



## The Analysis of a Scientific Research on the Study of Phonological and Semantic Processes of Comprehension in Sensory Aphasia

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**Abstract:** This article gives information about aphasia and its types, as well as the works in the field of neurolinguistics around the world. Also, the common experiments in neurolinguistics are introduced in this article. Moreover, an analysis of scientific research work on phonological and semantic processes in sensory aphasia is given.

**Keywords:** aphasia, neurolinguistics, sensory aphasia, ERP, PMN, N 400.

The process of speech is an integral part of linguistic studies. Speech process is shown as a reflection of language in reality. Ferdinand de Saussure, a scientist who distinguished language and speech linguistics, notes the speech process as a process of “pure mental order” involving at least two people.[4]

The formation of the science of neurolinguistics, which studies the speech process together with brain activity, is associated with the name of the French neurologist Paul Broca. In 1861, this scientist’s speech at the Paris Anatomical Society was the first research in this direction. He conducted research with a patient named Labrjin, who lost the ability to speak as a result of a brain injury. The patient could not speak for long due to brain damage and repeated the same sentences.

After his death, when his brain was examined, it was found that the left hemisphere of the frontal lobe cortex was damaged. Broko decided to conduct the same experiment with the second patient in a very short time. Both patients had speech difficulties as a result of damage to the left hemisphere of the brain. Paul Broca's greatest innovation in the 19th century medical world was that different parts of the human brain are responsible for different tasks, including human speech, which is carried out in the left hemisphere.

Aphasia (loss of speech) occurs when the parts of the human brain are responsible for understanding and producing speech are damaged. The study of aphasia and its types is the one of the research areas of neurolinguistics.

Type of aphasia	Specific features
Broca’s aphasia	Slow, slurred speech, short pronunciation, comprehension relatively intact
Wernicke’s aphasia (sensory)	Fluent, well-articulated speech, word meanings are distorted and not logically related.

Alexander Romanovich Luria, who is one of the well-known representatives of neurolinguistics, is recognized as the founder of modern neuropsychology. He lists six types of aphasia in his book Traumatic Aphasia. Three of them are related to the type of sensor related to speech understanding, and the others are related to the type of motor related to the expression of speech [5].



Type of aphasia	Initial defect
Impairment of speech understanding	
Sensory (acousto-gnostic)	Disturbance of phoneme differentiation
Acousto-mnestic	Auditory-speech memory (слухоречевая память) impairment
Semantic	Impaired understanding of logical-grammatical constructions and word selection according to meaning
Disruption of speech production	
Afferent motor	Selection disorder of articulation
Efferent motor	Disturbance of kinesthetic organization of speech Disturbance of grammatical structure
Dynamic	Disorders of verbal planning and verbal activity

It is clear from the table, Wernicke's aphasia (sensory aphasia) is a type of aphasia caused by damage to the upper and middle parts of the left hemisphere of the brain. In scientific literature, incomplete understanding of speech, production of grammatically correct, but semantically unconnected speech is cited as one of the main characteristics of sensory aphasia. [1]

The scientific research work that we want to analyze [2] is devoted to the study of phonological and semantic stages in the process of understanding of patients with Wernicke's aphasia (sensory aphasia). An important feature of this research work is that the experimental results were based on PMN (Phonological Mapping Negativity) and N 400. The purpose of the analysis of this scientific research is as follows:

1. Creating an idea about the research work being carried out in world neurolinguistics, their level and quality.
2. Serving the enrichment of scientific information about Wernicke's aphasia in Uzbek linguistics

In the process of analysis, it is desirable to have information about a number of terms.

ERP (Event-related potential) is the response of the brain to emotional and cognitive influences. An electrophysiological representation of this reaction.

PMN (Phonological Mapping Negativity) is a device that records phonological disorders in the brain.

N 400 is a device that records semantic disorders in the brain.

PMN and N 400 are important parts of ERP.

During the experiment, 8 aphasic patients and 10 participants were selected for the control group. As a result of this research, the following scientific conclusions are drawn:

1. Impairment of understanding in Wernicke's aphasia occurred as a result of deterioration of phonological and semantic processes. This phenomenon has so far been identified using offline neuropsychological methods. In this study, the phonological and semantic stages in the process of understanding a single word were comprehensively investigated using ERP.
2. The effects of N 400 and PNM in patients with Wernicke's aphasia were low and intermittent. The results of the participants in the control group were artificially worsened and compared with the experimental group, and a correlation analysis was performed. As a result, the PMN (phonological mapping negativity) indicator was determined in the experimental group, but the N400 amplitude did not show the result when the word picture related to the behavior was shown.



3. Phonological impairment and language comprehension are interrelated in patients with Wernicke's aphasia. Based on the results of the experiment, a hypothesis is presented that the disturbance of the acoustic-phonological process leads to the deterioration of the access to the semantic system.

Experimental conclusions are based on PNM and N400 results, which are important components of ERP. The PNM is a negativity indicator that indicates a shift of about 250 ms when a stimulus is presented to the lateral-central region and determines whether a response was returned that did not match the phoneme present in the context. Therefore, this indicator provides the first phase of comprehension and the accuracy index of phonological analysis.

The N400 is a late phase of semantic processing and is associated with components that form a peak at 200 and 600 ms in the central-lateral region after stimulus presentation.

It is also seen as a predictor of disruption in the integration of semantic information in context and retrieval of information from semantic memory. The magnitudes of this component are modeled based on two competing forces. A smaller N400 is triggered when a semantic judgment is more easily made based on a congruent stimulus, or not triggered when an incongruent stimulus is presented, as the first case is favored in semantic analysis. The magnitude of the N400 also decreases when the auditory condition decreases, and this is why it is also seen as an effect that reflects a decrease in the quality of information reaching the semantic field.

In the research work, the extent to which acoustic, phonological, semantic disorders occur in phonological and semantic systems was checked based on the condition of word-picture examination. In this test, the participants evaluate whether the picture is the same or different from the word shown on the screen. Participants are asked to answer which picture the word belongs to by pressing the appropriate buttons.

Both the test group and the experimental group will be given the same number of 120 tasks in a total of 240 tasks. 40 of the tasks were based on matching, 40 on phonological mismatch and 40 on semantic mismatch.

The end-of-experiment results support the hypothesis that indeed, low-grade phonological impairment in patients leads to semantic impairment and thus to impaired comprehension.

In conclusion, Wernicke's aphasia is characterized by fluent but semantically disjointed speech. Considering that Uzbek linguistics has not yet to carry out any scientific research in this field, it is somewhat difficult to comprehend the nature of research conducted in the world of linguistics.

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