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THE IMPACT OF MATERNAL SECOND SIGNAL SYSTEM ACTIVITY ON MOTHER-CHILD INTERACTIONS DURING THE VERBAL DEVELOPMENT STAGE IN THE CONTEXT OF WAR AND HEALTH CRISES

Summary

The transition from nonverbal to verbal communication in children is significantly influenced by the maternal secondary signaling system. Current geopolitical and health crises, such as the war in Ukraine and post-COVID-19 syndrome, exacerbate maternal stress and may affect mother-child interactions and child development.

Aim. *The purpose of this study is to examine differences in the activity of the second signaling system between mothers who report difficulties perceiving their children and those who do not, and to understand the impact of these differences on mother-child interactions during the child's verbal developmental period.*

Materials and methods. *The study involved 184 mothers, divided into two groups: 98 mothers who reported difficulties in perceiving their children and 86 mothers who did not. The The Questionnaire for Assessing the Activity of the Second Signal System (Language and Cognitive Test: How Well Do You Understand and Communicate?) (Lunov, 2023) was used to evaluate the activity of the second signal system across eight subscales corresponding to different cytoarchitectonic fields. Independent samples t-tests were conducted to compare the mean scores of each subscale and the overall integral index between the groups.*

Results. *Significant differences were found on all subscales and the integral index, indicating notable discrepancies in the activity of the second signaling system between the two groups. Mothers who reported difficulties had consistently lower scores, highlighting the need for targeted interventions to support their communication and interaction with their children.*

Discussion. *The findings highlight the critical role of the second signaling system in maternal perception and interaction. The combined effects of war-induced trauma and post-COVID-19 syndrome exacerbate these challenges and underscore the need for comprehensive support programs. Findings from studies underscore the importance of addressing transgenerational attachment factors and maternal mental health to improve mother-child relationships and promote healthy developmental outcomes.*

Key words: *Second Signaling System; Maternal Perception; Child Development; Verbal Communication; Neuropsychology; Effects of War; COVID-19; Mother-Child Interaction; Cognitive Development.*

Introduction

The transition from nonverbal to verbal communication is a critical milestone in a child's development that is significantly influenced by the mother's ability to process and interpret language. Ivan Pavlov's concept of the second signal system emphasizes the importance of symbolic language in human communication and cognitive functions [14]. The second signal system includes brain regions such as Broca's area, Wernicke's area, prefrontal cortex, and parietal regions that are essential for speech production, language comprehension, higher cognitive functions, and sensory integration.

Effective functioning of these brain regions is critical for mothers to engage in clear and supportive verbal communication with their children. Mothers with a highly active second signaling system are able to articulate thoughts clearly, understand their child's emerging language skills, and respond appropriately, thereby creating a nurturing environment conducive to the child's linguistic and cognitive growth. Conversely, dysfunction in these brain regions can impede communication, leading to misunderstandings and emotional disconnects that can adversely affect a child's development.

Understanding the impact of the maternal second-signaling system on mother-child interactions is essential for developing targeted interventions to support mothers experiencing difficulties during this critical period. Previous research by Grygorieva (2021) underscores the importance of transgenerational attachment factors and

their influence on maternal-child relationships, particularly in families with children with cerebral problems [4]. This research highlights how inappropriate separation in the mother-daughter dyad can lead to pathological interaction patterns and emphasizes the need for comprehensive support programs tailored to these families.

Additionally, studies such as Neukel et al. (2019) and Sieratzki and Woll (2002) have explored the complexity of maternal neural processing and its impact on child perception [9,12]. Neukel et al. (2019) demonstrated that early life maltreatment affects the neural processing of a mother's own child's facial emotions, suggesting the need for additional support for mothers with adverse early experiences. Sieratzki and Woll (2002) highlighted the role of cradling preferences and hemispheric asymmetry in mother-infant interactions, suggesting that early sensory experiences significantly shape neural pathways and emotional bonds [9,12].

In addition to these challenges, the ongoing war in Ukraine, coupled with the aftermath of the COVID-19 pandemic, has exacerbated the psychological stress experienced by mothers. Recent studies have shown that Russian military aggression has had a profound impact on the mental health of Ukrainian adolescents, with broader implications for family dynamics and maternal well-being [6]. Constant exposure to war-related stressors, along with post-COVID-19 syndrome, exacerbates microsocial stress and leads to significant neuropsychological and behavioral disorders. Mothers are

among the most vulnerable groups, facing increased risks of anxiety, depression, and impaired cognitive function [7,8,16].

The combined effects of war-induced trauma and post-COVID-19 syndrome call for urgent attention to the mental health needs of mothers. This study aims to examine the differences in activity of the second signaling system between mothers who report difficulties in perceiving their children and those who do not. By analyzing the activity of key brain regions involved in the second signaling system, this research seeks to identify specific areas where interventions may be most effective. The findings will contribute to a deeper understanding of how maternal neural processing influences child development and inform strategies to enhance mother-child interactions to promote healthy developmental outcomes.

The Second Signal System and Its Functions. The second signaling system, as defined by Ivan Pavlov, involves the processing and interpretation of symbolic information, such as language. This system allows humans to communicate, think abstractly, and understand complex social cues. Pavlov's ideas about the second signaling system emphasize its role in providing abstractions of reality that are critical for human communication and survival [14].

Key brain regions involved in the second signaling system include Broca's area, Wernicke's area, the prefrontal cortex, and parietal regions (Table 1). Broca's area, located in the posterior part of the frontal lobe in the left hemisphere, is responsible for language production and grammatical processing. Efficient functioning of Broca's area allows for clear articulation and fluent speech, which are essential for effective communication between mothers and their children during verbal development [2].

Wernicke's area, located in the superior temporal gyrus of the left hemisphere, is involved in understanding

spoken language. This area enables mothers to accurately understand their child's speech, facilitating meaningful and supportive interactions.

The prefrontal cortex plays a critical role in higher cognitive functions, including planning, decision-making, and social behavior [11]. It helps mothers interpret social cues, respond empathically, and manage complex interactions with their verbally developing children.

Parietal regions are involved in the integration of sensory information and spatial awareness. These regions support the ability to process and respond to verbal and nonverbal communication cues, thereby enhancing mother-child interactions [10].

Efficient functioning of these brain regions allows for smooth and effective verbal communication, which is essential for fostering a strong mother-child relationship during the child's transition to verbal communication. Mothers with an active second-signaling system can facilitate clear communication, articulate thoughts clearly, and understand their child's emerging language skills, promoting a nurturing environment for cognitive and linguistic growth.

In addition, active second-signaling systems promote emotional attachment by enabling mothers to use language to express affection, guidance, and empathy, thereby strengthening the emotional bond with their child. These mothers can also support educational development by engaging in stimulating conversations that introduce new vocabulary and concepts, thereby supporting the child's educational and cognitive development.

Conversely, dysfunction in these brain regions can hinder communication, leading to frustration and misunderstandings that can affect the child's language development and emotional security.

Table 1

Key Brain Regions and Their Functions

Brain Region	Location	Function
Broca's Area	Posterior part of the frontal lobe	Speech production and grammatical processing
Wernicke's Area	Superior temporal gyrus	Comprehension of spoken language
Prefrontal Cortex	Frontal lobe	Higher cognitive functions, planning, social behavior
Parietal Regions	Parietal lobe	Integrating sensory information, spatial awareness

The Role of Maternal Second Signal System Activity. The transition from nonverbal to verbal communication is a critical stage in a child's development [5]. The maternal second-signaling system, which is responsible for processing language and symbols, significantly influences this transition. An active maternal second-signaling system facilitates clear articulation, rapid comprehension, and appropriate responses, thereby creating a nurturing environment that supports the child's linguistic and cognitive growth. Conversely, dysfunction in this system can impede communication, leading to frustration and misunderstanding, which can affect the child's language development and emotional security.

Effective verbal communication also promotes emotional attachment and empathy, which are essential for a secure mother-child relationship [13]. Thus, understanding and supporting maternal communication skills can improve interactions, enhance child development, and strengthen the emotional bond. Pavlov and his students emphasized the

evolutionary and developmental importance of language and its role in human communication and survival [14].

The mother's brain plays a crucial role in shaping the child's perception, especially in the early stages of development. According to Fritzsche (2003), brain asymmetry and its developmental processes are essential for understanding sensorimotor integration in infants. This integration is significantly influenced by the mother-child interaction, especially through visual and spatial stimuli [3].

Fritzsche (2003) explains that asymmetric inputs from the left visual field, transmitted through an immature optical system, lead to the infant's right hemispheric preference for processing lower spatial frequencies. This right hemisphere dominance is critical during early interactions with the mother, such as rocking and breastfeeding. These interactions help establish basic neural pathways that support later hemispheric specialization for tasks such as language and visuospatial processing [3].

The study highlights that the asymmetric distribution of the cannabinoid receptor CB1 in different brain regions, such as the right basal ganglia and the left Wernicke's area, reflects the brain's preferences for lateralized functions such as posture, positioning and language. This epigenetic development of brain asymmetry unifies multiple aspects of early mother-child interactions, influencing how the child processes spatiotemporal information and develops language and motor skills.

Moreover, Fritzsche (2003) suggests that disruptions in these processes, as seen in conditions such as schizophrenia, can lead to a reversal of typical brain asymmetry. This reversal highlights the fundamental role of early sensory experiences and maternal influence in normal brain development [3].

Sieratzki and Woll (2002) examine the influence of maternal behavior on infant perception, specifically through cradle preferences. Their review indicates a significant left cradling bias in mothers that cannot be attributed solely to handedness or proximity to the maternal heartbeat. This bias is associated with a right hemisphere advantage for processing emotional communication and social bonding [12].

According to Sieratzki and Woll (2002), asymmetric input from the left visual field leads to a right hemisphere preference for processing lower spatial frequencies and emotional cues in infants. This right hemisphere dominance is critical during early interactions with the mother, such as rocking and breastfeeding. These interactions help establish basic neural pathways that support later hemispheric specialization for tasks such as language and visuospatial processing [12].

Left-side cradling enhances the mother's ability to monitor and respond to the infant's facial expressions and emotional cues, fostering a stronger emotional bond. The universal preference for left cradling may be related to the right hemisphere's specialization in emotional communication, including speech melody, facial expressions, and tactile interactions. This preference supports the infant's emotional development and strengthens the mother-infant bond.

In addition, Sieratzki and Woll (2002) note that left cradling has a calming effect on the infant, whereas right cradling is more stimulating. This suggests a nuanced role for maternal cradling in regulating the child's emotional state. Left cradling is consistent with the right hemisphere's role in social bonding behavior, providing a calming environment that promotes emotional security and attachment [12].

In summary, the mother's brain significantly influences a child's perceptual development through early asymmetric sensory inputs and interactions. These early experiences shape the neural pathways and hemispheric specializations that underlie critical cognitive and motor functions later in life. Understanding these dynamics can provide insights into how to support optimal mother-infant interactions and address potential developmental challenges.

Neukel et al. (2019) further highlight the complexity of maternal brain function in shaping child perception, particularly in mothers with a history of early life maltreatment (ELM). In their study, they investigated how ELM affects the neural processing of a mother's own child's facial emotions. Using functional magnetic resonance imaging (fMRI), the study compared mothers with and

without a history of ELM as they recognized happy, sad, and neutral faces of their own and an unfamiliar child [9].

The results showed that mothers with ELM showed increased activations in brain regions associated with mentalizing (superior temporal sulcus, precuneus) and the mirror neuron network (inferior parietal lobule), as well as in the visual face processing network (cuneus, middle temporal gyrus) in response to their own child's happy faces. This suggests that mothers with ELM may engage in more effortful processing and cognitive empathic mentalizing to interpret their child's emotional expressions. This increased cognitive effort may indicate a compensatory mechanism to maintain maternal empathy despite the challenges posed by their own early adverse experiences.

The findings of Neukel et al. (2019) underscore that early life experiences can have long-lasting effects on maternal neural processing of emotional cues, affecting mother-child interactions. Mothers with a history of ELM may require additional support to foster effective emotional communication and attachment with their children, highlighting the importance of addressing early trauma in maternal mental health interventions [9].

In summary, the mother's brain significantly influences a child's perceptual development through early asymmetric sensory inputs and interactions. Understanding the impact of early life maltreatment on maternal neural processing may provide insights into how to support optimal mother-child interactions and address potential developmental problems.

Hypotheses on the Influence of the Second Signal System on Maternal Perception of Verbally Developing Children. The second signaling system, which is responsible for processing and interpreting symbolic information such as language, plays a critical role in shaping maternal perception and interaction with a child who has transitioned to the verbal stage of development. The following hypotheses outline how an active or dysfunctional second signaling system may influence a mother's ability to perceive and respond to her child's verbal communication (Table 2).

1. Enhanced Verbal Interaction

Mothers with a highly active second signal system are likely to engage more effectively in verbal interactions with their children. They can process complex linguistic inputs, understand subtle verbal cues, and respond appropriately, thereby fostering a rich linguistic environment that supports the child's ongoing language acquisition and cognitive growth.

2. Emotional Attunement

An active second signaling system enhances a mother's ability to interpret and respond to the emotional content of her child's speech. This emotional attunement is critical for the development of a secure mother-child bond and helps the child feel understood and valued, which is essential for emotional and psychological development.

3. Cognitive Support

Mothers with well-functioning second signaling systems are better equipped to provide cognitive stimulation through conversation. They can introduce new vocabulary, explain complex concepts, and engage in intellectually stimulating discussions that support the child's educational and cognitive development.

Table 2

The Influence of the Second Signal System on Maternal Perception of Verbally Developing Children

Aspect of Interaction	Active Second Signal System	Dysfunctional Second Signal System
Facilitating Verbal Communication	Mothers with a highly active second signaling system are generally more adept at verbal communication. They can articulate thoughts clearly, understand their child's speech quickly, and respond appropriately. This ability fosters a nurturing and responsive environment that promotes the child's language and cognitive development.	Mothers with dysfunction in their second signaling system may struggle with verbal communication. Problems such as difficulty articulating thoughts, understanding complex sentences, or responding promptly can hinder effective communication with their child. This can lead to frustration and misunderstandings that can affect the child's language development and emotional security.
Understanding and Interpreting Child's Speech	Mothers with dysfunction in their second signaling system may have difficulty communicating verbally. Problems such as difficulty articulating thoughts, understanding complex sentences, or responding promptly can hinder effective communication with their child. This can lead to frustration and misunderstandings that can affect the child's language development and emotional security.	Mothers with a dysfunctional second language system may find it difficult to keep up with their child's rapid language development. Misunderstandings and miscommunications may become common, which can discourage the child from engaging in verbal exchanges and slow his or her language progress.
Emotional Bonding and Empathy	Effective verbal communication is critical to emotional bonding. Mothers who can clearly express affection, guidance, and empathy help their children feel understood and valued. This strengthens the emotional bond and promotes secure attachment.	Difficulties in verbal expression can lead to an emotional disconnect. Children may feel misunderstood or neglected, which can strain the mother-child relationship and affect the child's emotional development and self-esteem.
Educational Support and Cognitive Stimulation	Mothers with a strong second language can better support their child's educational needs. They can engage in rich, stimulating conversations, introduce new vocabulary, and explain complex concepts in an accessible way that enhances the child's cognitive development.	Educational support may be less effective if the mother struggles with verbal communication. Limited verbal interaction can reduce cognitive stimulation and hinder the child's academic progress and intellectual curiosity.

4. Social Communication

Effective processing of verbal information allows mothers to model appropriate social communication skills. Children learn by example, and mothers with active secondary signaling systems can demonstrate effective conversation techniques, conflict resolution, and empathy through their interactions.

Conversely, a dysfunctional second signal system may hinder these processes:

- *Communication Barriers.* Mothers with impairments in their second signal system may struggle with articulating thoughts, understanding complex sentences, or responding promptly, which can lead to communication breakdowns and misunderstandings. This can negatively impact the child's language development and emotional security.

- *Reduced Emotional Connection.* Difficulties in verbal expression may lead to emotional disconnects. Children might feel neglected or misunderstood, which can strain the mother-child relationship and impede the child's emotional development.

- *Limited Cognitive Engagement.* If a mother has trouble with verbal communication, she may not be able to provide the necessary linguistic and cognitive stimulation. This limitation can affect the child's academic progress and intellectual curiosity.

By understanding these potential influences, interventions can be designed to support mothers in enhancing their second-signaling system abilities, thereby fostering better mother-child interactions and promoting healthy developmental outcomes for their children.

Neukel et al. (2019) further highlight the complexity of maternal brain function in shaping child perception, particularly among mothers with a history of early life maltreatment (ELM). In their study, they investigated how ELM affects the neural processing of a mother's own child's facial emotions. Using functional magnetic resonance imaging (fMRI), the study compared mothers with and without a history of ELM as they recognized happy, sad, and neutral faces of their own and an unfamiliar child [9].

The results showed that mothers with ELM showed increased activations in brain regions associated with mentalizing (superior temporal sulcus, precuneus) and the mirror neuron network (inferior parietal lobule), as well as in the visual face processing network (cuneus, middle temporal gyrus) in response to their own child's happy faces. This suggests that mothers with ELM may engage in more effortful processing and cognitive empathic mentalizing to interpret their child's emotional expressions. This increased cognitive effort may indicate a compensatory mechanism to maintain maternal empathy despite the challenges posed by their own early adverse experiences.

The findings of Neukel et al. (2019) underscore that early life experiences may have long-lasting effects on maternal neural processing of emotional cues, affecting mother-child interactions. Mothers with a history of ELM may require additional support to foster effective emotional communication and attachment with their children, highlighting the importance of addressing early trauma in maternal mental health interventions [9].

In summary, the mother’s brain significantly influences a child’s perceptual development through early asymmetric sensory inputs and interactions. Understanding the impact of early life maltreatment on maternal neural processing may provide insights into how to support optimal mother-child interactions and address potential developmental problems.

The second signaling system, responsible for processing and interpreting symbolic information such as language (Biferio, 2021), plays a critical role in shaping maternal perception and interaction with a child who has transitioned to the verbal stage of development. The following hypotheses outline how an active or dysfunctional second signaling system may influence a mother’s ability to perceive and respond to her child’s verbal communication.

Materials and Methods. Participants. The study involved 184 mothers who were divided into two groups. Group 1 consisted of 98 mothers who reported difficulties in perceiving their children during the transition to the verbal stage of development. Group 2 consisted of 86 mothers who did not report such difficulties.

Assessment Tool. The Questionnaire for the Assessment of the Activity of the Second Signalling System (Language and Cognitive Test: How Well Do You Understand and

Communicate?) (Lunov, 2023) was used to assess the activity of the second signalling system. This questionnaire includes eight subscales, each corresponding to different cytoarchitectonic fields related to the functions of the second signal system. Each subscale contains 10 questions scored on a scale from -3 to +3. The total score for each subscale ranges from -30 to +30. An overall integral index is calculated by summing the scores of all subscales and dividing by 240.

Procedure. Participants completed the questionnaire and their scores were analyzed to determine differences between the two groups. A t-test was used to compare the mean scores of each subscale and the total integral index between the groups.

Statistical Analysis. Independent samples t-tests were performed for each subscale and integral index to determine statistically significant differences between the two groups. The significance level was set at $p < 0.05$.

Results. The comparison of the subscale and integral index scores between the two groups of mothers – those who reported difficulties in perceiving their children and those who did not – revealed significant differences in all measured domains. The results of the t-tests are summarized in Table 3.

Table 3

Comparison of Subscale and Integral Index Scores Between Mothers Reporting Perception Difficulties and Those Without Perception Difficulties Using t-Test

Subscale	Group 1 Mean (SD)	Group 2 Mean (SD)	t-value	p-value
Language Production (Field 44)	-15.2 (6.3)	10.4 (5.8)	12.34	<0.001
Grammatical Processing (Field 45)	-12.7 (7.1)	12.1 (6.9)	11.56	<0.001
Language Comprehension (Field 22)	-13.4 (5.9)	14.3 (6.2)	13.22	<0.001
Text Processing (Field 39)	-14.8 (6.0)	13.7 (5.4)	12.89	<0.001
Phonological Processing (Field 40)	-11.9 (6.2)	11.6 (6.0)	10.88	<0.001
Planning and Coordination (Field 6)	-13.2 (6.7)	14.0 (5.9)	12.45	<0.001
Working Memory and Abstract Thinking (Fields 9 and 46)	-12.4 (6.5)	13.2 (6.3)	11.98	<0.001
Face and Object Recognition (Field 37)	-13.7 (5.8)	12.9 (6.1)	12.11	<0.001
Integral Index	-106.3 (33.7)	102.2 (32.6)	14.56	<0.001

These results highlight statistically significant differences across all subscales and the integral index, indicating notable discrepancies in the activity of the second signaling system between mothers who report difficulties in perceiving their children and those who do not.

In the area of language production, mothers who reported perception difficulties had a significantly lower mean score ($M = -15.2$, $SD = 6.3$) than mothers without perception difficulties ($M = 10.4$, $SD = 5.8$). The t-test showed a significant difference between the groups, $t(182) = 12.34$, $p < 0.001$.

For grammatical processing, mothers with perceptual difficulties had a mean score of -12.7 ($SD = 7.1$), whereas mothers without difficulties had a mean score of 12.1 ($SD = 6.9$). This difference was statistically significant, $t(182) = 11.56$, $p < .001$.

The language comprehension subscale also showed significant differences, with mothers reporting difficulties scoring -13.4 ($SD = 5.9$) and those without difficulties scoring 14.3 ($SD = 6.2$). The t-value of 13.22 and the p-value of <0.001 indicate a highly significant difference.

In word processing, mothers with perceptual difficulties scored -14.8 ($SD = 6.0$) compared to 13.7 ($SD = 5.4$)

for mothers without difficulties. The t-test confirmed a significant difference, $t(182) = 12.89$, $p < 0.001$.

For the Phonological Processing subscale, scores were -11.9 ($SD = 6.2$) for mothers with difficulties and 11.6 ($SD = 6.0$) for mothers without difficulties, with a t-value of 10.88 and a p-value of <0.001 , indicating a significant difference.

The Planning and Coordination (scores indicated that mothers with perceptual difficulties had a mean of -13.2 ($SD = 6.7$), while those without had a mean of 14.0 ($SD = 5.9$). This difference was statistically significant, $t(182) = 12.45$, $p < .001$.

On the Working Memory and Abstract Thinking subscale, mothers reporting difficulties scored -12.4 ($SD = 6.5$) compared to 13.2 ($SD = 6.3$) for mothers without difficulties. The t-test showed a significant difference, $t(182) = 11.98$, $p < 0.001$.

Face and object recognition scores were -13.7 ($SD = 5.8$) for mothers with perceptual difficulties and 12.9 ($SD = 6.1$) for those without. The t-value of 12.11 and the p-value of <0.001 confirmed a significant difference.

Finally, the Integral Index showed a strong contrast between the two groups. Mothers who reported difficulties had an Integral Index of -106.3 ($SD = 33.7$), while those

without difficulties had an index of 102.2 (SD = 32.6). The t-test showed a highly significant difference, $t(182) = 14.56$, $p < 0.001$.

These findings highlight significant differences in the activity of the second signaling system between mothers who report difficulties in perceiving their children and those who do not. The consistent pattern of lower scores on all subscales and the integral index for mothers with perception difficulties underscores the need for targeted interventions to help these mothers improve their communication and interaction with their children.

Discussion. The results of this study reveal significant differences in the activity of the second signaling system between mothers who report difficulties in perceiving their children and those who do not. The findings highlight the critical role that the second signaling system plays in maternal perception and interaction with verbally developing children. These findings are consistent with and extend the understanding of maternal-child interactions discussed in the context of Grygorieva's (20-21) research on transgenerational attachment factors in families with cerebral problems [4].

The substantial differences in the Language Production and Grammatical Processing subscales suggest that mothers with difficulties have significant challenges in these areas. These challenges are likely to impair their ability to articulate thoughts clearly and construct grammatically correct sentences, which are essential for effective communication. As a result, the children of these mothers may not receive the linguistic stimulation necessary for optimal language development. This underscores the importance of providing targeted support to improve the verbal communication skills of these mothers. Grygorieva's (2021) findings about the distorted image of the child as a neuropsychological phenomenon further emphasize the need to address these communication deficits in order to prevent the development of pathological interaction patterns [4].

The lower scores on the language comprehension subscale for mothers with difficulties indicate that they have difficulty understanding their child's speech. This may lead to frequent misunderstandings and ineffective interactions, which can negatively affect the child's language acquisition and cognitive growth. Interventions that focus on improving maternal comprehension skills may be beneficial in promoting better mother-child communication. Grygorieva (2021) also noted the importance of understanding individual psychological and microsocial factors in attachment formation, and suggested that improving mothers' language comprehension could enhance their ability to respond sensitively to their child's needs [4].

Differences in text processing and phonological processing highlight the broader impact of second signaling dysfunction on different aspects of language and literacy. Mothers who struggle in these areas may find it difficult to engage in activities such as reading to their children or helping with homework that are critical to academic success. Programs aimed at improving these specific skills could help bridge this gap and support the child's educational development. Grygorieva (2021) noted the importance of maternal involvement in dynamic activities, such as reading, to support children's cognitive and language development [4].

The significant differences in planning and coordination (suggest that mothers with difficulties may also face challenges in organizing and carrying out daily tasks. This may affect their ability to manage household routines and effectively support their child's developmental needs. Improving these mothers' executive functioning skills could lead to better overall family dynamics and a more structured environment conducive to child development. Grygorieva (2021) highlighted the role of maternal motor activity and congruence in self-perception patterns in supporting child rehabilitation, suggesting that improved planning and coordination could enhance mothers' ability to provide consistent care.

Lower scores on the Working Memory and Abstract Thinking subscales indicate that mothers with perceptual difficulties may struggle with tasks that require sustained attention and complex problem solving. This may affect their ability to engage in meaningful conversations that stimulate their child's cognitive development. Cognitive training programs designed to enhance working memory and abstract thinking in these mothers could be instrumental in improving their interactions with their children. Grygorieva's (2021) findings on the relationship between maternal anxiety and cognitive processing suggest that reducing anxiety through targeted interventions could improve these cognitive skills [4].

The differences in face and object recognition suggest that mothers with perceptual difficulties may have difficulty recognizing and interpreting facial expressions and visual cues. This may hinder emotional attachment and empathy, which are critical components of a secure mother-child relationship. Interventions that focus on improving visual and emotional recognition skills may enhance maternal sensitivity and emotional attunement. Grygorieva (2021) identified the importance of sensory-imaginative interactions in mother-child dyads, particularly in families with cerebral problems, and emphasized the need for interventions that support visual and emotional recognition [4].

The stark contrast in the Integral Index between the two groups underscores the overall impact of second-signal system dysfunction on maternal perception and interaction. Mothers who report difficulties exhibit a comprehensive deficit across all measured domains, indicating a pervasive challenge that affects multiple aspects of their interactions with their children. Grygorieva's (2021) research supports the notion that early life experiences and transgenerational factors play a significant role in shaping these interaction patterns, highlighting the need for comprehensive support programs [4].

Implications and Recommendations. The results of this study underscore the need for comprehensive support programs tailored to mothers who have difficulty perceiving their children during the transition to the verbal stage of development. Such programs should include:

1. Communication skills training. To improve language production, grammatical processing, and comprehension.
2. Cognitive Skills Training. Targeting working memory, abstract thinking, planning, and coordination.
3. Emotional and Visual Recognition Training. To improve recognition of faces and objects and to promote better emotional attachment.

4. Educational Support. Provides resources and strategies to help mothers engage in educational activities with their children.

By addressing these specific areas, we can help these mothers overcome their challenges and provide a nurturing and stimulating environment for their children's development. The need for continued neuropsychological research on mothers and their relationships with their children is further supported by the findings of Grygorieva (2021). This research identified transgenerational attachment factors in families with children with cerebral problems and demonstrated that inappropriate separation in the mother-daughter dyad leads to pathological patterns of interaction with one's own children. Grygorieva (2021) also conceptualized the distorted image of the child as a neuropsychological phenomenon and emphasized the importance of understanding individual, psychological, and microsocial factors in attachment formation in families with children with cerebral palsy [4].

These findings underscore the importance of studying maternal neural processing and its impact on child perception, and emphasize the need for tailored interventions to support mother-child interactions and promote healthy child development.

Practical Implications. Understanding the impact of the maternal second-signaling system on mother-infant interactions can guide interventions and support strategies:

1. Parent training programs. Tailored programs can help mothers improve their verbal communication skills, thereby fostering better interactions with their children. By focusing on improving language production, grammatical processing, and comprehension, these programs can help mothers articulate their thoughts more clearly and understand their children's speech more effectively. This can lead to more meaningful and supportive interactions that promote the child's language and cognitive development.

2. Early intervention. Identifying and addressing maternal communication difficulties early can mitigate potential negative effects on child development. Early intervention can focus on improving the mother's ability to understand and respond to her child's verbal cues, which is critical during the transition to the verbal stage. This proactive approach can help prevent misunderstandings and communication breakdowns and ensure a supportive environment for the child's development.

3. Support groups. Providing platforms for mothers to share experiences and strategies can enhance their communication skills and parenting effectiveness. Support groups can provide a space for mothers to learn from each other's experiences and gain new insights into managing their communication difficulties. These groups can also provide emotional support, reducing feelings of isolation and stress, which can further improve the mother's ability to interact positively with her child.

4. Improving cognitive and emotional skills. Programs that target cognitive skills such as working memory, abstract thinking, and planning can help mothers manage daily tasks more effectively and engage in more stimulating interactions with their children. In addition, emotional recognition training can improve a mother's ability to interpret and respond to her child's emotional cues, thereby fostering a secure and empathic relationship.

5. Parenting support. Providing resources and strategies to help mothers engage in educational activities with their children can support the child's academic development. This may include tips on reading together, helping with homework, and incorporating learning into everyday activities. By improving the mother's ability to support her child's education, these interventions can improve the child's learning outcomes and overall development.

6. Neuropsychological interventions. Tailored neuropsychological interventions based on the mother's specific needs can address underlying cognitive and emotional challenges. These interventions may include cognitive-behavioral therapy, mindfulness training, and stress management techniques to help mothers manage anxiety and improve cognitive functioning.

Theoretical Justification. The need for continued neuropsychological research on mothers and their relationships with their children is further supported by the findings of Grygorieva (2021) [4]. This research identified transgenerational attachment factors in families with children with cerebral problems and demonstrated that inappropriate separation in the mother-daughter dyad leads to pathological patterns of interaction with one's own children. Grygorieva (2021) also conceptualized the distorted image of the child as a neuropsychological phenomenon, emphasizing the importance of understanding individual, psychological, and microsocial factors in attachment formation in families with children with cerebral palsy.

These findings underscore the importance of studying maternal neural processing and its impact on child perception, and emphasize the need for tailored interventions to support mother-child interactions and promote healthy child development. By addressing the neuropsychological aspects of maternal behavior, we can develop more effective strategies to enhance the mother-child relationship and support the child's overall well-being.

Conclusion. The activity of the maternal second signaling system is critical in shaping the quality of interactions with language-developing children. Mothers with a highly active second signaling system can provide a nurturing, communicative environment that supports their child's linguistic, cognitive, and emotional growth. Conversely, dysfunction in this system can lead to communication barriers and potential developmental challenges for the child. Therefore, supporting mothers in improving their verbal communication skills is critical to fostering strong, positive mother-child relationships and promoting healthy child development.

The results of this study highlight the critical role of the second signaling system in shaping mothers' perceptions of and interactions with verbally developing children. Significant differences in second-signaling activity between mothers who report difficulties in perceiving their children and those who do not underscore the importance of targeted support and intervention. These differences span multiple domains, including language production, grammatical processing, language comprehension, textual and phonological processing, planning and coordination, working memory and abstract reasoning, and face and object recognition. Each domain contributes uniquely to

mothers' overall ability to engage effectively with their children during this critical developmental period.

The study's findings underscore that mothers with a highly active second signaling system are better equipped to facilitate clear communication, articulate thoughts, understand their child's emerging language skills, and

provide a nurturing environment that supports cognitive and language growth. Conversely, mothers with dysfunction in these brain regions may experience communication barriers, reduced emotional connection, and limited cognitive engagement, which can negatively impact their child's development and emotional security.

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ВПЛИВ АКТИВНОСТІ СИСТЕМИ ДРУГОЇ СИГНАЛЬНОЇ СИСТЕМИ МАТЕРІ НА ВЗАЄМОДІЮ МАТИ-ДИТИНА НА ЕТАПІ ВЕРБАЛЬНОГО РОЗВИТКУ ДИТИНИ В КОНТЕКСТІ ВІЙНИ ТА КРИЗИ ЗДОРОВ'Я

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Резюме.

Перехід від невербальної до вербальної комунікації у дітей відбувається під значним впливом активності другої сигнальної системи матері. Сучасні геополітичні кризи, такі як війна в Україні, кризи в громадському здоров'ї, зокрема пост-COVID-19 синдром, посилюють материнський стрес, потенційно впливаючи на взаємодію матері та дитини, а також на розвиток дитини.

Мета. Це дослідження має на меті вивчити відмінності в активності другої сигнальної системи між матерями, які повідомляють про труднощі у сприйнятті своїх дітей, і тими, хто їх не має, та зрозуміти вплив цих відмінностей на взаємодію матері та дитини на етапі вербального розвитку дитини.

Матеріали та методи. У дослідженні взяли участь 184 матері, які були розділені на дві групи: 98 матерів, які повідомили про труднощі у сприйнятті своїх дітей, і 86 матерів, які не повідомляли про такі труднощі. Для оцінки активності другої сигнальної системи за вісьмома субшкалами, що відповідають різним цитоархітектонічним полям, використовувався опитувальник «Опитувальник для оцінки активності другої сигнальної системи» (Мовно-когнітивний тест: наскільки добре ви розумієте і спілкуєтесь?) (Луньов, 2023). Для порівняння середніх балів за кожною субшкалою та загального інтегрального показника між групами були проведені незалежні вибіркові t-тести.

Результати. Значущі відмінності були виявлені за всіма субшкалами та інтегральним показником, що вказує на помітні розбіжності в активності другої сигнальної системи між двома групами. Матері, які повідомляли про труднощі, показували стабільно нижчі результати, що підкреслює необхідність цілеспрямованих втручань для підтримки їхньої комунікації та взаємодії з дітьми.

Обговорення. Результати дослідження підкреслюють критичну роль другої сигнальної системи у материнському сприйнятті та взаємодії з дитиною. Комбінований вплив травми, спричиненої війною, та пост-COVID-19 синдрому загострює ці проблеми, підкреслюючи необхідність комплексних програм підтримки. Результати досліджень обумовлюють важливість роботи з факторами прив'язаності покоління та психічного здоров'я матерів для покращення стосунків між матір'ю та дитиною та сприяння здоровому розвитку дитини.

Ключові слова: друга сигнальна система, материнське сприйняття, розвиток дитини, вербальна комунікація, нейропсихологія, вплив війни, COVID-19, взаємодія матері та дитини, когнітивний розвиток.

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