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## **RESTORATION OF SPEECH IN PATIENTS WITH APHASIA VIA INTERACTIVE TECHNOLOGIES**

**Abstract.** The article deals with the use of interactive technologies in logopedic restoration of speech function in patients with various forms of aphasia caused by organic lesions of the central nervous system of various etiologies. The article describes the structure and the content of the rehabilitation-diagnostic computer program “Speech Restoration” at different stages of logopedic rehabilitation of patients with aphasia and specifies the peculiarities of its application in the comprehensive system of rehabilitation of patients with focal lesions of the central nervous system. For practical reasons, the program tasks are divided into seven blocs: 1) speech stimulation (restoration of automated speech series; actualization of the names of months and seasons; work with numbers; reading poems and abstracts from songs); 2) speech sounds and letters; 3) phonetic structure of words (reading by syllables, reading words with the same initial sound, etc.); 4) vocabulary (matching words and pictures, synonyms, antonyms, metaphors, anagrams); 5) grammar (the category of number, prepositions); 6) phrasal speech (deformed phrase, making up three phrases according to pictures out of the words from the list); 7) restoration of the functional basis of written speech, correction of specific and non-specific violations. The opportunity to manipulate images and texts according to individual preferences enhances the patient’s motivation. The feedback (response of the complex to correct task completion) is effected at the auditory and visual levels.

**Keywords:** aphasia; information technologies; logopedics; speech disorders; logopedic rehabilitation; speech restoration; neuro-rehabilitation; speech impairments; focal brain lesions.

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High incidence of focal lesions of the brain among the adult population of the Russian Federation makes it imperative to work on improvement of the technologies of their neuro-rehabilitation aimed at restoration of the damaged functions (L. V. Stakhovskaya, O. A. Klyuchikhina, M. D. Bogatyreva, V. V. Kovalenko, 2013—2016; V. M. Shklovskiy, 2010—2013; A. V. Belopasova, 2012; M. A. Piradov, Z. A. Suslina, 2008, etc.).

Loss of working capacity and reduction of social activity in patients with focal brain lesions are associated with the emergence of multiple violations of the higher cortical functions, among which speech underdevelopment, including aphasia, occupies a special place. Logopedic rehabilitation of patients with aphasia focuses on expansion of speech and socio-communicative skills. Optimization of logopedic intervention is associated in modern aphasiology with the introduction of the methods recreating the structure of the damaged link of the speech function in detail. Regular enough and multiple repetitions of the damaged operations lead to the restoration of

the impaired speech activity in patients with aphasia.

Modern standards of rehabilitation training of patients with aphasia presuppose the use of computer-assisted technologies. The given article describes the advantages of the rehabilitation-diagnostic logopedic module “Speech Restoration” at different stages of logopedic rehabilitation of patients with different forms of aphasia.

While designing the content, the structure and the interface of the rehabilitation-diagnostic module “Speech Restoration”, we followed the recommendations of the leading specialists in aphasiology and the experience of creation of similar programs. Specifically, we have analyzed a large number of various materials containing tests and exercises used for restoration of phrasal speech, as well as different home and foreign computer-assisted e-learning systems (for example, «DR.Fluency», Speech Therapy Systems, 1994—1999, etc.). The final choice of tests and exercises was made taking into account the opportunity of their modification and adaptation. The tests and exercises were structured into

topics, sections and subsections. Each subsection contains a host of similar exercises varying in difficulty, which makes it possible to take into account the education stage and the state of the patient.

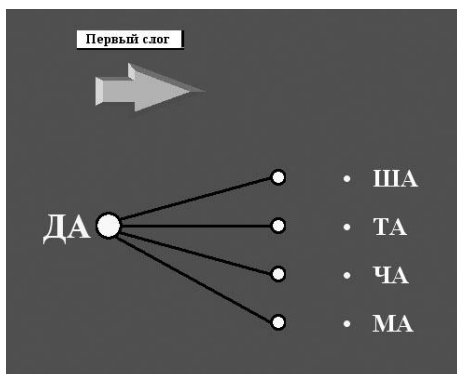
The selectivity built into the content of the program, the sequence of operations completion, the opportunity of multiple repetitions (trainability principle) of the program by the patient in the process of learning, the support on external auxiliary means – all this creates the conditions for provision of a high degree of activity and independence of the patient in overcoming the defects.

The computer-assisted program “Speech Restoration” is designed in accordance with the main requirements to the methods of the speech function restoration. The total number of tasks in the system is being constantly enlarged and is close to 1,000 at present. For the sake of convenience, they are grouped into 7 blocks.

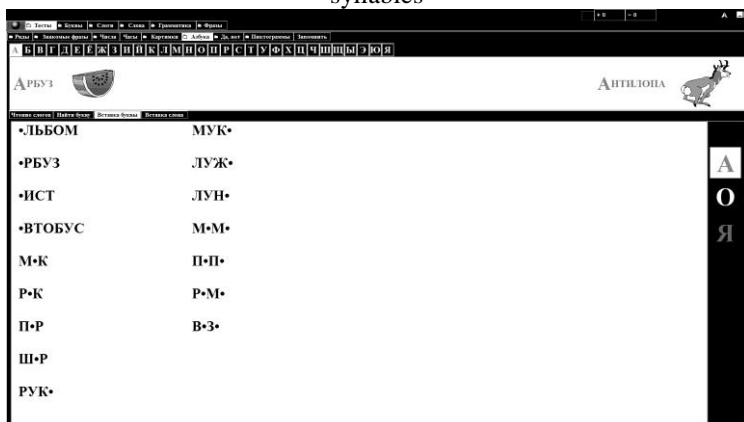
**1. Speech stimulation:** restoration of automated speech series; actualization of the names of months and seasons; work with numbers; reading poems and abstracts from songs, etc. (Figures 1, 2)



**Fig. 1.** An exercise on disinhibition of pronunciation



**Fig. 2.** An exercise on actualization of understanding of simple open syllables



**Fig. 3.** An exercise on restoration of the link “articuleme – phoneme – grapheme”

**2. Speech sounds – letters:** alphabet (repetition of syllables, naming letters, inserting letters, inserting syllables); letters in a word; different images of letters (Figure 3).

**3. Phonetic structure of words:** reading by syllables, reading words

with the same initial syllable, reading words with the same initial element; inserting syllables, finding syllables; sorting out words of various lengths; making up words of different syllables, dividing text into syllables; etc. (Figure 4).



Fig. 4. An exercise on restoration of the sound-letter synthesis of the phonetic word structure without visual support

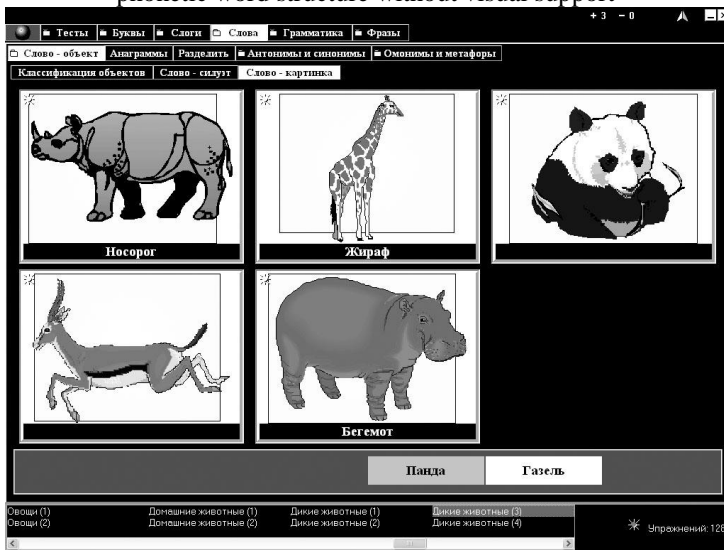
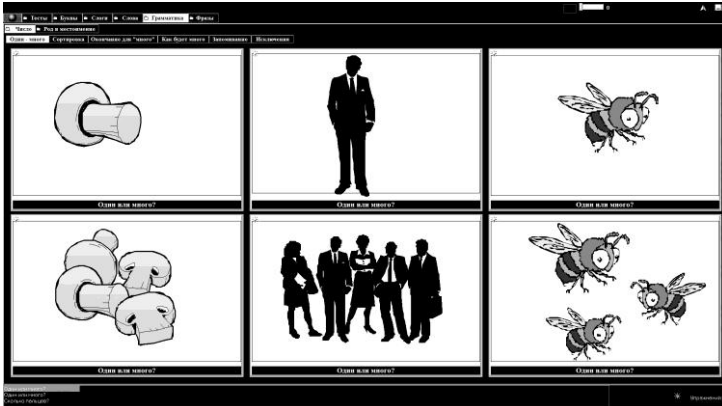


Fig. 5. An exercise on restoration of global reading skills

**4. Vocabulary:** word – image synonyms and antonyms; metaphors (choosing the right word, placing and homonyms; anagrams (Figure 5)



**Fig. 6.** An exercise on restoration of grammatical construction skills

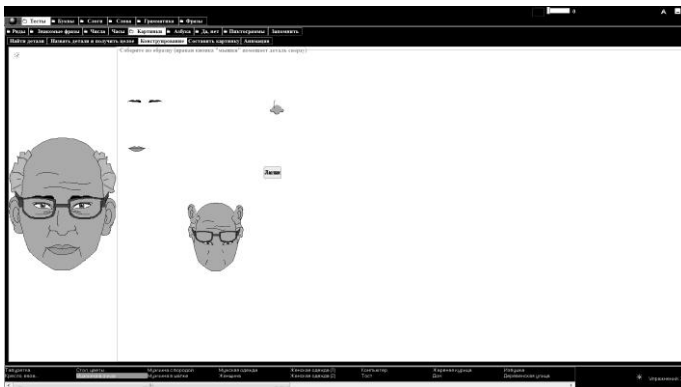


**Fig. 7.** An exercise on restoration of written utterance programming

**5. Grammar:** the category of number (sorting out by the notions “one – many”, sorting out by number, changing the singular into the plural, remembering the plural number inflections, exceptions); gender and pronouns; verbs; prepositions; description of actions (Figure 6).

**6. Phrasal speech:** placing captions under plot-driven pictures; deformed phrase; deformed phrase with conflicting words; making up three phrases on the pictures out of the words from the list (Figure 7).

**7. Restoration of the functional basis of written speech, correction of specific and non-specific violations.**



**Fig. 8.** An exercise on overcoming optico-spatial disorders

The program content can be set up for each patient individually; it depends on the form of aphasia and the structure of speech communication defect.

The experience of many years of application of the module “Speech Restoration” in the system of rehabilitation training of patients with aphasia corroborates its efficiency and effectiveness. The analysis of the factors of optimization of rehabilitation training involving implementation of the module “Speech Restoration” showed a change in the patient’s motivation, improvement of their emotional attitude to logopedic sessions; increase of the effectiveness of monitoring and control over the dynamics of written speech restoration due to precision and accuracy of procession of the temporal and qualitative indicators of the patient’s completion of the computer-assisted program tasks;

improvement of the quality of reinforcement of the new algorithm of the restored speech due to intensification of the individual logopedic practice of speech habits.

The automated program complex “Speech Restoration” creates an opportunity to visualize various means of restoration of phrasal speech for the development of the largest number possible of various verbal-nonverbal associations in the patient. The provision of an opportunity to manipulate images and texts to suit the interests of the patient facilitates the improvement of the person’s motivation. The program gives a chance to listen to the auditory material read by male or female speakers. Feedback (response of the complex to correctness of task completion) is provided on the auditory and visual levels. The rehabilitation-diagnostic module provides an opportunity to choose the most adequate tasks for

each patient and offers unlimited resources for observation of the speech restoration dynamics.

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