

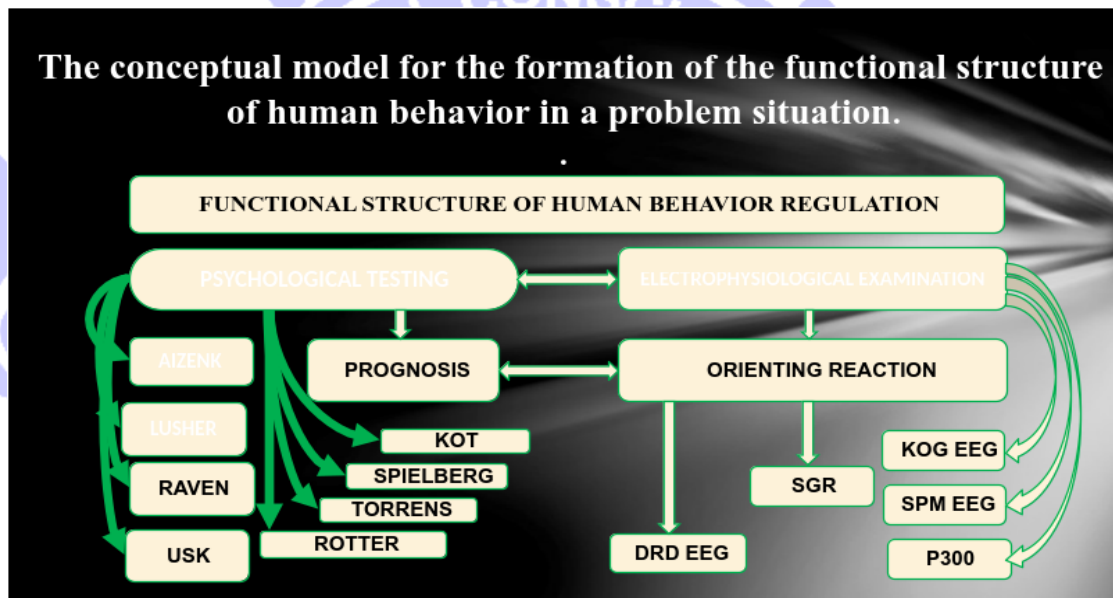
CONSCIOUSNESS AND ARTIFICIAL INTELLIGENCE IN THE ERA OF COGNITIVE TECHNOLOGY

Ryabchikova N.A.

Doctor of Biological Sciences,
Lomonosov Moscow State University, Moscow, Russia
Sychev S.M., Bulankina A.S.
nat@guesstest.ru

Article

At the present stage of the development of science, methods of formal description and mathematical methods of studying cognitive functions are becoming increasingly important. It is known that now such directions as algebraic biology and system theory, algorithmic description and construction of mathematical models of brain function are relevant. We proposed and scientifically substantiated the conceptual model of the functional structure of the regulation of the purposeful human behavior. It is based on a comprehensive study of correlations between the individual psychological characteristics of the human prognostic activity and neurophysiological indicators of the work of his brain. The conceptual model for the formation of the functional structure of the regulation of adequate human behavior in a problem situation.



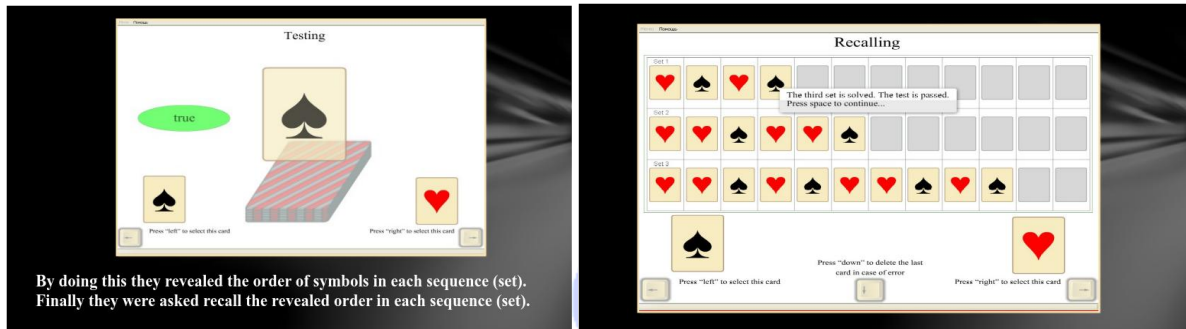
It is known that probability prognosis is one of forms of intellectual activity of the person. That is why there is actual a definition of the information importance of prognosing as studying method of cognitive human brain function. Such properties of a human brain as perception, memory, thinking for definition of intellectual possibilities were investigated. For this purpose, in experiment the computer variant of a psychological origin al method of Prognosis 3.2 developed many years ago (H.A by Ryabchikova, S.M. Sychev) for adult healthy examinees was used

Within a ten-minute testing period the “Prognosis 3.2” method allows evaluation of the level of cognitive brain functions such as attention, memory and thinking. This method allows the intellectual capability of the subject to be revealed and evaluates the adequacy of his behavior in problem situations. It is necessary to emphasize that the objective experimental data can be checked and analyzed by statistical methods.

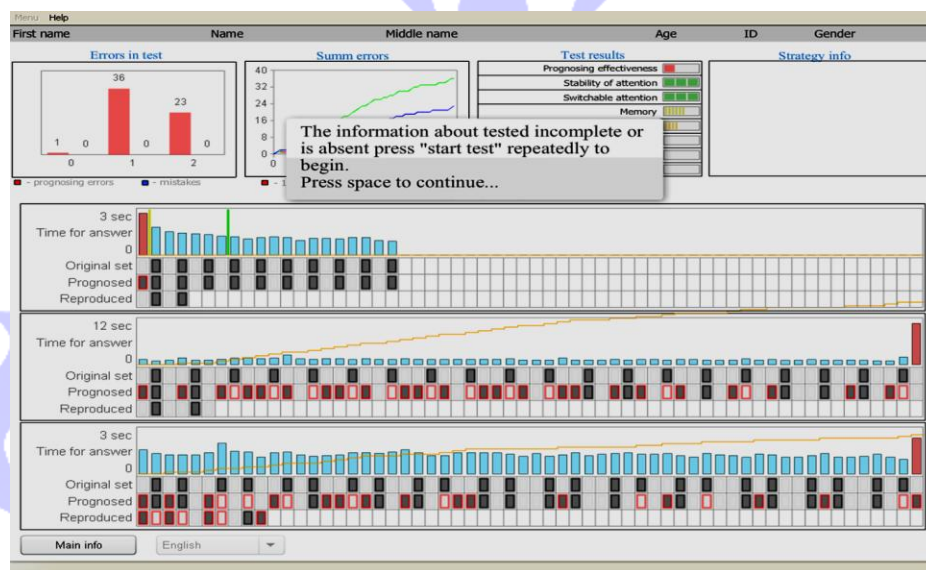
The effectiveness of a subject’s prognostic activity in the testing situation is assessed on the basis of quantitative and qualitative criteria with the influence of environmental factors taken into account.

During of the experiment, we offered a tested 3 sequences of symbols. There are only two different symbols. These symbols were represented on cards placed faces down. The cards were arranged in a certain order unknown to tested.

The tested had to reveal the sequences of symbols in each set. The sequences contained different numbers of symbols. In the first sequence there were two symbols, the second one contained three symbols and the third one consisted of five symbols. To make their prediction a tested had to press either the left arrow for “spade”, the right one “heart”.



Experimental data



Now I would like to explain the white and black boxes mean (stand for). The white boxes reflect (stand for) the letter “A”, and the black ones - for “B”. The middle row shows the sample sequence. The upper one shows the tester's choice and lower one shows the recalled sequence.

There are 4 indices that allow evaluating the tested ability to predict.

- The first one is the attention’s distribution in the prognosis’s effectiveness determinate by the number of errors.
- The next one is the stability of attention defined (judged upon) by the number of “distraction” errors.
- The next one is short-term memory testing by the number of recalling errors.
- The last one is the choice of the strategy’s kind.

The term ‘strategy’ implies an algorithm a person chooses in the process of solving any cognitive task. There are two types of prognosing strategies: rational and irrational. The rational kinds of strategies include:

The strategy of comparing an a priori prognosis with the really sequence. This is one of the widespread strategy choices.

The strategy with a priority for input information. This one is simpler than the first one, even though also effective.

The strategy with the priority for a prior's prognosis. It reflects the situation when an a priori tested prognosis can hinder detecting a really of symbols alternation which complicates the recognition of symbols order in sequence.

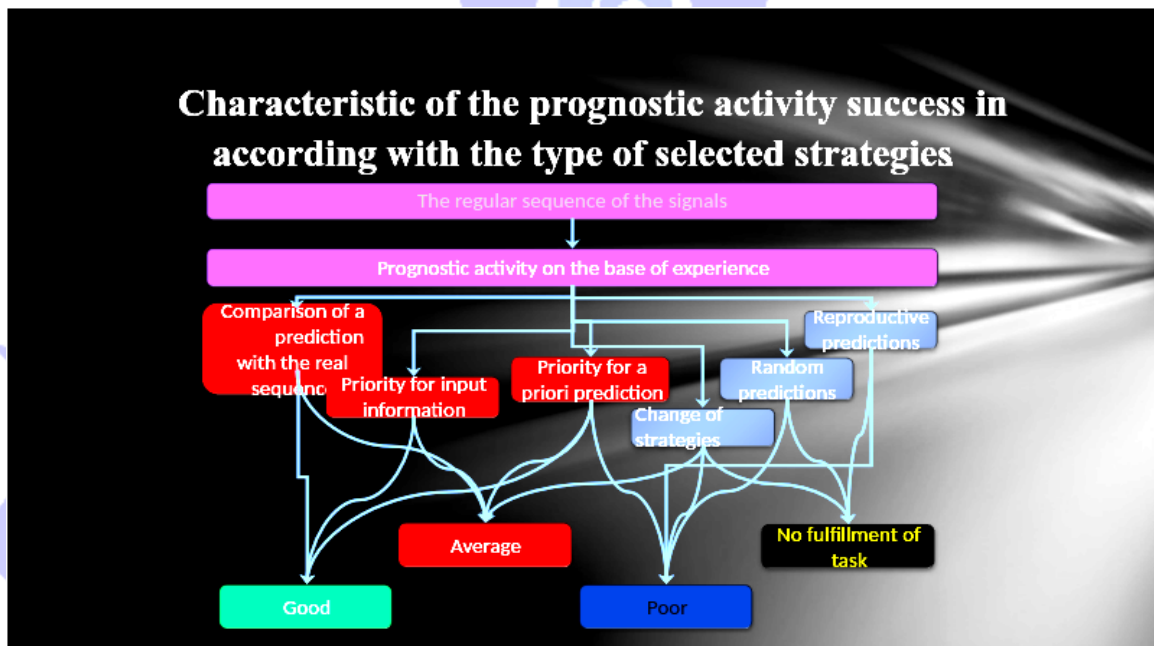
Among the irrational strategy choices are:

Frequent change of a priori prognoses – change of strategies during prognosing of cyclic sequences which reduces the quick revealing of the symbol's alternation order.

The least (“littler”) irrational strategy of occasional predictions when a tested randomly predicts the sequence symbols with (never mind) take no heed to correctness or incorrectness of previous results (prognoses).

The worst ‘strategy’ is when a tested, in despite of the incorrectness (falsehood) of predictions, inertly repeats simple order (‘A’ and ‘B’ alternations) used in the first set.

The principle of successful prognosing strategy selection can be reflected in a scheme presented below.



The results of the prediction depend on choice of strategy: it may be good, average, bad or there may be no result at all.

This method keeps the examiner's influence on the tested down to minimum

Being fully automatic, the testing has revealed four types of prognostic activity, allowing predicting the behavior of a person in a different situation.

- The subjects (individuals) of the first type (I) are capable of predicting events with the lowest number of errors and, are able for quick and adequate problem solving.
- Second type (II a, b) includes persons who are also capable of solving a prognostic problem. However, certain ‘distraction’ errors are possible in the process of fulfilling the task and both rational (II a) and irrational (II b) strategies may be employed.
- Persons belonging to the third type (III a, b) are characterized by high numbers of errors (III b), they may fail to recall (or lose) the detected order of sequence symbols (even if they chose a rational strategy – III a) and they usually not only fail to recall the order of symbols but also opt for most irrational strategies (III b).
- Fourth type (IV a, b) is the mostly groups persons who either partially (IV a) or entirely (IV b) failed to fulfill the task and they tend to choose only irrational strategies

Tab.1. CRITERIA OF DEFINITION OF PROGNOSTIC ACTIVITY TYPES OF THE PERSON				
Type (I-IV) prognostic activity in points (1-7)	prior's of erroneous predictions	Derivation errors	Reproduction of an order of sets	Strategy
I type 7 of points	0-4	0	All three	The rational
II type 6 of points of 5 points	a. 0-7	1 - 4 and more	All three	The rational
II type 6 of points of 4 points	b. 7.5 - 11	Absence or presence of errors	Reproduction of the revealed usages	Rational, change of strategy
III type 4 of a point 3 points	a. 7.5 - 11	Absence or presence of errors	Not reproduction of the revealed usages	The rational
III type 4 of a point 2 points	b. 7.5 - 11	Absence or presence of errors, loss of the revealed order is possible	Not reproduction of the revealed usages	Change of strategy, casual predictions
IV type 2 of a point 1 point	a. 11.5 and more (not performance of the task of one or two sets)	Presence of errors, loss of the revealed order	Not reproduction of the revealed usages	Change of strategy, casual predictions, reproductive predictions of 1st set
IV type 2 of a point 1 point	b. 11.5 and more (not task performance as a	The same	The same	Reproductive predictions of 1st set

This ranging that correlates with EEG level indicators that describe the peculiarities of man's brain cortex alertness, as well as with haemo-cerebrospinal fluid circulation indicators, allows assessing the efficiency degree of man's prognostic activity in totality, and defining the level of a number of psychic functions (memory, thought, attention).

Why do you need all this?

Imagine that the ship is drowning, the plane falls. ... Or there is a battle, a dangerous game where you need to outwit the enemy. Any extreme situation requires a quick and adequate human reaction. The one who will make the right decision survive in a matter of seconds, but will win even more who foresee these situations and prepared a "plan" of actions in advance. Good forecasting is the main difference between the commander and a soldier, a master and a craftsman. A smart person is able to "sculpt" his "required" future as he wants to see him. Moreover, even mistaken in any specific actions, in the end result, it achieves success. Having a good memory, you can get rid of erroneous forecasts.

What does this give?

Determining the level of intellectual capabilities:

Allows you to determine the early career guidance according to its type of prognostic activity.

When selecting a responsible position, the ability of a person is taken into account to correctly evaluate events and, accordingly, respond to them, which persons with the difficulties of forecasting are not capable of. So, it can be argued that any insufficiency of the brain is revealed by testing according to the "Forecast 31.1" methodology.

Therefore, our technique is universal and applicable. The method of Prognosis 31, 2 has wide application for an estimation of the psychophysiological status of the human in various problem situations. for example, in medicine when determining the prodromal stage of the development of Parkinson, Alzheimer's disease, dementia and various types of schizophrenia in patients at risk, which will allow the onset of the disease for 20 years. Our methods have also been adopted as an innovative technology in the scientific center Skolkovo.

Knowledge of the laws by which the human brain works allows you to control and predict its behavior in any, especially problematic situation.

Conclusions

1. The testers of the first group were distinguished by a high rate of formation of an adequate forecast and the correct reproduction of the order of elements in the sequence at the end of testing, due to the successful course of the processes of "recording" and "reading" information in the register of short-term

memory. On the contrary, short-term memory deficiency is one of the main reasons for the low efficiency of prognostic activity of the second group subjects.

2. The low speed of access to the correct forecast or failure to proceed with it, especially when solving the 3rd set, was largely due to the difficulty of identifying the sequence of elements and keeping it in memory. Another reason for ineffective forecasting can be considered insufficiently labile switching attention, characteristic of all subjects with the difficulties of forecasting.
3. The difference from the existing psychological testing techniques that are built by the type of questionnaires and give only general and not always correct answers, we have accurate quantitative data that allow you to unequivocally determine the intellectual capabilities of a person.
4. In order to expert analysis of the results of computer testing, it is advisable to use deep neural networks with the opposite distribution of error, and to create a complete analysis matrix, use a generative neural network as a factor in the expansion of the model applicability.

The prospect of using this approach is seen: Firstly, in an increase in the number of various kinds of markers, i.e., relevant indicators of the physiological state of a person in the study of the human mental activity.

Secondly, it expands the boundaries of the study of various aspects of intellectual activity and the mechanisms of their brain support.

Acknowledgements

This study was carried out in community with the State Budgetary Scientific Center of Neurology, the Federal State Budgetary Educational Institution of Higher Education "Russian State Pedagogical University named after A.I. Herzen", St. Petersburg and supported by international organizations Bodiflo LLC (USA & Australia), ITAG (USA), RFF Grant 15-04-00598, No. 99-04-482 99. LCC Alparkdem Skolkovo (Center for Innovation Technologies).

References

1. Naiser U. Cognition and reality. - M., Progress. - 1961.
2. The crossing of L.I., Rozhkova L.A., Ryabchikova N.A. Features of probabilistic forecasting and indicative reaction in children with learning difficulties. —Shum. Enter. - 1991. - T.41. - Issue 6. -p.1102-1111.
3. Ryabchikova N.A., Podyacheva E., Tomilovskaya E., Shulgovsky V.V. The role of interhemispheric neurodynamic in the process of probabilistic forecasting. —In the GNI named after I.P. Pavlova.-1999.
4. 2022. The artifision intelligence in the ratio of cognitive functions of the human brain. 1, 2 Ryabchikova N.A., 1 Sychev S.M., 1 Bazyan.b. H. <https://doi.org/10.29003/m2910.sudak.ns2022-18/290-291>
5. Udk 100.32; BBK 32.813 N.A. Ryabchikova (Moscow, Russia) Analysis of the structure of artificial intelligence in a situation of choice in forecasting, p. 121, State Academic University of University of Sciences, Russian State Humanitarian University, Russian Friendship University of Humanitarian Research, Transcendental Toy in Modern Philosophy - 8, 8, 8, Metaphysics, epistemology, transcendental Cognitiveness and artificial intelligence, a collection of theses of the International Scientific Conference. Moscow, April 20-22, 2023
6. 2024. The World Congress "Theory of systems, algebraic biology, artificial intelligence: mathematical foundations and applications" International Conference "Consciousness 2024", abstracts, Ryabchikova N.A. Theory of consciousness and artificial intelligence.pp.190-192.With the NGO "MIA", LLC "CIT", Biomashistemy, vol.8, no. 3,2024
7. 2024 All-Russian Scientific and practical conference with international participation "The teaching of Academician I.P. Pavlov in the modern system of neuroscience., Ryabchikova N.A. Theory of cognitive activity in relation to artificial intelligence, pp.88-89, St. Petersburg, 2024

