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LURIAN NEUROPSYCHOLOGICAL SYNDROMES

Síndromes neuropsicológicos de A. R. Luria

Síndromes Neuropsicológicas de A. R. Luria

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Palabras Clave*: A. R. Luria, evaluación neuropsicológica, neuropsicología, síndrome, síntoma, conceptos.*

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A B S T R A C T

This article summarizes A. R. Luria's contributions to psychology and neuropsychology: we identify and explain his five essential concepts related to the neuropsychological syndromes (higher mental functions, functional system, neuropsychological factor, symptom and syndrome) and the neurological syndromes themselves, as well as characteristics that we can observe in clients as we go through each part of the Lurian neuropsychological assessment: Pre-Motor Syndrome (post-frontal - Kinetic Syndrome), Prefrontal Syndrome (Regulatory-Executive Syndrome), Mediobasal frontal syndrome (Neurodynamic Syndrome), Occipital or occipital-parietal syndrome (visual and spatial recognition disorder), Parietal Syndrome (kinesthetic and somatic-gnostic disorder), Temporal Syndrome (Acoustic and Phonemic Perception Disorder and Memory Disorder), TPO Syndrome (temporo-parieto-occipital), Memory Syndrome, Interhemispheric Interaction Disorder Syndrome or Corpus Colossus Syndrome and Language Syndrome. Rehabilitation is not to be done considering just one brain function at a time, but all of them together as a whole. According to J. M. Glozman, this is the practical value of A. R. Luria's entire syndromic analysis.

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R E S U M E N

Este artículo resume las contribuciones de A. R. Luria a la psicología y la neuropsicología. Identificamos y explicamos: sus cinco conceptos esenciales relacionados con los síndromes neuropsicológicos (funciones mentales superiores, sistema funcional, factor neuropsicológico, síntoma y síndrome) y los síndromes neurológicos en sí, así como las características que podemos observar en los clientes de cada uno de ellos. parte de la evaluación neuropsicológica de Luriana (Síndrome Premotor (Postfrontal - Síndrome Cinético), Síndrome Prefrontal (Síndrome Regulador-Ejecutivo), Síndrome Frontal Mediobasal (Síndrome Neurodinámico), Síndrome Occipital u Occipital-Parietal (Trastorno del Reconocimiento Visual y Espacial), Síndrome Parietal (trastorno cinestésico y somático-gnóstico), Síndrome Temporal (trastorno de percepción acústica y fonémica y trastorno de la memoria), Síndrome TPO (temporo-parieto-occipital), Síndrome de Memoria, Síndrome de Trastorno de Interacción Interhemisférica-Síndrome del Cuerpo Calloso y Síndrome de Lenguaje. La rehabilitación no debe hacerse considerando sólo una función cerebral a la vez, sino considerándolas todas juntas como un sistema. Según J. M. Glozman, éste es el valor práctico del análisis sindrómico completo de A. R. Luria.

R E S U M O

Este artigo resume as contribuições de A. R. Luria para a psicologia e a neuropsicologia. Identificamos e explicamos: seus cinco conceitos essenciais relacionados às síndromes neuropsicológicas (funções mentais superiores, sistema funcional, fator neuropsicológico, sintoma e síndrome) e as próprias síndromes neurológicas, bem como características que podemos observar nos clientes em cada parte da avaliação neuropsicológica Luriana (Síndrome Pré-Motora ou pós-frontal - Síndrome Cinética), Síndrome Pré-Frontal (Síndrome Regulatória-Executiva), Síndrome Frontal Mediobasal (Síndrome Neurodinâmica), Síndrome Occipital ou Occipital-parietal (transtorno de reconhecimento visual e espacial), Síndrome Parietal (transtorno cinestésico e somático-gnóstico), Síndrome Temporal (transtorno de percepção acústica e fonêmica e transtorno de memória), Síndrome TPO (temporo-parieto-occipital), Síndrome de Memória, Síndrome de Transtorno de Interação Inter-hemisférica ou Síndrome do Corpo Caloso e Síndrome da Linguagem. A reabilitação não deve ser feita considerando apenas uma função cerebral de cada vez, mas considerando todas juntas como um sistema. De acordo com J. M. Glozman, este é o valor prático da análise sindrômica completa de A. R. Luria.

In this article, we will briefly address A. R. Luria's contributions to psychology and neuropsychology: some of Lurian terminologies, the functional system, neuropsychological factor and the main neuropsychological syndromes.

Let's start by identifying A. R. Luria's contributions, as they were the reason why he became the most famous and cited neuropsychologist in the world. A. R. Luria's contributions are present in all areas of neuropsychology. According to J. M. Glozman (2012a), these are the major ones: human conflicts, the influence of social structure on psychological processes, developmental Neuropsychology, the role of speech in regulating normal and abnormal behavior and the increased neural activity in normal and abnormal children. A. R. Luria extensively studied neuropsychology and language and the differences between typical and atypical children. He also studied several higher mental functions such as: psychomotricity, language, memory and the perception area as well as the executive functions. Lastly, A. R. Luria liked to repeat that nothing is more practical than a good theory.

J. M. Glozman (2012a) identified some basic principles of the psychological study in A. R. Luria's perspective: how he dealt with the concrete personality of a human being, as a biological, social and psychological unit; the study of individual regularities, the uniquely determined sequences, combining a description of unique and individual processes with the study of regular and legal processes; the study of the individual human mind as a whole and the particular mental phenomena as functions, elements of this whole, developing in this concrete human personality, with the possibility of changing by transforming social conditions and the study of individual values of the examined psychological phenomena for the life of the current personality. A. R. Luria considered cognitive processes as coming from the complex interaction and interdependence of biological factors (individual mind), which are part of physical nature, and cultural factors, which emerge in the process of human history. In this way A. R. Luria and L. S. Vygotsky came together in the 1920s to understand the psychological processes (Luria, 1963/66, 1973).

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A. R. Luria and L. S. Vygotsky's principles of the analysis of the organization of psychological processes are the following: specify the relationship between elementary and higher forms of psychological activities and their cerebral organization in healthy adults; determine possible changes in psychological processes that may appear in different forms of brain damage, and those that may be expected in early abnormal ontogenetic development. The analysis goes from normal functioning to atypical functioning. The same principle applies for habilitation or rehabilitation.

Just as the properties of water cannot be discovered directly by knowing that water consists of two atoms of hydrogen and one of oxygen, the properties of a psychological process, such as voluntary attention, cannot be recovered directly by knowing how it works. Individual cells respond to new stimuli. In both cases, the properties of the "system" - water in one case, voluntary care in the other - must be understood as qualitatively different from the units that compose them.
(Luria, 1979, p.31).

Until the 1920s, discussions about neuropsychology revolved around whether to be localizationist, or right after, anti-localizationism. The idea was that the brain was equipotential and the whole brain could learn easily. All this was revisited during the Second World War by A. R. Luria. It was in a hospital in Russia, in Ural, that A. R. Luria described the areas of the brain (frontal, parietal, etc.) and this became known as A. R. Luria's Theory of the Systemic and Dynamic Organization of the brain. This theory was based on studies of right hemisphere functions and inter-hemispheric interactions as well as research on cerebral subcortical pathologies and studies of brain mechanisms in mental, neurotic and somatic diseases (Luria, 1973; Solovieva & Rojas, 2018).

The structure of mental activity and later its location in the brain became his focus of attention. His studies identified different syndromes and mental disorders, resulting in the neuropsychology of memory, neurolinguistics, diffuse syndromes after cerebral-vascular pathology; syndromes of underdevelopment or atypical development, heterogeneity in the maturation of brain structures and its connections which result in learning difficulties (i.e., developmental neuropsychology was born at this stage) and also mental dysfunctions in normal individuals in specific functional states or with some individual particularities in cognitive performances. These studies led to the development of the neuropsychology of individual differences, which uses neuropsychological concepts and methods to assess healthy individuals (Glozman, 2012a).

A. R. Luria identified five essential concepts related to the neuropsychological syndromes: higher mental functions, functional system, neuropsychological factor, symptom and syndrome. Let's start with higher mental functions which are complex processes of self-regulation. They are social in origin, their structure is mediated, and their functioning is conscious and voluntary. Each higher mental function is a functional system consisting of many components, each of which is based on the work of a special area of the brain and plays its special role in the system. A. R. Luria defines a functional system as follows: The presence of a constant (invariable) task, performed by variable (varying) mechanisms, bringing the process to a constant (invariable) result, is one of the basic characteristics that distinguish the work of each 'functional system'. The second distinguishing feature is the complex composition of the 'functional system', which always includes a series of afferent (adjusting) and efferent (effector) impulses. (Luria, 1973, p. 28).

We cannot find a location for this system, but we can identify its different components.

A neuropsychological factor is a structural and functional unit that has a psycho-physiological modus operandi, and neuropsychological factors in different parts of the brain have varying functions. Damage in a neuropsychological factor can cause disruptions in the development of a functional system, and this can lead to a neuropsychological syndrome. The emergence of a symptom is indicative of damage to a neuropsychological factor.

A person's behavior is organized by conditions in both the internal and external environment, and properties of spatial organization are necessary for many activities – to estimate distance, for movement, to solve constructive tasks, to understand the discharge structure of numbers, to evaluate the spatial differences of letters, for the representation of the scheme of our own body, and others. Properties of spatial organization can be seen in speech, such as in the words "above", "under", "right", "left"; and in comparative structures, inverted sentences and grammar cases ("father's brother"). Damage of the temporal-parietal-occipital area (TPO) may lead to impairments on operations with spatial oriented objects. On this basis, it is possible to infer that the TPO zone provides the mental activity factor of spatial and quasi-spatial analysis and synthesis (Korsakova, Moskovichiute, 1988).

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A syndrome is defined as a combined, complex impairment of mental functions due to damage of certain areas of the brain which leads to the removal of a particular factor from normal work. In particular, the above example follows that when the TPO zone is damaged there is impairment of the visual-spatial perception, speech, praxis, visual thinking, counting operations and other processes needed for spatial analysis and synthesis. (Korsakova & Moskovichiute, 1988).

A syndrome is a law-governed constellation of symptoms caused by a certain primary deficit (pathological factor). Symptoms can be primary, secondary and tertiary (compensatory). A syndrome is caused by impairment in one neuropsychological factor, which disturbs several psychological functions while preserving others (Solovieva, et al., 2021). Syndromes such as dyslexia are a set of pathological factors or a component of these cause a disturbance of several factors in the functional reading and writing systems. Syndrome analysis (factor analysis) is an analysis of observed symptoms with the aim of finding a common basis (factor) that explains their origin. It assumes a gradual procedure, a qualitative estimation of the symptoms. This explains why the patient cannot read or perform motor actions. Let us give an example of the functional system of reading:

Neuropsychological investigation should not be limited to a simple statement that one or another form of mental activity is affected. The investigation must be a qualitative (structural) analysis of the symptom under study, specifying the observed defect and the factors that cause it. (Luria, 1969, p. 306).

J. M. Glozman (2012a; 2012b) describes the important aim of the assessment to be revealing the patient's strengths, the preserved components in the disturbed functional system and the preserved forms of the patient's activity to be used in the reconstruction of this functional system. Up-to-date interpretation of neuropsychological syndromes requires qualitative and quantitative integration of A. R. Luria's procedures. There is the product dimension, that is, the level of performance in a task (accuracy, time, number of errors, and so on) with reference to some expected (normative) level of performance. And there is the process dimension, that is, the means by which the interpreter achieves the product or level of help needed or stimulation. A. R. Luria's approach is primarily based on this second point. This does not mean that he ignored the size of the product.

A. R. Luria developed his approach to neuropsychological assessment through the local diagnosis of brain damage. This approach remains very relevant and current for some cases of epilepsy, neurosurgery or traumatic cases. An important part of A. R. Luria's assessment is a differential diagnosis between organic and psychological etiologies of disorders. A. R. Luria's assessment includes an interpretation of cognitive activity as functional systems, an individualized approach and an emphasis on the analysis of errors (Ardila, 1992). The main task of neuropsychological assessment, especially for children, is a comprehensive description of impairments (underdevelopment) of higher mental functions and the identification of factors underlying these impairments. This is to answer why the person cannot do a certain task. Development of treatment plans and strategies for enabling cognitive disorders or underdevelopment. It is not ethically correct to diagnose without proposing a treatment plan. Evaluation of the results of different types of treatment: surgical, pharmacological, neuropsychological and others. This part can only have quantitative results, so that we can determine the effectiveness of treatments. Determining the best treatment methods for different cases. Prognosis of evolution or involution of cognitive functioning and strategies are the main tasks of neuropsychology to help that individual.

SYNDROMES

In this part of the article, the syndromes themselves will be discussed. For each syndrome we will describe the characteristics that we can observe in clients as we go through each part of the Lurian neuropsychological assessment. The first 3 syndromes we will discuss are localized in the frontal region of the brain. Then we will present the neuropsychological syndromes in the posterior part of the brain.

Pre-Motor (post-frontal) Syndrome (Kinetic Syndrome)

The **Pre-Motor (post-frontal) Syndrome (Kinetic Syndrome)** includes efferent motor aphasia, agraphia and difficulty with organization, which causes the affected person to repeat and persevere. This form of aphasia is caused by damage to the secondary cortex area in the low part of the premotor zone of the left dominant (in right-handed) hemisphere of the brain. When functioning normally, this area of the brain provides a smooth switch of one oral or articulation act to another. We do not speak spelling out the letters (for example, w, i, n, d, o, w), it is necessary that they merge in consecutive rows (to become

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the word “window”), which L. S. Vygotsky called “successive” (consistent), and A. R. Luria called “kinetic melodies” (Viesel, 2009). In efferent motor aphasia, the reproduction of smooth speech suffers due to the pathological inertness of articulation acts. The patient can easily say letters or sounds separately but has great difficulties in reading or pronouncing the syllables, words or phrases entirely. A typical example is P. Broca’s patient known as Ta-Ta-Ta because he couldn’t say anything else but Ta-Ta and couldn’t move from this syllable to the next. This is an example of this kinetic factor in speech. These defects of the pronunciation aspect of speech cause systemic disorders in other aspects of speech function: reading, writing and partly understanding of speech. Dynamic apraxia is the basis of speech defect, and this is expressed as the difficulties of assimilation and reproduction of the motor program (for example, in a given sequence of poses “fist-side-palm”). Reproduction of the set series of poses is expressed with “stucks” or perseverations or when the client fails to do the 3 movements of this test doing just 2 movements. They can also appear in the dynamic graphic test, when the client cannot move from the triangle to the square and that’s why for transition the client rather often uses the “platforms” (fig.1).

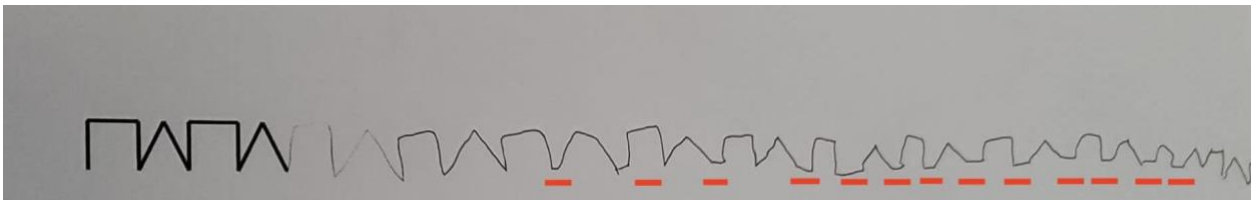

Figure 1. Example of performing a graphic test of a child with kinetic difficulties. Boy, 9 years old.

In dynamic aphasia there is a brain damage in the postfrontal zone of the left hemisphere, located in the front of the Broca’s zone at the level of the tertiary cortex areas. This form of aphasia was first described by A. R. Luria (Viesel, 2009), and then actively developed in studies conducted by T. V. Akhutina (Akhutina, 2012). A patient with this type of aphasia understands speech, can name objects, but cannot independently build a detailed statement (Akhutina, 2012). Damage leads to loss of speech initiative (table 1).

Table 1:

Features of expressive speech of patients with dynamic aphasia

Spontaneous Speech	Absent
Repetition Speech (echolalia) Dialogue Speech Automated Speech Deutomatized Speec Naming	Available
Telling a Story According to Topic/Description of the Picture	Not available

For patients with dynamic aphasia, spontaneous speech is absent, and they are unable to tell a story based on a topic or provide a description for a picture. Only the following forms of speech are available to them: repetition (echolalia), dialogue speech, automated speech, dearomatized speech and naming.

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In this syndrome, there is a use of truncated phrases, patterns, stereotypes in speech, missing verbs, complex adjectives, pronouns, and prepositions. Dynamic aphasia can be diagnosed by asking the patient to tell the story of a picture or a set of pictures, of any given topic or to interpret the meaning of a text. The patient also loses verbal fluency and cannot name objects and struggles with tasks such as naming 5 red objects or 5 animals that live in the north. The patient is unable to write on his own, spontaneously having only the ability to write isolated words, to copy a text or from dictation.

Inertia in cognitive functioning or perseverations is when the client perceives an object and even though he knows what it is, he cannot make the transition from the last object he named to the one right in front of him and persists in calling the new object by the old object's name. The patient's motor memory is impaired. For example, I hold up glasses and ask what is this? The client replies that these are glasses. The client cannot name the element. After a while I ask about a cup and the client keeps talking about the glasses. This syndrome stems from one factor, and it can manifest itself in different cognitive functions.

This syndrome is observed in Luria's assessment in the following aspects/functions: The person usually exhibits obsessions, and their praxis includes pathological inertia (perseveration of movements), non-automated movements (spasms) in dynamic praxis, stereotypies in dynamic praxis, disturbance in visual-motor coordination (dissimulation: different size of elements) in graphic dynamic praxis, extra impulses in asymmetrical tapping and/or reproduction of rhythmic structures, presence of synkinesis and perseverations in the movement system.

In terms of language, alterations in fluency ("truncated" speech), perseveration in naming, absence of reproduction of the sequence of elements, perseveration in repetition, absence of reproduction of the sequence of elements and inertia of associative processes (repetitions, stereotyped combinations of words). For memory, there is usually contamination of groups of stimuli (reproduction of words that are not part of the test), Difficulties in retaining the sequence (serial organization) of stimuli and perseveration (vertical and horizontal repetitions) of elements. Reasoning is altered by a perseveration in calculation and inertia in solving generalization tasks.

Prefrontal Syndrome (Regulatory-Executive Syndrome)

The **Prefrontal Syndrome (Regulatory-Executive Syndrome**). Prefrontal convexital cortex of a brain forms "front associative complex" of cortical zones characterized by a large complexity of functions, among which the main ones (according to A. R. Luria) are the functions of "programming and control" under complex forms of mental activity. These cortex zones of large hemispheres are included in the third structural and functional block of the brain (according to A. R. Luria). Damage of these brain structures leads to a violation of factors of "associative type", providing complex forms of integrative and regulatory activity of the brain. Violation of higher forms of regulatory processes, voluntary regulation of mental activity, is reflected on a wide spectrum of mental functions - from motor to intellectual. It also leads to regulatory violations of the emotional and personal spheres (Homskaya, 2005).

Patients with this syndrome have the following characteristics tend to not have active complaints: the client is not aware of his difficulties, such as a child who says that it's okay that he got bad grades in school. There is a loss of critical attitude towards one's own mistakes. One of A. R. Luria's disciples gave the following example: You ask a patient: "Is this wrong?" The patient answers without emotions: "It probably is, but mistakes happen."

Patients may exhibit dependent behavior such as difficulty in paying attention, especially in children who are more easily distracted. Such children have trouble focusing, get tired quickly at school, and have short attention spans. They often skip letters when writing, especially at the end of words. They tend to have extremely poor speech production and have underdeveloped syntax and use of art tools. The main pathological factor in this case is deficits in voluntary attention, verbal self-regulation, programming, goal setting and control over the flow of one's own activities.

Behavioral and intentionality commitments may also be impacted. Behavior of such patients is subservient to stereotypes, stamps and sometimes can be interpreted as a phenomenon of "uncontrolled chaotic behavior". In children, "uncontrolled chaotic behaviors" may present as the child seizing everything that the hand can find, taking things without permission, including from the table of the psychologist or doctor, jumping up in the middle of conversation and running somewhere to take something, not obeying the adult and norms of behavior in a public place and so on (fig.2). Affected children need support to start tasks and also with external organization.

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Figure 2. The office after the primary neuropsychological assessment with the child with "uncontrolled chaotic behavior". Boy, 8 years old.

This syndrome is related to impaired voluntary regulation of behavior (ADHD syndrome). An affected child might interrupt teachers and classmates while they are talking. Children affected by this syndrome are not naughty or rude, their behavior is out of their control. Impulsive reactions (disinhibition of immediate responses) are present in speech, motor functions, reasoning, and in Gnostic functions. Impulsive reaction needs to be present in all functions in order to meet criteria for this syndrome. For example, in the HEAD test, where the examinee has to do some postures imitating the examinator, the examinator will make a move for the examinee to repeat but the examinee does not do the correct move and realizes his mistake and quickly corrects himself, this is considered a self-correction. Secondary disturbances of this syndrome are related to apraxia, aphasia, and agnosia.

A. R. Luria states that the person who has this syndrome does poorly in all the tests but has the possibility of improving. The involvement of external supports, primarily organizing activities by an adult, should be the basis for psychological work with children, in order to facilitate the formation of their internal algorithm of functioning in a new social reality. Similarly, the main method of executive functions rehabilitation of adults is to create conditions in cooperative activity of the psychologist and patient, allowing the patient to make an action plan with support of the psychologist.

The person is generally aggressive, restless and may have other disruptive behavior; presents with negativism (refusing to do the exercise), reasoning (speech in defense of an idea), disturbance in estimating distances, hyperactivity, general excitement, puerility, stereotyped movements, absence of active complaints and absence (decreased) concern about one's own shortcomings, euphoria. The praxis includes simplification of the dynamic praxis program, macrography in graphic dynamic praxis, Impulsivity (echo movements with self-correction) in the Head Test, digital praxis, and constructive praxis. Impulsivity in gnostic tests may be observed, as well as pseudo agnosia (difficulties in controlling and paying attention to perception), disturbances in perception selectivity and tactile inactivity. In terms of language, there is usually guess reading, impulsivity in oral tests and ramblings. Alterations in memory may include confabulation (inclusion of elements not presented, semantic substitutions (by word that has similar meaning) and perceptual substitutions (by a visually similar image). Reasoning may be altered by impulsivity in analyzing a figure or a story, impulsivity in calculation and in solving an exercise, inability to develop a plan to solve an exercise and impulsive resolution of generalization tasks.

Mediobasal frontal syndrome (Neurodynamic Syndrome)

The next syndrome is **the Mediobasal frontal syndrome (Neurodynamic Syndrome).** The damage of mediobasal departments of the frontal lobe cortex leads to the disturbances of modal-nonspecific factors (e.g. activation-inactivation factor). The syndrome of frontal lobe mediobasal areas impairment is not accompanied by disturbances of higher motor functions. In this category of patients there are no motor perseverations in either manual or speech areas, as well as in primary gnosis disorders. The central sign that characterizes this syndrome is changes in the condition of brain activation, consciousness and emotional processes. These patients are generally characterized by a decrease in the level of brain activation, quick exhaustion, and fluctuations in the general functional condition. They find different signs of consciousness disorders in the

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form of wrong orientation in place, time and in themselves (Homskaya, 2005). Slowness to initiate activity and fluctuation of attention and activity; bradymnesia (slow memory), difficulties with orientation in time and space; decreased selectivity (for example confusing the numbers 21 and 12); modal nonspecific memory defects (all memory functions are affected) are specific for the syndrome. It is different from the kinetic syndrome in which only the motor part of the memory is affected. It also includes micrographia in handwriting and dynamic praxis graphic test, exhaustibility, bradyphrenia related to slow thinking and bradylalia which concerns slow speech.

General characteristics of the person include emotional numbness and indifference. For praxis, exhaustion (micrographia) in graphic dynamic praxis test and difficulty starting the exercise (loss of motor initiative) may be observed. Alterations in language use may include micrographia in writing, loss of initiative in speech, delay in starting the activity, difficulty in understanding and slowness of speech activity (in associative processes). Memory is usually affected by fluctuations, extenuation (instability) of memory activity before memorizing 10 words and difficulty starting memorization (low level after the first presentation). In terms of reasoning, the person may show loss of spontaneity in intellectual pursuits (need for external stimulation). Affected neurodynamic aspects include: decreased intellectual work capacity, fluctuations in intellectual work capacity, fatigue, bradyphrenia, bradymnesia, fluctuation in memory activity, bradylalia, slowing of hand folding movements, attenuation phenomenon (decrease in the number of movements in the second half of the exercise in compared to the initial half), decreased speed of graphic activity, decreased speed of hand movements and loss of spontaneity (difficulty starting the exercise).

Now we are going to discuss the neuropsychological syndromes in lesions of posterior brain regions.

Occipital or occipital-parietal syndrome (visual and spatial recognition disorder).

The basis of these syndromes is the disturbances of modal-specific visual and visual-spatial factors associated with the impairment of secondary cortical fields of the visual analyzer and adjacent departments of the parietal cortex. I. M. Sechenov described these disorders as disturbances of the simultaneous principle of brain activity (Homskaya, 2005).

Defects in this syndrome

- Visual agnosia (Object - inability to recognize the real objects. 2. Literal - inability to recognize the letters, sometimes the patient knows what letter is shown but does not know how to write it. 3. Simultaneous - inability to make interrelationships with the object. 4. Colors – inability to recognize colors. 5. Facial – inability to recognize people's faces. 6. Optic-spatial – example: visual impairment of perceptual activity).

- Disturbances of visual memory, visual attention, ignoring (more often left) part of space. Disturbances of optical-spatial analysis and synthesis: difficulties in orientation in external visual space. Visual and spatial disturbances can be manifested in the motor sphere as well. In these cases, there is a difficulty in spatial organization of motor acts, which violates the posture praxis, and spatial (constructive) motor apraxia appears.

- Independent group of symptoms due to damage of the occipital-parietal areas of the cortex constitute disturbances of speech functions in the form of optic-mnestic aphasia ("amnestic aphasia" — using the terminology of many authors). This form of speech disorders consists in a disturbance of visual representations, which makes it difficult to recall words denoting specific objects.

General characteristics of the person include disturbance in the orientation of time and disturbances in the orientation in the space around you. For gnoses the following may be observed: primary material agnosia, fragmentation of perception (identification of a fragment as the whole object), neglect of one side of the visual space, disturbances in simultaneous syntheses in perception and errors in the perception of spatial characteristics of visual stimuli.

In terms of praxis, difficulty in spatial organization of movements and actions: spatial search, mirror movements (errors) and spatial distortion (in dynamic praxis, Head Test, cubes, digital praxis, constructive praxis and drawing) may be observed. Disturbances in understanding logical-grammatical relationships may be present in the client's use of language.

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TPO (temporo-parieto-occipital)

The **TPO (temporo-parieto-occipital) Syndrome** – (Polymodal disorders of spatial analysis and synthesis). This syndrome is based on disturbances of more complex - integrative ("associative") - factors related to the work of the tertiary fields of the cortex. These factors also provide a simultaneous analysis and synthesis of information, but at a higher - above modal - level, which A. R. Luria defined as the level of "quasi-space" relations. At the same time, in the damage of the TPO zone, spatial analysis and synthesis is often impaired.

This syndrome has the following symptoms:
- Primary acalculia. Such patients have difficulties to perform simple math operations (addition, subtraction), they also have difficulties moving from one category of number to another. They have difficulty in recognizing numbers. The affected person confuses the quantity, for example saying 109 instead of 1009. The affected person might also have difficulty knowing which number is higher, for example confusing the order of 99 or 101.

- Semantic aphasia refers to the ability to understand simple sentences. Some examples are the understanding of speech structures describing real spatial relationships (draw a triangle on the "right", "left", of a cross or "above", "under" the cross). Another example is disturbed logical-grammatical structures when the patient needs to evaluate spatial relations.

- Spatial apractoagnosis, disturbances in gnosis and praxis.
Deficits in reasoning may include inability to understand the meaning of a thematic illustration, slowness, need for tips, inability to understand the meaning of a story, slowed understanding with external help, primary acalculia, non-automatized calculations and difficulty in generalization processes.

Parietal Syndrome (kinesthetic and somatic-gnostic disorder

The **Parietal Syndrome (kinesthetic and somatic-gnostic disorder).** "Parietal" syndromes are associated with the damage of secondary cortical fields of the skin-kinesthetic analyzer, as well as tertiary parietal fields. In neuropsychology there are two main types of syndromes of the parietal area of the brain: inferior-parietal and superior-parietal.

1. Inferior-parietal syndrome. The gnostic tactile disorders, which are included in this syndrome and known in neuropsychology like tactile agnosia were deeply studied. These disorders are manifested in the form of disturbances related to the identification of objects when touched without eye contact (astereognosis). Another form of gnostic disorders included in this syndrome is finger agnosia (or Gerstmann syndrome) - the inability of the patient to identify his/her own fingers with closed eyes. There is also a disturbance of the possibility of identification of numbers and letters "written" on the skin (tactile alexia). Another disturbance associated to the inferior-parietal symptoms of the left hemisphere (in the righthanded) is related to speech defects in the form of afferent motor aphasia, as well as other complex motor disorders - disturbances of voluntary movements and actions according to the type of kinesthetic apraxia.

2. In superior-parietal syndrome, gnostic disturbances are manifested in the form of false somatic images or sensations - feelings of "alien" hand, several limbs, reduction or increasing of body parts (somatoparagnosis). In the right-impairments of the parietal area of the cortex, the defects are often not perceived by the patients at all – this is a symptom, which is called anosogonosia. The gnostic parietal symptoms also include a disturbance of the "body scheme" (somatoagnosia) - a disorder of the recognition of the parts of the body.

For the praxis there are usually errors in the somatic location of movement in the Head Test, kinesthetic disturbances (motor clumsiness) in digital praxis and oral praxis. In terms of gnoses, decreased superficial cutaneous sensitivity in the hand, negligence of one side in tactile perception and astereognosis.

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Temporal Syndrome (Acoustic and Phonemic Perception Disorder and Memory Disorder)

The **Temporal Syndrome (Acoustic and Phonemic Perception Disorder and Memory Disorder)**. Convexital temporal neuropsychological syndromes clearly differ depending on the side of the damage due to clear lateralization of brain mechanisms of speech functions.

While studying the syndromes of damages of the temporal areas of the left hemisphere cortex, A. R. Luria identified a syndrome connected to the damage of the T1 zone ("nuclear zone" of the auditory analyzer cortex), which is based on the disorder of phonematic hearing, and the syndrome associated with the damage of the T2 zone (areas located on the border of the temporal and parietal-occipital cortex), related to auditory memory.

When the T1 zone of left hemisphere (in the righthanded) is damaged, the primary symptom is a phonematic hearing impairment resulting in speech disorder (sensory aphasia). These disturbances do not usually affect non-speech and musical hearing, as well as other forms of gnostic activity. Due to the disturbances of phonematic hearing, a whole complex of speech functions is disintegrated: writing (especially under dictation), reading, and active speech. This disturbance affects the meaning structure. This leads to the "alienation of the meaning of words" and secondary violations of intellectual activity related to instability of speech semantics.

The damage of the T2 area of the left hemisphere leads to impairment of auditory memory, which is manifested in the form of acoustic-mnestic aphasia. Patients can repeat the individual sounds of speech and individual words correctly, but have difficulties when repeating a series of words (even three or four).

The basis of disturbances in the damage of the temporal areas of the right hemisphere are disturbances of non-speech and musical hearing, as well as non-speech sound memory and musical memory. In these cases, the patient is unable to determine the value of different sounds and noises of daily life (auditory agnosia) or can't recognize and reproduce familiar melodies (amusia).

Gnoses show auditory agnosia, deficits in auditory attention and reduced auditory perception. Omissions in auditory perception may be observed in language, and the memory may be affected by sound replacements (for similar sounding word).

Memory Syndrome

Also, part of the Temporal Syndrome is the Memory Syndrome which includes Errors in the reproduction of the anamnesis of the disease and biographical data and confabulations (inclusion of themes unrelated to the questions). Changes in praxis can be observed as difficulty in assimilating the motor program and difficulty in memorizing instructions in response selection. Memory is affected by a decrease in the memorization of words during the learning process, unstable memorization and difficulty in memorization of movements. Changes in reasoning may include forgetting an intermediate result during an arithmetic operation.

Interhemispheric Interaction Disorder Syndrome-Corpus Colossus Syndrome
(Interhemispheric coordination syndrome)

The **Interhemispheric Interaction Disorder Syndrome-Corpus Colossus Syndrome**
(Interhemispheric coordination syndrome), which wasn't described by A. R. Luria, includes: tension, slowed reciprocal coordination; failures in case of acceleration in reciprocal coordination; alternating or symmetrical execution in asymmetrical beat and/or reciprocal coordination; one-hand delay in reciprocal coordination and/or asymmetric tapping; specific designs and dyslexia (analytical reading).This type of drawing is only difficult for people who have this syndrome including the Table design. – tridimensional design.

Changes in praxis include tension, slowed reciprocal coordination, failures in case of acceleration in reciprocal coordination, alternating or symmetrical execution in asymmetrical beat and/or reciprocal coordination and delay of one hand in reciprocal coordination and/or asymmetrical beat.

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Language Syndrome

At last, we could not forget to mention the **Language Syndrome** composed of Language and Reasoning symptoms:

Language: 1. Disorders in prosody (fuzzy, slurred speech, etc.): undeveloped speech, impoverished speech, difficulties in grammatical structuring, difficulty in serial speech, evocation of names, paraphasia in naming and spontaneous speech, paragraphia, paralexia. 2. Disorders in the speech test comprehension: linking words to images, misunderstanding of the meaning of words involving phonetic changes and semantic changes. 3. Disorders in the repetition of words and phrases: phonetic changes, semantic changes and limited vocabulary.

Reasoning: Generalized word difficulty in the concept exclusion test.

CONCLUSION

Rehabilitation is not to be done considering just one brain function at a time, but all of them together as a whole. For example, in agraphia is related to the mirror effect that is present in the spatial disorder's syndrome, and we must carry out rehabilitation in spatial representations present in all mental functions, such as praxis, language and others, and not just rehabilitate writing. Complex rehabilitation is much more efficient. According to J. M. Glozman, this is the practical value of Luria's entire syndromic analysis.

Finally, we will end with a quote from L. S. Vygotsky:

> *The basic characteristic of human behavior in general is that humans personally influence their relationships with the environment and, through the environment, personally change their behavior, bringing it under their control.*
>
> (Vygotsky, 1978, p. 51).

The Vygotsky-Luria approach is a scientific phenomenon, whose value cannot be limited by the achievements made by the authors themselves but opens the potential for development in new branches and directions.

Our article is dedicated in memoriam to this very generous and wonderful woman who contributed a lot to modern developmental neuropsychology Dr. Janna M. Glozman, our co-author. This important and fantastic woman led us through the trails of Lurian Neuropsychology. We are very grateful for all her wonderful and generous teachings and in this article, which she wrote together with us, we aim to express all this gratitude and describe her extensive knowledge about the Lurian neuropsychological syndromes.

Thank you, Dr. Janna M. Glozman, for all the teachings and profound updates to the systemic and dynamic system your teacher developed. As you were to Luria, a deep and loving follower we want to be to you! You left a legacy to the world, by updating Luria's assessment for children and preschoolers.

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