

THE COGNITIVE MODELING FOR THE ANALYSIS OF THE INFORMATION-EDUCATIONAL ENVIRONMENT

A.N. VETROV, E.E. KOTOVA, N.N. KUZMIN

“The Saint-Petersburg state electrotechnical university "LETI"”

For the complex solution of the problem of creation and subsequent analysis of the information-educational environment (IEE) of the automated (remote) training (ART) system with the elements of adaptation based on the parametrical cognitive models (CM) block the cognitive modeling technology (CMT) and the technique of using of the technology for the formation of CM are offered.

CMT acts as the universal in relation to the object of research and is the iterative cycle, including the sequence of stages, allowing not only to obtain the primary representations in the context of the spectrum of scientific aspects of consideration, but and to carry out the structural analysis. CMT includes the following stages: the identification (the obtaining of primary representations about the researched situation), the conceptualization of situation (the conceptual scheme of the researched situation in the subject area), the structuring of situation (the structured knowledge about the situation in the subject area), the formalization (the construction of the first and second levels of the structure of CM), the structural analysis (the verification of the first level of the structure of the obtained CM), the parametric analysis (the verification of the second level of the structure of CM, its parameters), the realization (the placement of the obtained CM in the basis of the environment of research), the modelling (the modeling based on the holistic approach), the analysis (the statistical processing of obtained data with the help of CM), the substantive interpretation (the interpretation of the obtained dependencies and knowledge), the synthesis (the accumulation of new knowledge about the dynamics of situation in the subject area).

For the difficult objects of research CMT provides the inviting of consultants: an expert – the subject specialist (the methodologist for IEE and etc.); a cognitologist – the specialist in the area of knowledge engineering; a system analyst – the specialist in the area of the systems analysis and modeling, a programmer – the qualified specialist, oriented in the methods and approaches to the realization modern program means by means of the high-technological environments of programming.

The technique of use of technology (pic. 1) and the algorithm of formation of CM (not presented in the article) are designed for the formalization of a sequence of use of CMT with the purpose of formation of CM for the tasks of analysis of IEE of ART with the elements of adaptation based on the parametrical CM. For the research of the structurally difficult objects, it is recommended to use the presentation of CM in the view of the oriented graph, the vertices of which form a row of sets (pic. 2, above). that is convenient for the subsequent analysis. For the structurally simple objects of research it is recommended to use the schematic representation of CM (pic. 2, below). CM – the parameterized repertoire, echeloned on a set of portraits and stratified on a row of sets (the presentation CM in pic. 2, above). For IEE of ART CM reflects the most important aspects and parameters of information interaction of the subjects and means of training, ensuring the consistency of generation of the educational influences with the personal characteristics (features) of the subjects of training (PChT), and also allowing to reveal the reasons of difficulties in the process of the formation of knowledge.

The contour of adaptation in IEE of ART based on the block of CM is technologically realized at the possibility of generation of the training influences based on CM of educational means in coordination with PChT, contained in CM of the subject of training.

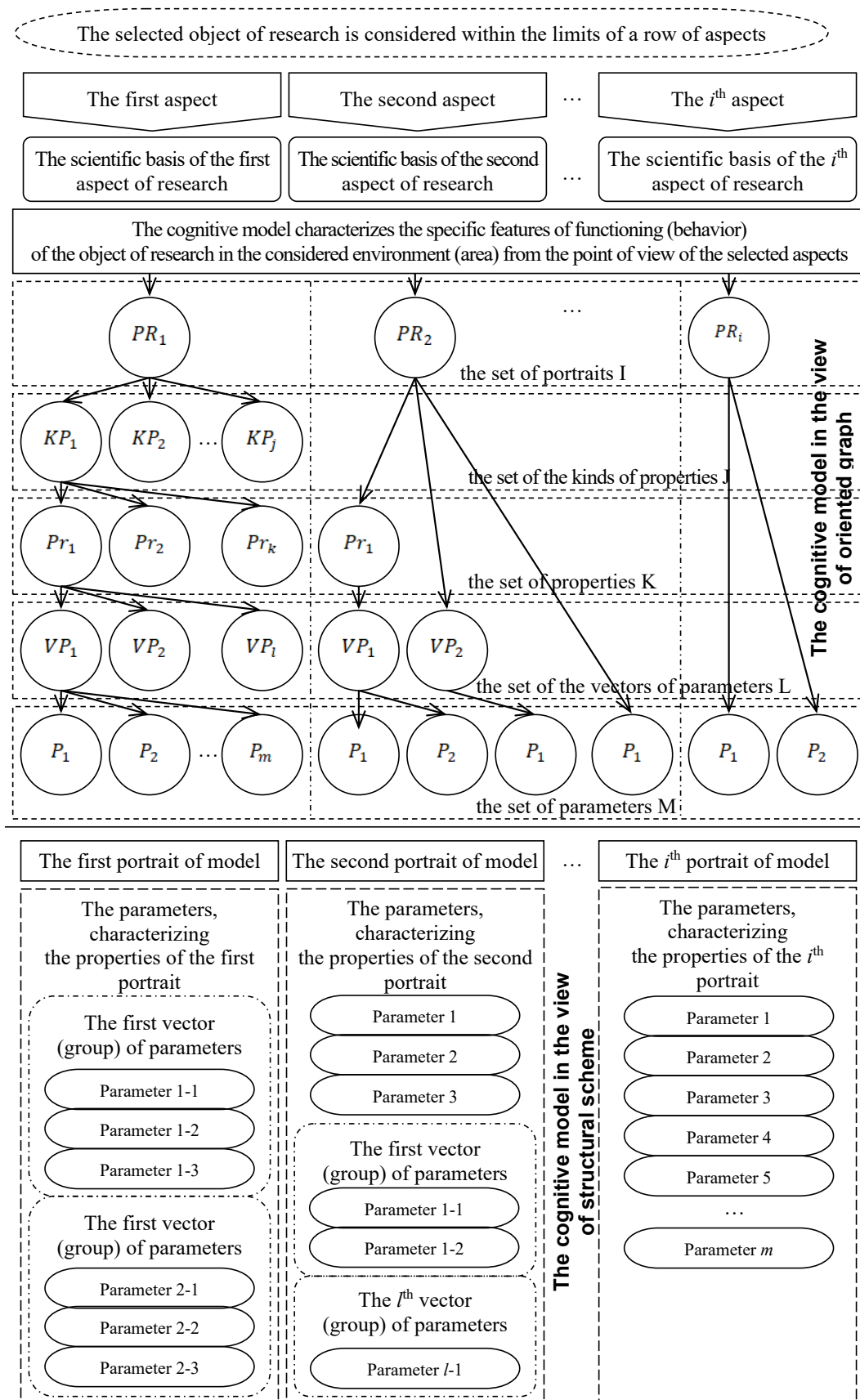


Pic. 1. The technique of use of the cognitive modeling technology

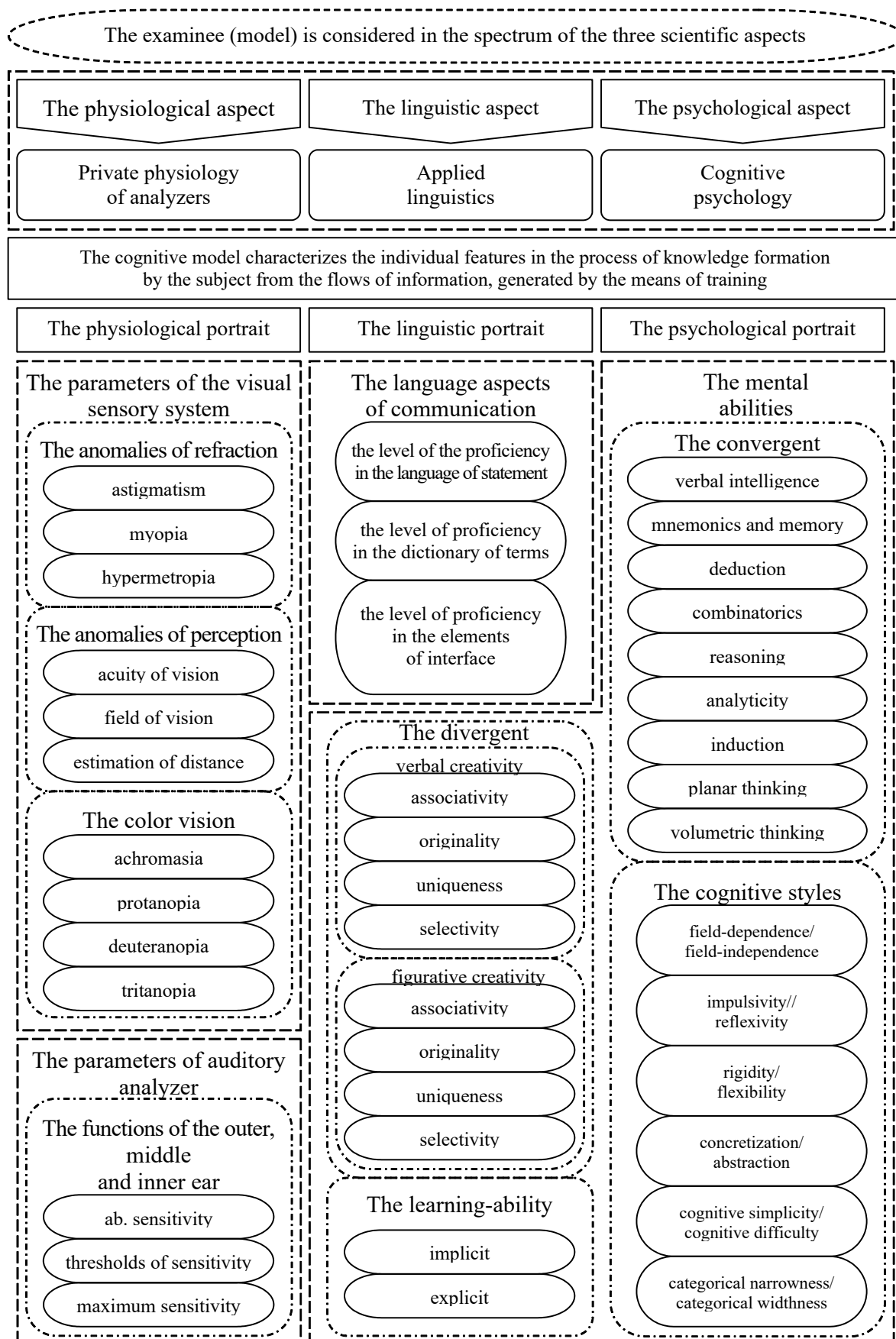
Accordingly CM is differentiated on CM of the subject (the parameters, characterizing PChT) and CM of the means of training (the parameters, characterizing the potentially possible types and kinds of generated information-educational influences).

CM of the subject of training (pic. 3) concentrates the parameters of physiological, psychological and linguistic portraits, characterizing PChT.

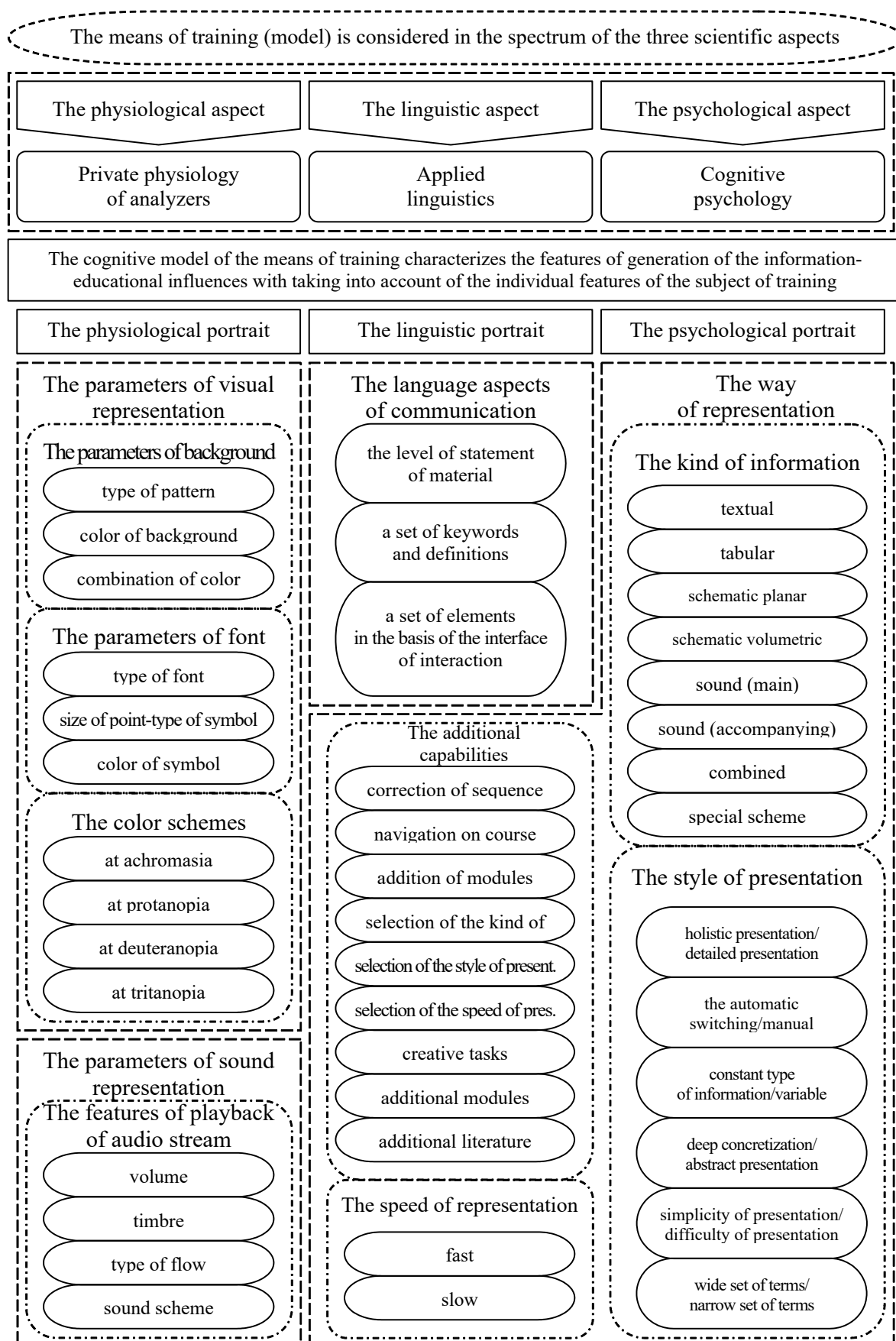
CM of the means of training (pic. 4) contains the parameters, characterizing the potentially possible types, kinds and features of generated information-educational influences.



Pic. 2. The basis for the formation of the structure of cognitive model, presented in the view of graph (top) and structural scheme (bottom)



Pic. 3. The cognitive model of the subject of training



Pic. 4. The cognitive model of the means of training

For the automation of the tasks of research of the vectors of parameters in the structure of the portraits of CM of the subject used the software tool, developed on the basis of the architecture of the expert system and containing a set of applied methods in the basis of knowledge base. on the scientific basis of the private physiology of sensory systems, cognitive psychology and linguistics.

The estimation of efficiency of the introduction of the results of research was carried out with using of the commonly-accepted indicators of efficiency:

$$K = \{k_1; k_2; k_3\} = \left\{ Y_2 - Y_1; \frac{Y_2}{Y_1}; \frac{Y_2 - Y_1}{Y_1} 100\% \right\}$$

The coefficients respectively designate the absolute, comparative and relative indicators of efficiency, and the results of statistical processing of a posteriori data of a series of experiments are summarized in table 1.

Table 1.

The results of statistical processing of the data of experiment

The name of indicators	The number of the experimental group of examinees							
	1	2	3	4	5	6	7	8
The experiment №1 (without the use of technology)								
Average point Y_1	3,850	3,414	3,224	3,678	4,036	3,643	3,790	3,645
AQD of. point	0,867	0,178	1,958	0,879	0,577	0,783	1,679	1,047
The experiment №2 (with the use of technology, personal adaptation)								
Average point Y_2	4,041	3,674	3,357	3,786	4,157	3,853	3,821	3,743
AQD of. point	0,723	0,127	1,743	0,743	0,446	0,654	1,538	0,986
The results of research								
k_1	0,191	0,26	0,133	0,108	0,121	0,21	0,031	0,098
k_2	1,049	1,076	1,041	1,029	1,029	1,057	1,008	1,026
k_3	0,049	0,076	0,041	0,029	0,029	0,057	0,008	0,027
Change of AQD	-0,144	-0,051	-0,215	-0,136	-0,131	-0,129	-0,141	-0,061

The proposed approach allows to realize the additional contour of adaptation based on the parametrical cognitive models block, and also to carry out the analysis of the efficiency of functioning of the information-educational environment of automated (remote) training.