorders that arise as a result of local damage to the brain. According to the definition of the founder of Russian neurolinguistics A.R. Luria ¹, this discipline studies the mechanisms of brain organization of speech, as well as the patterns of changes in speech processes when the central nervous system is damaged.

The term "neuropsycholinguistics" includes the component "neuro", which indicates a close connection of this direction with neurosciences - one of the leading areas of human body studies. Within the framework of neurosciences, such disciplines as neurobiology, neurophysiology, neuropsychology and other related areas that study the functional organization of the nervous system are distinguished. The connection of neurolinguistics with neurosciences requires an analysis of the physiological mechanisms underlying speech activity.

The development of neuropsycholinguistics was preceded by a long period of accumulation of empirical data on speech disorders associated with brain damage, i.e. aphasia. The foundations were laid by two fundamental discoveries in the field of neuropsychology:

1. localization of mental processes in the cerebral cortex;
2. functional asymmetry of the human brain.

One of the first researchers to suggest the heterogeneity of brain functions was the Austrian anatomist Franz Joseph Gall in the late 18th century. He hypothesized that different cognitive abilities were localized in separate areas of the brain. In addition to sensory and motor functions, he believed that certain areas of the brain were associated with personality traits, such as musical ability, wit, or predisposition to professions. However, his theory of phrenology, which suggested the possibility of determining character traits by the shape of the skull, was later refuted. Despite the criticism of phrenology, the idea of localizing mental processes was further developed and became the basis for neuropsychology and neurolinguistics. It was Gall who first suggested that speech function could be associated with the frontal lobes of the brain. Another important concept, the theory of functional asymmetry of the brain, developed gradually, based on observations of the anatomical and functional differences between the hemispheres.

The key moment in the study of the brain mechanisms of speech was the discovery of the localization of speech function in the left frontal lobe. The beginning of aphasiology as an independent science is traditionally associated with 1861 and the name of Paul Broca. However, earlier, in 1836, the French doctor Marc Dax presented a report in which, based on observations of 40 patients, he indicated a connection between speech disorders and damage to the left hemisphere. His work was not widely known, but two decades later Paul Broca confirmed this assumption based on clinical observations. Studying patients with speech loss, he found that they all had damage to the posterior third of the first frontal gyrus of the left hemisphere. This area was later called "Broca's center", and the disorder associated with it became known as motor aphasia. Initially, Broca used the term "aphemia" to describe this speech disorder, but it was later called "aphasia", proposed by M. Trousseau. Aphasia caused by damage to the left hemisphere became the subject of study of aphasiology, which in turn laid the foundation for the development of neurolinguistics and neuropsycholinguistics. Broca's research served as the starting point for the concept of hemispheric dominance, according to which the left hemisphere is considered to be the leader in organizing speech. Initially, this concept was formulated as "Broca's rule", which states that speech function is controlled by the hemisphere opposite the dominant hand. Later, this idea was developed by the

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English neurologist John Hughlings Jackson and led to the widespread idea of the dominant role of the left hemisphere.

In 1874, German neurologist Carl Wernicke made another important discovery when he described a second speech center in the brain. He found that patients with damage to the posterior part of the first temporal gyrus of the left hemisphere retain the ability to speak, but lose the ability to understand spoken language. This area, called Wernicke's area, is associated with sensory aphasia, in which speech perception is impaired. Research by Paul Broca ²and Carl Wernicke ³established that different speech functions are associated with specific areas of the brain. For example, patients with damage to Broca's area have difficulty with expressive speech, but their ability to understand speech remains relatively intact. At the same time, damage to Wernicke's area leads to sensory aphasia - patients speak fluently, but their speech often loses meaning and contains neologisms.

Already in the early stages of aphasia research, key findings were made:

1. Speech processes rely on several interconnected areas of the brain, each of which plays a specific role in the organization of speech activity.
2. Speech zones are adjacent to zones responsible for motor and sensory functions, which indicates a close relationship between speech and general brain activity.
3. The main speech centers are localized in the left hemisphere, which confirms the concept of its dominant role in speech function.⁴

Further study of the localization of language processes in the brain contributed to the development of areas related to the mapping of neural networks responsible for various aspects of speech. German psychiatrist K. Kleist proposed a model in which individual areas of the brain were correlated with different levels of language structure: phonological, lexical, morphological and syntactic. English neurologist G. Head also suggested that local brain damage can cause nominative, syntactic and semantic forms of aphasia. These studies laid the foundation for a direction in aphasiology known as localizationism . Thus, studies of the brain mechanisms of speech and aphasia played a key role in the development of neurolinguistics, which continues to develop, combining data on language activity with neurobiological and cognitive research.

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