



## Language and Speech Functional System under Development Pathologies (Mental Retardation)

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### Abstract:

This paper is devoted to the problem of developmental speech disorders among mentally retarded children. The solution of the problem is impossible without the study of all aspects of language and speech development. The psycholinguistic approach was taken as the basis, which, in author's opinion, reveals peculiarities of learning sign-speech system as fundamental.

The author of the article briefly characterized the psycholinguistic aspect of language and speech functional system (LSFS) in general and levels of semiotic subsystem in particular. LSFS is the highest sign level of communication and speech skills complex that ensures the formation of language units, learning and the use of conventional set of rules as well as their application in the process of speaking.

## 1. Introduction

Human speech develops under certain psychological and social preconditions

Theoretical approach to the problem of physiological and psychological preconditions of speech development is based on the concept of children's speech development patterns, which have been identified in the works of Бельтюков (1977), Выготский (1996), Гвоздев (1961), Эльконин (1989), Леонтьев (2010), Лурия (1979), Ушаков (1973), Шеремет (2013) and others. According to scholars, speech formation nature is as follows: children's speech is being initially developed as the result of adults' speech perception by kids, and their own speech activities; secondly, children's orientation in speech activities creates the background for speech self-development; finally, the formation of children's language generalizations and basic understanding of the speech phenomena play the leading role in their speech development (Шеремет, 2013).

Жинкин (1958) has defined speech as a language application process, which has been created by efforts of many people, serves the humanity and is its heritage (Соботович, 2004).

## 2. Purpose and Metodology

In psycholinguistics, speech is considered to be a form of human activity. In this regard, the process of a language acquisition has been identified as the language signs' application. Moreover, linguistic signs are understood as both material and ideational units (bilateral education, representing an object, a quality, a relation, or reality) (Уфимцева, 1974).



Bilateral trait of a linguistic sign is represented by: a) external, material, sound characteristics; b) internal, ideational, semantic features. Thus, a language acquisition is the process of both audio (material) and semantic (meaningful) language features and relevant combinatory laws' application mastering (Тищенко, 2006).

One of the major problems in modern speech therapy is the identification and correction of speech development for children with mental and (or) physical retardation. Thus, not only children's physical development, but also their cognitive skills formation and self-identification depend on remedial work carried out in due course, including the causes that give rise to speech disorders elimination.

Considering the speech activity phenomenon research carried out by different fields' experts: physiologists, psychologists, speech therapists, linguists, psycholinguists, neurophysiologists; in the frames of the article, we are covering the psycholinguistic aspect as the most up-to-date and under investigated one.

### 3. Literature review

According to scholars, the psycholinguistic nature of speech activity organization is based on the process of speech utterance and text comprehension, which is being performed by psychological mechanisms. These include: the mechanism of orientation in situational context and language; the language forecasting mechanism in texts perception (the mechanism of apperception): a formation of a hypotheses about a statement's possible content; the mechanism of gaps between definitions fulfilment, made by a person on the basis of statements and texts available in his or her imagination, knowledge, life experience; the statements and texts conversion mechanism through the application of individual images, concepts, and speech tools by a person, based on: a) relevant concepts' range actualization; b) language grammatical rules orientation; c) establishment of deep semantic correlation between words and phrases' meanings; the mechanism for an expression or text's meaning deduction (Леонтьев, 2010).

As it has been mentioned above, the speech and language development is an integral part of mental ontogenesis. The language structure itself is closely related to the structure of basic mental processes and behavior. According to Bruner "...a language structure corresponds fairly accurately to psychic phenomena and processes, which it has to encode" (Брунер, 1984). According to the author, this feature provides different languages with grammatical similarities, which serve as the background for a number of universal principles of different languages' grammar systems.

The set of linguistic units, their combinatory rules for statements design, physiological mechanisms for statements application as a speech form are pieces of relevant functional self-organized system. Considering the above mentioned components and their problems, which should be solved, this system, according to Корнев (2006), can be named as the language and speech functional system (LSFS). It creates basic psychophysiological foundation for communication and speech activity. A general problem and its result, utterances generated in verbal communication process, act as the LSFS forming factors. Similar to many other functional systems, LSFS includes a number of subsystems, which, in their turn, may have individual subsystems (of second level). Each subsystem has a certain specialization, as well as some autonomous operations, both in functioning and the development processes.

The concept of language and speech functional system has been offered by A. Корнев as a relevant model, which ensures the integration of experimental data and theories, gathered in various scientific disciplines. It was developed on the basis of HNA physiology (Highest Neuro Activity functional system theory Анохин, 1975), psycholinguistics (speech activity theory by Леонтьев (2010) speech formation model by Леонтьев and Ахутина), neuropsychology (theories and models by Лурия (1979) about structural and functional organization of brain as mental activity subject).

LSFS model can be visualized as the one including three major subsystems: semiotic, programming, speech acts interpreting and regulatory (Корнев, 2006). The following investigates each of the subsystems.

Semiotic language subsystem within LSFS is the highest level of symbolic communicative language skills set (Бернштейн, 1990), and ensures speech units' formation, acquisition and incorporation of the conventional set of rules for statements generation application. In linguistics, the following levels of subsystems' (language levels) are available: phonemic (phonological), lexical, syntactic, morphological.



The phonological subsystem language analysis conducted by Соботович (2004), unveiled for scholars the notion of language competence phonological component. According to the author, it involves fluency in the following practical language skills:

- 1) generalized language phonemes;
- 2) words' sound images (words' phonemic composition with sequence of phonemes in it);
- 3) paradigmatic organization of phonemes according to their distinctive features.

The mentioned material covered, the results may allow children to self-identify their linguistic deviations from language norms in the case of wrong word pronunciation or content reproduction.

Mentioned skills acquisition takes place during children's mental formation as the result of the following important actions:

- dismemberment of sample speech flow into rhythmic intonation segments and individual semantic structures recognition under definite characteristics;
- acoustic analysis of word's audio structure;
- constant and applicable phonemic features' selection and group identification;
- differentiation and memorizing of words according to their phonemic content;
- recognition of words in the speech between interlocutors;
- establishing connections among a word, its sound and relevant objects and phenomena, they refer to (Соботович, 2004).

The notion of generalization lies at the root of lexical meaning. In a language, there may be no name for an object, phenomenon, feature, but there are names for each correspondent class and group. Thus, a lexical meaning of a word is a generic imprint of homogeneous objects, actions, events, qualities.

The highest degree for words lexical meaning generalization is the abstract (categorical) meaning of a part of speech.

The five types (categories) of abstract lexical meanings have been identified: object, number, action, object's modifier and action's modifier.

As numerous psychological and psycholinguistic researches show, the semantic word structure studies are currently passing a complicated stage of their development, – from word objective relation formation and its meaning perception to generalized lexical meaning of verbal concepts (Брунер, 1984; Выготский, 1996; Леонтьев, 1997; Шахнарович, 1990 and others).

The lexical level formation indicators of language subsystems are as follows:

- varied levels of word generalized meaning completion: correlation of words (their audio image) both as separate individual objects and those with a whole class of similar features; children's mastering of word meaning itself or its meaning in specific situations in speech communication patterns; word semantic features classification that is applicable in all situations it is used in, and assimilation of relevant lexical systematic background; lexical word meaning mastering by application of its permanent invariant features in varied ways; consequently, word semantic structure spread (different types of word portable meaning studying, as well as the range of its synonyms); abstract and generalized word lexical meaning mastering;
- semantic relationships between words establishing: situational connections; syntagmatic connections; paradigmatic connections; conceptual, logical connections;
- semantic (lexical) language units mastering approaches: by relating objects, their features and qualities with their verbal forms; based on perception of human speech and its general understanding, initial visual perception of a situation, and then without such a support, based on detailed speech, namely the current comprehensive system of verbal connections in children's minds, who are cumulating and synthesizing different meanings of the same word; practical classification of words by semantic features varying in degrees of their generalization;
- grammatical component of speech activity mastering (the practical knowledge of grammar, which should be understood by a native speaker and be the tool to produce various complexity expressions (phrases and sentences), psychological operations (mechanisms) to ensure their mastering).

According to the definition by Корнев (2006), the other system's level is a subsystem of statements programming, speech acts interpretation and their implementation process control and relevant decoding, which provides a transition from one system to other codes. In fact, the process of this subsystem's functioning is the main component of numerous speech generating models, represented in literature sources.



The initial statement purpose could be described as a poorly structured one, amorphous formation. It should become a more classified, more clearly formatted and segmented unit considering the content terms, applying deep syntax techniques

(Ахутина, 1989; Леонтьев, 1997). The expected result, in its turn, should be transformed into a symbolic form using linguistic units of different levels (phonological, lexical, morphological). Since a speech utterance is realized only in a linear manner, in successive form, an external segregation becomes an important component of statements programming process. Such segregation, or linear statements organization process, includes steps of material, represented in a series of successive organized rows, simultaneous transformation. All these transformations occur almost simultaneously (Зимняя, 1985; Касевич, 1988; Ахутина, 1989; Залевская, 1999). This requires cognitive resources effective management performed simultaneously at different levels, in different subsystems, that is only possible through the work of regulatory subsystem. It should ensure coordination, subordination, and resources' support.

The final act of a statement generation consists of statements' motor program development containing segmental and suprasegmental levels. This includes the use of integral motor patterns, matching relevant syntagma or phrase, and the implementation of discrete motor routines, which correspond to phonetic word, morpheme, syllable. Sensor-motorial and cognitive approach to this subsystem includes the auditory perception and auditory speech gnosis, kinesthetic perception and kinesthetic and dynamic (or kinetic) praxis, motor regulation, and short-term memory (audio-verbal and motorial) (Лурия, 1973, 1975; Carroll, 1986).

The subsystem regulation enables the work of all LSFS levels regulation (these levels being involved in the process of speech production or texts decoding), enabling their operation and power (activation) optimization, adaptively choosing the strategy of language and speech processes, some of their formal characteristics in accordance with their internal and external (mental) context. A number of authors made justification of such subsystem segregation as an independent one (Леонтьев, 1997; Залевская, 1999).

Functional tasks analysis is performed by the regulating subsystem, which enables a doer of speech action to select two hierarchically related levels: communicative and pragmatic one, as well as operational and dynamic level.

Motives, previous experience, communicative situation nature, speech and non-speech context dominating, communicative and pragmatic level coordinates the pragmatic application of speech activity in a communicative process. A motive, communicative intention, triggers the following content development.

The regulating subsystem is responsible for organization, choice of speech "genre" (according to Бахтин, 1998) and style elements in accordance to a number of circumstances. These factors include: final practical goal of an utterance (an impulse to action, information provision, request for information, behavior modification, etc.); utterances flow nature (story, description, remark, etc.); form of expression (oral or written); communicative situation component (ambient atmosphere, social and psychological relationships among interlocutors, overall awareness of interlocutors).

Decoding texts at this level, there occurs a configuration strategy for messages, which arise during discourse and paralinguistic components interpretation, situational context analysis and the application of above mentioned for the texts' essence decoding. The tasks, which are to be completed at this level of the regulatory subsystem functioning, are similar to what linguistics considers "pragmatics of speech" and refers to as – "... area of research in semiotics and linguistics, which studies speech linguistic signs functioning" (Корнев, 2000).

Корнев (2006) research defines the background for constructivist model of language learning as the statement about communicative speech practice as the main source and leading force for children's speech and language mastering. The author says that statements generating experience, motor programming and realization serve an extremely important role for optimal speech and language development. In the process of practical reproduction of linguistic samples obtained from social environment, and while experimenting with this material, a child becomes a linguistic individual, he or she forms his or her verbal behavior. In accordance with the above mentioned opinion, the scholar says that in the process of speech formation, the stage of motor program formation and implementation not only performs an executive function, but also plays its role for material approbation and statements generating skills development. Only completed utterance, considering its audio form, enables a child to assess the effectiveness of speech production skills, which are in the possession of a child at a particular stage of his or her development. An utterance audio form is an object for the



utterance result, produced by an acceptor, comparison with the expected one, and the feedback, which provides the speaker with tools for relevant skills improvement (Корнев, 2006).

The period during which the speech activity is being developed and improved begins when a child is 8 months old and ends when a speaker is about 12 years old (Корнев, 2000).

Half of this period is spent on the maturation of main operational base for language resources, and the second half – on language and speech activity development in a situation of resolving cognitive or communicative tasks. This period can be divided into several stages: I – initial (8-18 months); II – early (18-30 months); III – middle (30 months – 6 years); IV – late (6-12 years).

The principle of first three stages segregation is relatively traditional one (Гвоздев, 1961; Жукова, Мастюкова, Филичева, 1998): each of them is significant because a child begins to master one of the basic linguistic resources (lexicon syntax, morphology). The IV stage isolation is rarer, although it is the very age when a child learns complex forms of speech activity (contextual monologue speech); moreover, writing and its verbal and logical thinking begins to play the leading role in intellectual processes (Леонтьев, 2010; Пиаже, 1994; Эльконин, 1989). That is the reason of the age of 6 years to be the age of the second crisis.

Clinical symptoms of speech underdevelopment may arise during each of these different stages. The features of speech dysontogenesis at each stage can be characterized as follows:

The initial period (8-18 months). The moment, when the transition from the pre-verbal stage of human development to the speech one is considered to be the age when a child begins to understand some of the words and phrases contributed by adults (i.e. provides adequate behavioral reaction to speech utterances, addressed to him or her). For most children, this occurs between the age of 8-10 months (Брунер, 1984; Исенина, 1983). This is possible due to the maturation of the following determinants: a) cognitive – to the level of objects constancy understanding; b) communicative functions – to the level of situational and personal forms of communication; c) auditory perception – to the sufficient for main phonological features decoding level. A child gradually extends his or her conversational vocabulary, a set of compressed statements “speech clichés”. At the age of 10-12 months, the majority of healthy children enrich their speech by another prerequisite: mature articulation praxis, an ability to coordinate targeted arbitrary articulation actions.

At this stage, the most common factors of speech dysontogenesis are the following: psychomotor retardation, deep violations of motility development due to paresis or paralysis and significant hearing loss.

Clinical features of speech dysontogenesis may be as follows: a) fragmented, unstable speech in signs context understanding, or its absence, while maintaining orientational reaction to verbal stimuli; b) a delay in the first words’ skills development (after 14 months) and a slow increase in vocabulary baggage with the absence (or presence) of speech audio characteristics’ serious violations; c) serious violations in sound and syllabic structure with absence (or presence) of distorted prosodic speech elements, the first words’ skills normal development, but slow further increase of vocabulary baggage and the domination of bubbling pronunciation of words. 80% of children with such features’ history, were diagnosed as mentally retarded or underdeveloped.

The early period of ontogenesis (18-30 months) corresponds to the emergence of phrasal speech and a language system formation initialization. This is being ensured by cognitive functions’ maturation advance (the beginning of sensor-motor intelligence, the maturation of visual-active thinking, successive schemes of serial actions emergence) (Брунер, 1984; Пиаже, 1994). Syntagmatic linguistic operations become available for a child and, therefore, the fonotaxis develops (linear organization, combinatorics of syllables and sounds within words), as well as syntax does. Due to the further maturation of kinesthetic articulation praxis, the phonological repertoire of a child is being developed.

At this stage, speech dysontogenesis is shown somewhat differently. Mental retardation of the majority of children causes significant delay of phrasal speech emergence. Up to 2.5-3 years, these children use limited set of words with a primitive sound and syllable structure. The saturation of vocalization in the process of communication is usually low. Speech understanding is limited by a set of statements, often repeated in a familiar context. This kind of dysontogenesis is legitimately regarded as the second level of speech underdevelopment. It should be noted that sometimes a full compliance of the degree of speech underdevelopment to the intelligence retardation was not found in that group of children. Some children had developed speech activity before mental maturity, and others – on the contrary.

Today, underdeveloped speech primary forms’ delimitation from the secondary ones coincides with a significant difficulty for speech therapy science. The second level of speech underdevelopment arises due



to mental retardation, and is characterized by primary speech underdevelopment, so-called “speech development age” (the level of speech competence), and is usually equal to “mental age”.

Under any of these forms of speech underdevelopment, the dissociation between these two indicators is observed.

Speech disorders under mental retardation and overall underdevelopment have not been researched to their full capacity. The first attempt to provide a systematic explanation for a number of psycholinguistic speech disorders, including those in the nosology of intellectually disabled people, was made by German scholar Henner Barthel.

## 4. Results

Experimental speech studies of mentally retarded children (MRC) and children with psychic development delay (CPDD) (Лалаева, 1998), based on psycholinguistic approach, showed that intelligence disorders affect speech development of children in different ways.

Initially, mental disorders influence semantic operations' organization of speech utterances production, especially connected ones. Speech utterances made by MRC are characterized by a violation of logics sequence, a lack of complex semantic relations, a large number of semantic gaps' presence.

Secondly, intellectual delay affects the level of linguistic semantics, because a child is not anymore able to use a particular linguistic form, in case he or she does not understand its meaning. In this regard, MRC have significant difficulties with lexical, derivational, grammatical meanings mastering. MRC and students with PDD hardly differentiate affixes, similar in semantics, grammatical gender, case, tense, personality.

Thirdly, intellectual underdevelopment affects the capability to master formal linguistic means. The more complex language construction of a particular meaning is, the harder is its mastering for MRC (difficulties in learning of prepositional case constructions).

Fourthly, the analytic and synthetic activities' underdevelopment corresponds to the quality, accuracy and capacity of speech processing, since human speech is perceived and reproduced in the shortest possible time. Children's speech learning correlates to the process of speech information perception identification, which is reflected in speech formation. Initially, a child learns one-word and two-word utterances (subject – predicate, subject – object), then he or she combines these elements in tree-word statements (subject – predicate – object).

A child with intellectual disabilities does not have a strategy for rapid verbal communication decoding and deciphering, what violates the development of his or her impressive speech and adversely affects the formation of expressive speech.

Thus, in the early stages of children's development there arises speech and intellectual development autonomy. In the following period, cognitive processes formation serves as one of the regulators of speech pace and sequence development. However, at the same time, it is the semantics that plays the primary determinant role in the further speech development for normal and disordered intellectual children's development scenarios.

## 5. Discussion

Thus, a speech activity is accomplished by human mental activity's complex mechanisms. The processes of thinking, memory retention before a further reflection are the internal mechanisms through which, in their turn, the main speech operation mechanism is enabled. The latest is defined as the unity of two segments: the mechanism for words composing with the help of their elements, and phrases out of words compilation mechanism. If any of the mechanisms has been uncompleted, it may lead to ontogenetic development disorders, speech activity underdevelopment. Correspondingly, the psycholinguistic approach to speech activity and its functioning features identification serves as the background for the determination of educational and correctional work with children, who have various psycho-physical disorders, and in particular with mentally retarded ones.

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