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A NEUROPSYCHOLINGUISTIC MODEL OF SPEECH DISORDERS AND SPEECH ISOLATION

Pulatshoh Ramazonovich Bobokalonov,
*PhD in Philology, doctoral candidate
at the International University Asia.*

Abstract: Speech is a multidimensional neuropsycholinguistic phenomenon involving the interaction of neural structures, cognitive processes, and linguistic systems. Although speech disorders and speech isolation are often considered similar communication disorders, they differ significantly in their underlying mechanisms. This study proposes an integrated neuropsycholinguistic model that distinguishes between structural linguistic deficits and functional communicative impairments. The model proposes that speech disorders arise primarily from a disruption in linguistic encoding, while speech isolation arises from a disruption between conceptualization and verbal implementation.

Keywords: speech disorder, speech isolation, neuropsycholinguistics, cognitive, model, language processing, cognitive communication

Introduction. Human speech is not only a means of communication but also a central component of human thinking, emotions, and social functioning as a complex neuropsycholinguistic system. The speech process is formed through the mutual integration of various levels of brain activity, including the sensory, motor, cognitive, and affective systems. Therefore, any speech impairment or interruption is not only a linguistic phenomenon but also a reflection of underlying neuropsychological processes.

In modern research, the concepts of speech impairment and speech isolation are often viewed as similar phenomena, yet their essence, mechanism, and manifestations differ significantly. While speech impairment is largely associated with disruption of the structural components of the language system—phonetics, vocabulary, or grammar—speech isolation is characterized by a person's inability to fully express their verbal abilities in external communication for various reasons.

From a neuropsycholinguistic perspective, these two phenomena are directly linked to changes in the activity of various functional areas of the human brain. For example, the left hemisphere, particularly the speech centers identified by Paul Broca and Carl Wernicke, plays a crucial role in the development and comprehension of language. Meanwhile, the right

hemisphere supports the emotional and prosodic aspects of speech. When the balance between these systems is disrupted, speech impairment or speech isolation occurs.

Studying speech disorders and speech isolation based on a unified neuropsycholinguistic model allows us to identify their common and distinct aspects, improving diagnostic and treatment processes. In particular, the growing number of cases of communicative isolation in the modern social environment requires a thorough scientific analysis of this problem. Therefore, this paper develops a neuropsycholinguistic model of speech disorders and speech isolation, and systematically analyzes their cognitive, neural, and communicative mechanisms based on [theoretical framework + model description + schematic structure].

Main part. The integrative approach of neuropsycholinguistics is important for explaining speech disorders and speech isolation. According to this approach, speech is the result of the interaction of three main systems: 1) the neurophysiological system (brain structures), 2) the psychocognitive system (thinking, memory, attention), 3) the language system. At the neurophysiological level, speech activity is controlled primarily by specialized areas located in the left hemisphere of the brain: Broca's area (speech production - motor programming) and Wernicke's area (speech comprehension). At the same time, the right hemisphere provides intonation, emotional coloring, and communicative context. A three-stage continuous chain of neuropsycholinguistic modeling: themes (linguistic units and rules).

According to the psychocognitive basis, speech relies on the cognitive processes of conceptualization (thought formation), verbalization (converting thoughts into language), and monitoring (control). A characteristic feature of speech isolation is the presence of thought during speech. At the linguistic stage, phonetic, lexical, and grammatical components are of great importance, and when the system: [thought] → [semantic model] → [grammatical structure] → [phonological code] → [motor program] → [speech] works ineffectively, speech disorders occur. This model is distinguished by the following aspects: 1. It considers speech disorders and isolation within the framework of a single system;

2. It distinguishes them as structural and functional problems; 3. It provides a step-by-step analysis mechanism for diagnosis; 4. It can be used in pedagogy and clinical practice.

Studying speech disorders and speech isolation based on a unified model contributes to a deeper understanding of human speech activity and the development of effective diagnostic and intervention methods. Speech impairment differs from speech isolation. Speech impairment is a clinical condition, while speech isolation is a functional and communicative process. The "Speech Isolation Model" is a neuropsycholinguistic framework that explains how a gap occurs between a person's thoughts (inner speech) and their external expression (spoken or written speech) for a specific individual.

Speech impairment is evidence of organic or functional defects in the brain or language system. Difficulties with speech, comprehension, or direct word selection, persistent or prolonged, when a person cannot speak or speaks without meaning, indicate aphasia.

Speech is not simply a disorder. Its disorders are caused by problems with sounds, words, sentences, voice or rate of speech. Speech disorder means a problem with the normal formation or functioning of speech. It manifests itself at different levels and several main conditions are identified in the scientific literature. They include: 1. Articulatory disorders - incorrect pronunciation of sounds. For example: inability to pronounce "r", "s"; 2. Phonological disorders - confusion or substitution of sounds: pronouncing "titob" instead of "kitob"; 3. Lexical disorders - a state of insufficient vocabulary and the inability to find the right word; 4. Grammatical disorders - incorrect sentence construction, incorrect combination of words; 5. Speech fluency disorders - interruptions in speech, stuttering (logoneurosis), "getting stuck" on a sound or word (perseveration) and a state of stopping and slurred speech (scanning); 6. Voice disorders (phonation) - a voice that is too low or high, hoarse. 7. Neurological disorders (aphasia) are speech disorders caused by brain damage, resulting in a weakening of the ability to understand speech in Wernicke's area and the ability to construct sentences in Broca's area. In isolated speech, impairments associated with brain activity include the inability to select the correct word at one of these stages, the inability to construct a sentence correctly, or the inability to clearly pronounce sounds. In this case, sounds in words are dropped, sounds are replaced, they are pronounced incorrectly, and speech becomes incomprehensible—that is, a disruption of the phonological and motor stages of speech occurs.

Every word is made up of sounds. The sound system in the brain of every language is automated for word formation. Broca's area is responsible for word formation, word selection, and sentence construction. When we talk about converting thoughts into words, we mean sentence construction. A decrease in its activity leads to increased activity in the amygdala (limbic system), and speech processing becomes isolated. Stress or arousal alters the action of the neurotransmitters adrenaline/cortisol, which impede rapid word retrieval in the brain and lead to stagnation. An imbalance between the brain's thought planning and emotional stress blocks attention and working memory, making it difficult to organize thoughts. Suppression of speech production in the brain hinders the conversion of thoughts into words, causing speech isolation.

This process consists of [thought → word + word → sentence + sentence → sound + plan → pronunciation]. This scientifically proven, systematic process is called the speech isolation model from a neuropsycholinguistic perspective. Speech isolation, in simple terms, is a state of "I understand, but I can't say it." This means that a person has an idea but can't express it in words. They know what they want to say, but they can't speak it or can't express it correctly. Speech isolation is primarily associated with sound distortion, a deficit, or difficulty pronouncing it. In this case, it's not the speech that is isolated, but the sound. Sound isolation is a state in which a person knows a word and a sentence, but cannot pronounce the sounds correctly.

Before speaking, a person perceives a thought in the brain, the thought is converted into words, these words are formed into a sentence, and finally, the sentence is spoken out loud.

This involves: 1) the cognitive stage (the formation of an idea, intention, or concept not yet translated into language, through thought formation in the prefrontal cortex); 2) semantic-conceptual coding (temporal area — lexical selection, transformation of a concept into a meaningful unit or falling into a state of anomie when incapable of finding the needed word); 3) grammatical structuring (syntax in Broca's area — inability to create or construct a grammatically correct sentence); 4) phonological coding (correct formation of a sound system or confusion of a sequence of sounds in Wernicke's area); 5) planning of the motor cortex (implementation of an articulation plan in the integration of Broca's area of the brain or blocking of speech in a state close to mutism). 6) articulation phase (production or interruption of external vocal speech using the speech apparatus).

In young children, an inability to find words, "getting stuck," breaking off sentences mid-sentence, briefly or incorrectly expressing even simple thoughts, complete silence when excited, a seeming delay in speech development, and frequent use of sounds like "uh..." and "mm..." are explained by the fact that the language system is not yet fully formed, and emotional control is weaker. In adolescents and adults, a thought arises, but the word "doesn't come" quickly, an inability to initiate a sentence or it is blocked, speech slows or becomes confused under stress, speech deviates from the topic or is forgotten, speech becomes more intense in front of a group of people—that is, in a social situation, an internal thought arises, but external speech "gets stuck," which is caused by [high cognitive load + social pressure + stress response]. Children often experience "disruptions" in the developing speech system, and in adults, the formed system is temporarily blocked under the influence of stress or emotions. According to neuropsychological data, this is associated with delayed speech formation in the Broca's area and difficulties in planning thoughts in the prefrontal cortex. During stress or arousal, the limbic system "suppresses" the speech centers. This is a temporary disorder. A condition similar to temporary speech blocking or isolation indicates difficulties in converting speech into words, and this can take various forms depending on age.

Perseveration is the unnecessary repetition of the same sound, syllable, or word in speech. In this case, words like "men-men-men borama" or "kitob-tob-tob-tob" are repeated and slowed down, preventing the transition to the next word but remaining connected to the previous element. They are pronounced with a delay.

The scientific basis for difficulties converting speech into words (temporary speech block or "speech production difficulties") is clearly explained in neuropsycholinguistics and neuroscience.

According to the model of speech development in the brain, if any part of thought formation (the prefrontal cortex), word selection and grammatical structure, or the articulatory chain are disrupted, thoughts will not be converted into words.

- Working memory is essential for speech development. Memory becomes overloaded under stress, making it difficult to quickly select words. Neurotransmitter changes occur. Dopamine imbalances are disrupted, adrenaline and cortisol levels increase, which slows

rapid speech development. In patients with aphasia (Broca's aphasia), speech development is impaired. Under social stress, even healthy people experience a "functional speech block." Difficulty translating thoughts into words: the result of an imbalance between neural networks (Broca's aphasia + prefrontal cortex) + the stress system (amygdala) + working memory resources.

"Speech isolation" is conventionally divided into several types:

1. Social speech isolation - lack of communication or its complete absence

- The person rarely communicates with others or is withdrawn

Cause: social environment, loneliness, conflict

2. Psychological speech isolation

- Does not speak due to internal fear, stress, or anxiety

Cause: emotional pressure, trauma

3. Neurological speech isolation

• Associated with a disruption in the speech centers of the brain, involving the Paul Broca and Carl Wernicke areas. Result: impaired speech development or speech comprehension.

4. Linguistic isolation:

• Separation from the language environment (switching to another language, lack of communication). Result: decreased vocabulary, slower speech. 5. Situational (temporary) isolation:

- Arousal, fear, stage fright. Speech temporarily "gets stuck."

The neuropsycholinguistic characteristic of speech isolation is that it is a consequence of the disruption of language and communication systems in the human brain, which is associated with a disruption or insufficient functioning of these systems.

From a neuropsycholinguistics perspective, speech isolation:

- weakens the connection between language and thinking;
- inner speech (the language of thinking) predominates;
- external speech (speaking) declines.

Speech isolation has a very strong negative impact on child development. For a child, speech is not only a means of speaking, but also a means of thinking, socialization, and emotional development.

1. If a child does not communicate sufficiently, speech development slows:

- vocabulary is small;
- the ability to construct sentences is poorly developed;
- pronunciation errors are common.

This can lead to delays in speech development.

2. Speech isolation affects language and thinking (cognitive development):

- the child slowly learns concepts;
- the development of abstract thinking slows;

• problem-solving ability declines. 3. Speech isolation causes problems in social development:

- communication with peers becomes difficult;
- social skills (greetings, asking questions) weaken;
- withdrawal occurs due to the inability to express oneself.

3. Speech isolation affects the emotional state:

- inner nervousness or depression may develop;
- self-esteem decreases;
- aggression may increase.

4. Speech isolation affects brain development:

- neural connections in the brain are actively developed through speech;
- speech isolation slows this process.

This demonstrates that speech isolation in children and adults is associated with the functioning, cognitive, and communicative properties of the brain.

The main cause of conditions similar to speech isolation (agitation, fear, inability to speak in stressful situations) is an imbalance in the brain between the emotional and speech systems.

1. Dominance of the emotional system. In cases of strong arousal or fear, the amygdala is activated. It signals "danger," and the brain switches to defense mode rather than speech mode. 2. Inhibition of the speech centers. The areas of Broca's field and Wernicke's field typically include:

- sentence construction;
- understanding meaning;
- word selection. However, in stressful situations, the signal reaching them becomes "disorganized," and activity slows.

3. Allocation of cognitive resources. The brain simultaneously:

- assesses danger;
- increases heart rate;
- concentrates attention.

As a result, speech "resources" become scarcer.

4. Changes in neurotransmitters. Adrenaline and cortisol levels increase. This makes it difficult to express thoughts quickly and clearly. Conditions such as speech isolation are caused by the brain leaving the "logical speech mode" and switching to "emotional defense mode."

CONCLUSIONS. Speech disorders and speech isolation are two distinct but interrelated neuropsycholinguistic phenomena of human speech activity. The study results show that speech disorders are primarily associated with defects in the structural components of the language system—the phonological, lexical, and grammatical levels—which are often attributed to damage to the speech centers of the left hemisphere of the brain, particularly the Paul Broca and Carl Wernicke centers. In contrast, speech isolation manifests itself as a

functional impairment in its implementation in external communication, despite the preservation of linguistic competence. That is, although a person possesses thought and linguistic units, psychological, emotional, or neurodynamic barriers arise during the process of converting them into speech or using them in social communication.

Based on the proposed neuropsycholinguistic model, the following general conclusions can be drawn: a) speech disorder is a structural (systemic) defect; 2) speech isolation is a functional (communicative) impairment, the distinction between which depends on the stage of the speech process at which the impairment occurs; studying both conditions within a single model increases the effectiveness of diagnosis and intervention.

Speech disorders are primarily associated with disruptions in linguistic coding mechanisms, including phonological, lexical, and grammatical processing. These deficits are typically associated with local dysfunctions in the cortical areas of language identified by Paul Broca and Carl Wernicke. In contrast, speech isolation is not caused by a disruption in linguistic competence itself, but by a disruption in the integration between conceptualization and verbal expression, which is often influenced by cognitive control, emotional regulation, and social-communicative factors.

In conclusion, understanding speech as an integrated neuropsycholinguistic system allows for a clearer distinction between impairment and isolation, and, as a result, facilitates targeted and effective approaches in both theory and practice.

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