

REVIEW

Psychology of the Possible and the Paradigm of Probabilistic Prognosis

Irina G. Skotnikova^{a*},

^a*Institute of Psychology, Russian Academy of Sciences, Moscow, Russian Federation*

Abstract. The main directions and current state of the Probabilistic prognosis paradigm development are elucidated. Namely, studies of advance reflection phenomena, hypotheses generation and unconscious anticipation are described. Predictive coding theory in neurobiology is presented briefly which is actively working out at present in order to explain brain mechanisms of probabilistic prognosis. In line with the analysis of the main provisions of the Probabilistic prognosis paradigm, the monograph by V. V. Znakov "The Psychology of the Possible" (2021) is reviewed. In the V. V. Znakov's book, the Possible category is considered in different fields of psychology and is understood as a content which is potentially accessible to a human being in a perspective. The structure of V. V. Znakov's conception of the Possible is built as a fractal system of triads. In this context, new steps have been done in the study of understanding, spirituality and truth problems.

Keywords: The Possible category, a fractal system of triads, problems of understanding, spirituality and truth, probabilistic prognosis, generation of hypotheses, advance reflection, unconscious anticipation, predictive coding theory

The monograph by Viktor Vladimirovich Znakov "The Psychology of the Possible" [57] has been published, which has shown a new extremely productive stage in the author's study of a person's subjective world in the context of his (her) being. It's clear that the Possible phenomena analyzed, are quite in line with anticipation and probabilistic prognosis paradigm in psychology, which has rather long history of development already, and is working out actively at present because of very high level of contemporary human life uncertainty. Let's consider the main ideas of the book firstly, and then the most developed studies in the frame of anticipation and probabilistic prognosis paradigm, mentioned by Znakov shortly and described by the present author in more details.

The monograph is seen as a new development of the tradition of being and consciousness, and person in the world investigation, grounded by S.L. Rubinstein [36, 37] in Russian psychology. For many years Znakov worked at the Institute

of Psychology, Russian Academy of Sciences in close cooperation with one of the nearest followers of S.L. Rubinshtein — A.V. Brushlinsky, who created a general methodological approach in psychology on the basis of the Subject category [14] — one of the central ones in his Teacher's legacy. Therefore, the prolongation of the named profound tradition is natural and logical scientific way for Viktor Vladimirovich.

The book on Psychology of the Possible is the fundamental scientific work that reveals the philosophical, psychological, epistemological, culture — oriented and methodological content of the Possible category. Its development is traced in different fields of psychology, and characteristics are given to the concepts of affordance (opportunities provided by the environment for a subject), a predictor (a prognostic parameter and a prognosis tool). And, certainly, the author's conception of the possible is of principle theoretical importance, and its structure is built as a fractal

* Corresponding author.

E-mail address: skotnikovaig@ipran.ru

system of triads. These are three realities that form the human world actuality: empirical, socio-cultural and existential. It would be useful to see a clearer definition of the category "reality of the world" — intuitively it can be understood precisely as the mentioned above category of a person's subjective world in the context of his being. A subject distinguishes and understands these three realities with the help of the three key categories — "necessary", "plausible" and "impossible". Besides, Znakov reveals several triads in his analysis of the Possible: the three characteristics of the unthinkable as a subspecies of the impossible; the three types of determination of his understanding of external and internal world corresponding to the three realities; the three types of understanding proper in cognitive, hermeneutic and existential traditions: understanding as knowledge, as interpretation and as comprehension, which corresponds to assessments of the truth, correctness and truthfulness of statements understood by people in communicative situations, as well as the three types of internal conditions of understanding: verbal and figurative signs, cognitive symbols and existential symbols; the three types of social knowledge: cognitive, conventional and spiritual; the three trends in the development of the psychology of the possible: going beyond the limits of the specific activity of the subject; disclosure of the plurality of variants of the dynamics of development, ways of self-change of subjectivity in a random unpredictable world, analytical distinction between "necessary", "plausible" and "impossible"; the three promising areas of psychological research on understanding post truth and lies. Such a clear structure reflects the logical completeness of the Possible concept.

Already in the listing of the epistemological triads considered by the author, it is clear that the analysis of the problem of understanding passes as a cross-cutting topic in the content of the book. In the development of this topic, he thereby makes another serious step (using new materials) towards the development of the previous equally fundamental stage in its study [56]. In the context of Psychology of the Possible Znakov also develops two other major directions of his research: the problems of spirituality and truth. Earlier the author outlined the main milestones in the understanding of spirituality by comparing the positions of psychology and religion [54], and now he extensively examines

the phenomenology of the spiritual, discusses its definitions, genesis in mental activity, theoretical models and approaches to its study. The novelty of the author's view of human spirituality lies in considering it as a three-component mental formation, the emergence of which has meta-personal, activity and spiritual-practical grounds. As for psychological problems of truth, Znakov has already analyzed them in details at the level of a monographic publication [55]. In the new book, he specifically focuses on how in modern society, truth and falsehood are correlated in Russian and Western culture, and how the significance of the truth is reduced.

In the light of the first of the identified triads the author discriminates the key categories of necessary, verisimilar and impossible, and within the framework of the latter one, the sub-concept of unthinkable is highlighted. It is extremely interesting. He attributes the specifics of the necessary to empirical reality, the verisimilar to the socio-cultural reality (and this is his next advance in the development of the problem of truth), and the impossible and the unthinkable — to the existential one. Five! types of the impossible are distinguished as found in the literature: as a contradiction between a logically permissible (not contradicting the laws of logic) and physical inadmissibility of an action (a contradiction to the laws of nature); as unreasonable, the cause of which cannot be determined; as not verisimilar (absent in the past human experience) — but the author emphasizes that this concept and the concepts is not identical to of the impossible as unknown, unknowable, meaningless.

Constructive characteristics of poorly developed concepts of the unthinkable and post-truth are given. The three characteristics of the unthinkable are: suppression of irrational by rational; going beyond boundaries of the usual moral reasoning, due to a moral choice impossibility; such a discrepancy between knowledge and the existential experience of a subject who understands the world, in which he finds himself in an ambivalent position: at the same time, it is necessary and impossible to see the unthinkable. Two directions of post truth studies are highlighted: political (fake news) and philosophical-anthropological: untrue information, which is present in the mind nevertheless and influence the behavior of thousands of people (including lie).

In general, Znakov understands the possible following S.L. Rubinstein as content, potentially accessible to a human being in a perspective. The

two options of the “possible” category are separated — as an intellectual and personal choice from alternatives (truth or lie, altruism or selfishness, justification or conviction) and as the disclosure of new potentialities of an already, it would seem, analyzed topic of research, on which the modern psychology of understanding focuses.

As a direct student of B.G. Ananyev, Viktor Vladimirovich gives his characteristic of a functional organ [3]. It has to be mentioned at the same time, that earlier A.A. Ukhtomsky [45, 46] identified a temporary combination of various forces of the organism, capable to guarantee a certain achievement. Then N.A. Bernstein [11] described a functional organ as a temporary structure for combining various resources that provided purposeful human activity. In the theory of P.K. Anockhin, the functional system of a behavioral act psycho-physiological mechanisms (temporarily formed to perform a specific task) has the same meaning [5, 6]. Later A.N. Leont’ev [27] has grounded (based on psychological material) that a functional organ is generated by a subject’s task. It has been confirmed empirically: a temporary operational structure is built that combines cognitive resources with mechanisms of effort and activation, in order to solve a sensory task [20]. The concept of a functional organ was systematically developed by V.P. Zinchenko [51, 52] in the fields of engineering psychology and methodology.

The obvious urgency of the “Possible” concept developing is determined by the rapid changes in the modern world, which generate a high uncertainty in human life. Therefore, it’s is completely justified Znakov’s correlation of this concept with the problems of forecasting, anticipation, probabilistic prognosis in Russian psychology. Let’s note that we would like to start the consideration of the phenomenon of anticipation with the book by B.F. Lomov and E.N. Surkov [29]. Znakov highlights justification of anticipation general meaning as an imminent property of all mental processes in their development, the necessary readiness of the subsequent stages of development by the previous ones [39]; V.D. Mendelevich’s anticipatory concept of neurotic disorders, in the pathogenesis of which anticipatory failure plays a leading role [19]. Viktor Vladimirovich also characterizes this topic in the field of psychology of thinking, being a specialist in it. It is an emotional activation as an anticipation of a

principle for solving a problem [44]; demarcation of anticipation and prognosis as different ways of achieving the possible, established by the ratio of cognitive and emotional components of prognosis when solving mental problems [13]; the interpretation of thinking as a movement towards the possible, which has not yet been conceived, the idea of dynamic control of uncertainty with the emphasis on anticipation and prognosis [23, 24]. In this context, Znakov refers to the definition of probabilistic prognosis as an assessment of: which actions are most likely to achieve a success in a changeable situation [17] and to the analysis of relationships between the real and the possible [34].

Certainly, Znakov’s study of the Possible is quite close to anticipation and probabilistic prognosis paradigm in psychology. The present author also monitors the directions of works in this field, while systematically conducting experimental and theoretical studies in threshold-type tasks primarily, where decision-making always has a probabilistic nature, since subjective uncertainty is high (the levels of which are precisely set by the stimulation values) due to the sharp deficiency of input sensory or perceptual information [42]. Let us briefly summarize the most developed areas of works in cognitive psychology, supplementing Znakov’s materials with our analysis [40, 42]. In the classical theory of perception, such phenomena are described to be a process of perceptual hypotheses testing in order to decide: which object has been perceived, made by probabilistic prognosis of their reliability when moving from features to categories [12]. In cognitive neuroscience, the generation of hypotheses is recognized as one of the main functions of the cerebral cortex, and perception is considered through anticipation [32, 33]. Probabilistic prognosis in behavior has been actively studied ([17]. P.K. Anockhin used this term to characterize the acceptor of an action results as a functional system component [38], but gave it a more global meaning, generalizing it to the principle of advance reflection of external events by the brain [4]. Active advance reflection is considered in the Anockhin’s school not only as a universal attribute of all living beings’ existence, which appears with the emergence of life and is represented at all levels of its organization [1], but it is understood as one of the leading functions of mind in Russian psychology as a whole. When developing methods for controlling the accuracy of advanced reflection in choosing behavior (according to Anockhin), a theoretical conclusion has been formulated that the brain is not a logical, but a predictive device. To obtain hypotheses with a controlled level of

confidence, a theory of probabilistic semantic inference was proposed, which combined logical inference with calculations of probabilities and showed that in the theory of knowledge there is not only passive, catching up, but also active, anticipatory control of a probability of a decision made correctness [47, 48].

The idea of hypotheses rivalry is also realized in the model of consciousness as a competition of possible multiple sketches of behavior — portions of the stream of consciousness at different stages of their analysis (corresponding to simultaneous and asynchronous patterns of brain activity) — and the choice of one of them (Multiple Draft Models: [16]). It is similar to the conception of consciousness, which constantly test possible unconscious hypotheses about what is happening. The response awareness is the result of an unconscious process of choosing and checking one of them [2]. The model is also similar to a multi valued world image as a dynamic system of multilevel hypotheses and their continuous generation. The image of the world performs the function of a continuous prognosis as a tool of uncertainty radical reduction [43] — this work is also cited by Znakov in the section on anticipation). The conception of pre-adaptation to uncertainty has been developed as a fundamental strategy for living systems development in the course of unpredictable evolutionary routes [8]. Possible (what can happen as a result of a subject's activity) and probability are productively distinguished [28]. Znakov characterizes possible in a similar way — as a person's potential.

In modern neurobiology, anticipation processes are described by Predictive Coding Theory, the key idea of which is that the brain is a multilayered predictive mechanism [15, 18, 31]. Neural processing involves the interacting upstream of sensory data and the downstream of predictions about it. Each brain level receives information from the both streams and uses the Bayesian scheme for their coordination. This scheme is applied widely in cognitive science and points that the brain evaluates the posterior probabilities of hypotheses compared when choosing the most probable one between them (see [21], for example). Even a choice of an optimal behavior under uncertainty, made by insects and rodents, is often explained by decision making models using Bayesian probabilistic decision rule. And in general, the major models of decision making under

uncertainty, describe it in terms of subjective probabilities of possible outcomes and of the outcomes expected utility, i.e. of their subjective values.

In humans' visual discrimination [41, 49] and in slow-warm lizards one [50], in auditory discrimination in humans [49] and in assessment of stretching in them [30], choices of erroneous decision are slower and are more often accompanied by hesitations than choices of correct decisions. Apparently, an individual doubts before making a mistake and therefore acts slowly, while he typically gives correct responses without many doubts and therefore quickly, although he does not know when he will be mistaken or will respond correctly. It may be interpreted as an unconscious anticipation of forthcoming responses in uncertainty tasks. At the level of physiological mechanisms, the unconscious slowdown and uncertainty of erroneous decisions are explained by the conception of activity (before making mistakes) of cortical and sub cortical error - determining neurons. After making erroneous decisions, the activity of error - detecting neurons is recorded [9; 25, 26]. From the standpoint of the model of decision-making and confidence in sensory and perceptual tasks, which we develop, unconscious uncertainty of an erroneous decision is the result of the accumulation of an insufficient amount of unconscious information evidence in favor of this decision choosing. But in case of sufficient evidence, the decision is made more confidently and turns out to be correct [40]. "Confidence during the decision process" and "confidence after the decision made" were recorded experimentally [35]. This echoes the theoretically distinguished primary unconscious confidence before choosing between alternatives, which serves for a person as a subjective indicator of which one to choose, and secondary conscious confidence as a subjective assessment of correctness of an already made decision [41]. In our model mentioned, these two phenomena correspond mathematically to the evidence and the confidence itself — as the magnitude of the evidence deviation from the decision-making criterion.

It is not accidentally that in the modern era of ever-increasing uncertainty in life, several classes of conceptual-mathematical models have been developed which describe decision-making as a choice between alternatives and assessment of confidence in it. Indeed, in the absence of accurate and complete knowledge, the decision is made with the help of prognosis of the goal achievement. In such conditions, confidence in the hypothesis chosen is often the only psychological tool of

decisions correctness prognosis and controlling. We have reviewed such models and develop our model in the paradigm of probabilistic prognosis as the basic mechanism of perception and choice of actions in situations of uncertainty, using the typical example of them: sensory and perceptual tasks of similar objects discrimination [40]. Confidence is viewed as a subjective indicator of future decision predicted effectiveness and as an internal feedback for assessing a decision already made. The model is based on the psychophysical Signal Detection Theory and the Bayesian paradigm, in which a formal evidence variable is introduced in favor of a certain hypothesis about an object perceived. Evidence means sensory and perceptual information received by a subject, which he uses to choose a response. Evidence is an unconscious intermediate variable between input information and a decision made. Really a person feels a degree of confidence in the future response, and on the base of confidence he chooses that response alternative, a predicted utility or success, or correctness probability of which is assessed as maximal by the brain. Confidence is conscious when he is required to evaluate it. By modifying Bayes' rule, forming of the evidence and decision-making criteria is described (which happens strictly before a decision made), as well as the control of responses utility and correctness probability with their help.

In conclusion, let us note the promising directions outlined by Znakov for further research. They are studies of post truth and lies understanding: the ratio of cognitive and personal predictors of untruthful statements, rational conscious and emotional unconscious components of judgments, internal psychological conditions and external socio-psychological circumstances of alternative realities generation. Other areas of empirical research of the Possible are associated, in particular, with psychology of post-traumatic stress disorder (PTSD). Znakov mentions the technique of "anticipatory coping" with difficult life problems to be a person's desire to avoid doubtful situations [7]. We add that signs of PTSD occur only in 14–20% of people who have experienced the influence of intensive stressors. Thus, it is possible to overcome negative effects of such stressors by person's psychological resources mobilizing [22]. In addition, non-trivial empirical phenomena of prognosis and anticipation are described as tools for the possible analyzing not only in the future, but also

in the retrospective past [53]. Undoubtedly, a deep analysis of Psychology of the Possible, carried out by Viktor Vladimirovich, will open up new methodological ways to investigate this problem, which are so needed today. The materials we have collected, obtained ourselves and briefly presented here, illuminate additionally processes of anticipation and probabilistic prognosis.

References

1. Aleksandrov, Yu.I. (1999). Functional systems theory and systematic psychophysiology // Systematic aspects of mental activity / Ed. K.V. Sudakov. Moscow: Editorial URSS (In Russian).

Aleksandrov Yu.I. Teoriya funktsional'nykh sistem i sistemnaya psikhofiziologiya // Sistemnyye aspekty psikhicheskoy deyatelnosti / Pod red. K.V. Sudakova. Moskva: Editorial URSS, 1999.

2. Allakhverdov, V.M. (2000). Consciousness as a Paradox (Experimental Psychologies). V. 1. St Petersburg: "DNK Publishing House" (In Russian).

Allakhverdov V.M. Soznaniye kak paradoks (Eksperimental'naya psikhologika). T. 1. St Petersburg: «Izdatel'stvo DNK». 2000.

3. Ananiev, B.G. (1968). Human being as a subject of knowledge. Leningrad: Leningrad University publishing house (In Russian).

Ananiev B.G. Chelovek kak predmet poznaniya. Leningrad: Izd-vo Leningadskogo universiteta, 1968.

4. Anockhin, P.K. (1962). Advance reflection of reality. Questions of Philosophy. 7, 97–11 (In Russian).

Anockhin P.K. Operezhayushcheye otrazheniye deistvitelnosti // Voprosy filosofii. 1962. №7. S. 97–11.

5. Anockhin, P.K. (1968). Functional system as a methodological principle of biological and physiological inheritance // Systematic organization of physiological functions / Moscow, P. 5–7 (In Russian).

Anockhin P. K. Funktsional'naya sistema, kak metodologicheskii printsip biologicheskogo i fiziologicheskogo nasledovaniya // Sistemnaya organizatsiya fiziologicheskikh funktsiy. M., 1968. S. 5–7.

6. Anockhin, P.K. (1975). Essays on the physiology of functional systems. Moscow: Medicine (In Russian).

Anockhin P.K. Ocherki po fiziologii funktsional'nykh sistem. Moskva: Meditsina (1975).

7. Antsyferova, L.I. (2006). Personality Development and Problems of Gerontopsychology. Moscow: "Institute of Psychology RAS" Publishing house (In Russian).
Antsyferova L.I. Razvitiye lichnosti i problemy gerontopsikologii. Moskva: Izd-vo «Institut psikhologii RAN», 2006.
8. Asmolov, A.G., Shekhter, E.D., Chernorizov, A.M. (2018). Pre-adaptation to uncertainty as a navigation strategy for developing systems: unpredictable evolution routes. Moscow (In Russian).
- Asmolov A.G., Shekhter E.D., Chernorizov A.M. Pre-adaptatsiya k neopredelennosti kak strategiya navigatsii razvivayushchikhsya sistem: nepredskazyemye marshruty evolyutsii. Moskva: 2018.
9. Bechtereva, N.P., Shemyakina, N.V. et al. (2005). Error detection mechanisms of the brain: Background and prospects. International Journal of Psychophysiology. 58 (2–3). P. 227–234.
10. Bernshtein, N.A. (1947). Essays on the Physiology of Movements and the Physiology of Activity. Moscow: Medicine (In Russian).
Bernshteyn N.A. Ocherki po fiziologii dvizheniy i fiziologii aktivnosti. Moskva: Meditsina. 1947.
11. Bernshtein, N.A. (1966). On the Construction of Movements. Moscow: Medgiz (In Russian).
Bernshteyn N.A. O postroyenii dvizheniy. Moskva: Medgiz, 1966.
12. Bruner, J. (1973). Beyond the information given. London: George Allen & INWIN LTD,.
13. Brushlinsky, A.V. (1979). Thinking and Prognosis (Logical and Psychological Analysis). Moscow: Misl' (In Russian).
Brushlinskii A.V. Myshleniye i prognozirovaniye (logiko-psikhologicheskii analiz). Moskva: Mysl', 1979.
14. Brushlinsky, A.V. (2003). Psychology of Subject. Moscow: "Institute of Psychology RAS" Publishing house, St. Petersburg: Aletheya (In Russian).
Brushlinskii A.V. Psikhologiya sub'yekta. Moskva: Izd-vo «Institut psikhologii RAN», St. Petersburg: Aletheya, 2003.
15. Clark, A. (2016). Surfing Uncertainty: Prediction, Action, and the Embodied Mind. New York: Oxford University Press.
16. Dennett, D.C. (2005). Sweet Dreams: Philosophical Obstacles to a Theory of Consciousness. MIT Press.
17. Feigenberg, I.M., Ivannikov, V.A. (1978). Probabilistic Forecasting and Presetting for Movements. Moscow: Moscow University Publishing house (In Russian).
Feigenberg I.M., Ivannikov V.A. Veroyatnostnoye prognozirovaniye i prednastroyka k dvizheniyam. Moskva: Izd-vo Mosk. un-ta, 1978.
18. Friston, K. (2018). Does predictive coding have a future? Nature Neuroscience, 8, 1019–1021.
19. Granitsa, A.S. (2018). The relationship of anticipatory consistency and intuition in neurotic disorders (clinical and psychological aspects): Dis. ...PHD. Kazan (In Russian).
Granitsa A.S. Vzaimosvyaz' antitsipatsionnoy sostoyatel'nosti i intuitivnosti pri nevroticheskikh rasstroystvakh (kliniko-psikhologicheskkiye aspekty): Dis. ... kand. med. nauk. Kazan', 2018.
20. Gusev, A.N. (2013). From Psychophysics of "Pure" Sensations to Psychophysics of Sensory tasks: a Systematic-Activity Approach in Psychophysics. Questions of Psychology. 3, 143–155 (In Russian).
Gusev A.N. Ot psikhofiziki «chistyykh» oshchushcheniy k psikhofizike sensorykh zadach: sistemno-deyatel'nostnii podkhod v psikhofizike. Voprosy psikhologii. 2013. № 3. S. 143–155.
21. Kersten, D., Yuille, A. (2003). Bayesian models of object perception. Current Opinion in Neurobiology, 13, 1–9.
22. Kharlamenkova, N.E., Zaitsev, D.A., Nikitina D.A., Kormilitsyna, A.N. (2018). Emotional and personal characteristics of patients with meningioma diagnosis in expressed post-traumatic stress. Clinical and Special Psychology. 7(4), 150–167. doi: 10.17759 / cpse.2018070409. ISSN: 2304-0394 (online) (In Russian).
Kharlamenkova N.Ye., Zaytsev O.S., Nikitina D.A., Kormilitsyna A.N. Emotsional'no-lichnostnyye osobennosti patsiyentov s diagnozom meningioma pri vyrazhennom posttravmaticheskom stresse // Klinicheskaya i spetsial'naya psikhologiya. 2018. T. 7. No 4. S. 150–167. doi:10.17759/cpse.2018070409. ISSN: 2304-0394 (online).
23. Kornilova, T.V. (1994). Risk and Thinking. Psychological Journal. 14 (40), 20–32 (In Russian).

Kornilova T.V. Risk i myshleniye // Psikhologicheskiy zhurnal. 1994. T. 14. No 4. S. 20–32.

24. Kornilova, T.V. (2016). Forecasting and the "image of the world" in the actual genesis of dynamic control of uncertainty // Mental Resources of a personality: theoretical and applied research: Proceedings of the third international symposium / Ed. in-chief M.A. Kholodnaya, G.V. Ozhiganova. Moscow: "Institute of Psychology RAS Publishing house". P. 21–25 (In Russian).

Kornilova T.V. Prognozirovaniye i «obraz mira» v aktualgeneze dinamicheskogo kontrolya neopredelennosti // Mental'nyye resursy lichnosti: teoreticheskiye i prikladnyye issledovaniya: Materialy tret'yego mezhdunarodnogo simpoziuma / Otv. Red. M.A. Kholodnaya, G.V. Ozhiganova. Moskva: Izd-vo «Institut psikhologii RAN». 2016. S. 21–25.

25. Kropotov, Yu.D. (2009). Quantitative EEG, event related potentials and neurotherapy. Academic Press. L.: Elsevier.

26. Kropotov, Yu.D. (2009). Forgotten discoveries // Medvedev S.V. (Ed.). Natalia Bekhtereva. As We Knew Her. St Petersburg: Sova. P. 51–74 (In Russian).

Kropotov YU.D. Zabytyye otkrytiya // Medvedev S.V. (Red). Natal'ya Bekhtereva. Kakoy my yeye znali. Spb.: Sova. 2009.

27. Leont'ev, A.N. (1978). Activity, Consciousness and Personality. Prentice-Hall: Eglewood Cliffs, N.J, USA.

28. Leontiev, D.A., Ovchinnikova, Yu.Yu., Rasskazova, E.I., Fam, A.Kh. (2015). Psychology of Choice. Moscow: Smysl (In Russian).

Leontiev D.A., Ovchinnikova Yu.Yu., Rasskazova E.I., Fam A.Kh. Psychologiya vibora. Moskva: Smysl, 2015.

29. Lomov, B.F., Surkov, E.N. (1980). Anticipation in the structure of activity. Moscow: Nauka (In Russian).

Lomov B.F., Surkov E.N. Antitsipatsiya v strukture deyatel'nosti. Moskva: Nauka, 1980 (In Russian).

30. Lubin, P., Garriga-Trillo, A., Hecce, R.L. (1998). The relationship between stimulus magnitude, estimations, errors, and confidence in retarded subjects for stretching exercises. Fechner Day'98: Proceedings of the 14th Annual Meeting of the International Society for Psychophysics / Ed. by S. Grondin, Y. Lacouture.

Quebec: Canada, P. 261–266.

31. Marino, J. (2019). Predictive Coding, Variational Autoencoders, and Biological Connections. Real Neurons & Hidden Units Workshop. @ NeurIPS.

32. Moller, R., Gross, H.-M. (1993). Detection of coincidences and generation of hypotheses — a proposal for an elementary cortical function. In Gielen S., Kappen B. (Eds.). Proceedings of ICANN'93. Springer. P. 67–70.

33. Moller, R., Gross, H.-M. (1994). Perception through anticipation. Proceedings of PerAc94. IEEE Computer Society Press.

34. Petrenko, V.F., Suprun, A.P. (2013). Human being in the objective and mental world. News of Irkutsk State University. Series Psychology. V. 2(2). P. 62–82 (In Russian).

Petrenko V.F., Suprun A.P. Chelovek v predmetnom i mental'nom mire // Izvestiya Irkutsk. Gos. un-ta. Ser. Psikhologiya. 2013. T. 2. No 2. S. 62–82.

35. Petrusic, W.M., Baranski, J.V. (1997). Context, feedback and the calibration and resolution of confidence in perceptual judgments. American Journal of Psychology. 110, 543–572.

36. Rubinshtein, S.L. (1957). Being and Consciousness. Moscow: USSR Academy of Sciences Publishing house (In Russian).

Rubinstein S L. Bytiye i soznaniye. Moskva: Izd-vo Akademii nauk SSSR, 1957.

37. Rubinstein, S.L. (1997). The Human Being and the World. Moscow: Nauka (In Russian).

Rubinshteyn S. L. Chelovek i mir. M.: Nauka, 1997.

38. Saltykov, A.B. (2005). P.K. Anokhin's biological theory of emotions and probabilistic prognosis. Advances in modern biology. 125(6), 531–543 (In Russian).

Saltykov A.B. Biologicheskaya teoriya emotsiy P.K. Anokhina i veroyatnostnoye prognozirovaniye // Uspekhi sovremennoy biologii. 2005. T. 125. No 6. S. 531–543.

39. Sergienko, E.A. (2019). Modern trends in developmental psychology // New trends and prospects of psychological science / Ed.in-chief A.L. Zhuravlev, A.V. Yurevich. Moscow: "Institute of Psychology RAS" Publishing house", P. 341–377 (In Russian).

Sergienko E.A. Sovremennyye tendentsii v psikhologii razvitiya // Novyye tendentsii i perspektivy psikhologicheskoy nauki / Otv. Red. A.

L. Zhuravlev, A. V. Yurevich. M.: Izd-vo «Institut psikhologii RAN», 2019. S. 341–377

40. Shendyapin, V.M., Skotnikova, I.G. (2015). Modeling of Decision Making and Confidence in Sensory Tasks. Moscow: "Institute of Psychology RAS" Publishing house (In Russian).

Shendyapin V.M., Skotnikova I.G. Modelirovaniye prinyatiya resheniya i uverennosti v sensorykh zadachakh. Moskva: Izd-vo «Institut psikhologii RAN». 2015.

41. Skotnikova, I.G. (2008). Problems of Subject Oriented Psychophysics. Moscow: "Institute of Psychology RAS" Publishing house (In Russian).

Skotnikova I.G. «Problemy sub'yektnoy psikhofiziki». M.: Izd-vo «Institut psikhologii RAN», 2008.

42. Skotnikova, I.G. (2021). Decision making is a key component of mental activity // Development of concepts in modern psychology. V. 3 / Ed. A.L. Zhuravleva, E.A. Sergienko. Moscow: "Institute of Psychology RAS" Publishing house, (In Russian) (in press).

Skotnikova I.G. Prinyatiye resheniya — klyuchevoye zveno psikhicheskoy deyatelnosti. Moskva: Izd-vo «Institut psikhologii RAN», 2008.

43. Smirnov, S.D. (2016). Predictive activity as a way of existence and development of the image of the world // Principle of development in modern psychology / Eds. in chief A. L. Zhuravlev, E. A. Sergienko. M.: Publishing house "Institute of Psychology RAS", P. 215–234.

Smirnov S.D. Prognosticheskaya aktivnost' kak sposob sushchestvovaniya i razvitiya obraza mira // Printsip razvitiya v sovremennoy psikhologii / Otv. red. A. L. Zhuravlev, Ye. A. Sergiyenko. M.: Izd-vo «Institut psikhologii RAN», 2016. S. 215–234.

44. Tikhomirov, (1984). O.K. Psychology of thinking. Moscow: Moscow University Publishing house (In Russian).

Tikhomirov O.K. Psikhologiya myshleniya. M.: Izd-vo Mosk. un-ta, 1984.

45. Ukhtomskiy, A.A. (1954). Collected works / M.I. Vinogradov (Ed. in-chief). Leningrad: USSR Academy of Sciences Publishing House (In Russian).

Ukhtomskiy A.A. Sobraniye sochineniy / M.I.

Vinogradov (otv. red.). Leningrad: Izd-vo AN SSSR. 1954.

46. Ukhtomskiy, A.A. (1978). Selected Works. Moscow: Nauka (In Russian).

Ukhtomskiy A.A. Izbrannyye trudy. M.: Nauka, 1978.

47. Vityaev, E.E. (2007). Synthesis of logic, probability and learning in semantic probabilistic inference // Integrated models and soft computing in artificial intelligence. Proceedings of the 4th International Scientific and Practical Conference (Kolomna, 2007). Moscow: Fizmatlit, V. 1. S. 133–140 (In Russian).

Vityaev E.E. Sintez logiki, veroyatnosti i obucheniya v semanticheskom veroyatnostnom vyvode // Integrirovannyye modeli i myagkiye vychisleniya v iskusstvennom intellekte. Sb. trudov 4 Mezhdunarodnoy nauchno-prakticheskoy konferentsii (Kolomna, 2007). Moskva: Fizmatlit, 2007. T. 1. S. 133–140 (In Russian).

48. Vityaev, E.E. (2008). Principles of the brain activity, contained in P.K. Anokhin's theory of functional systems and P.V. Simonov's theory of emotions. Neuroinformatics. 3(1), 25–78 (In Russian).

Vityaev E.E. Printsipy raboty mozga, sodержashchiesya v teorii funktsional'nykh sistem P.K. Anokhina i teorii emotsiy P.V. Simonova // Neyroinformatika. 2008. T. 3. No 1. S. 25–78.

49. Vladykina, N.P. (2008). On the laws of the work of consciousness in nondiscrimination region. Bulletin of St. Petersburg University. Series 12: Psychology. Pedagogic. Sociology. Issue 2. St. Petersburg University Publishing house, P. 17–122 (In Russian).

Vladykina N.P. O zakonomernostyakh raboty soznaniya v zone nerazlicheniya // Vestnik Sankt-Peterburgskogo universiteta. Seriya 12: Psikhologiya. Pedagogika. Sotsiologiya. Vyp. 2. SPb.: Izd-vo S–Pb. GU, 2008. S. 117–122.

50. Zhelankin, R.V., Skotnikova, I.G., Selivanova, L.A. (2021). Characteristics of decision making in slow-warm lizards (*Anguis fragilis*) when discriminating between three kinds of visual stimuli. Izvestia Irkutsk State University, series "Psychology" 36 (16), 16–37.

Zhelankin R.V., Skotnikova I.G., Selivanova L.A. Kharakteristiki prinyatiya resheniya u yashcherits – veretenits lomkikh (*Anguis fragilis*) pri razlichenii trekh vidov zritel'nykh stimulov // Izvestiya Irkutskogo Gos. Universiteta, seriya "Psikhologiya". 2021. №1 T.36. No 16. S.16–37.

51. Zinchenko, V.P. (1978). Functional structure of executive (perceptual-motor) actions. *Ergonomics. VNIITE Proceedings. Moscow*, 16, 3–38 (In Russian).

Zinchenko V.P. Funktsional'naya struktura ispolnitel'nykh (pertseptivno-motornykh) deystviy // *Ergonomika. Trudy VNIITE. Moskva*, 1978. No 16. S. 3–38.

52. Zinchenko, V.P. (2011). Alexey Alekseevich Ukhtomsky and psychology // *Style of thinking: the problem of the historical unity of scientific knowledge. To the 80th anniversary of Vladimir Petrovich Zinchenko / under total ed. T.G. Shchedrina. Moscow: ROSSPEN*, P. 231–271 (In Russian).

Zinchenko V.P. Aleksey Alekseyevich Ukhtomskiy i psikhologiya // *Stil' myshleniya: problema istoricheskogo yedinstva nauchnogo znaniya. K 80-letiyu Vladimira Petrovicha Zinchenko / Pod obshch. red. T.G. Shchedrinoy. M.: ROSSPEN, 2011. S. 231–271.*

53. Zhuravlev, A.L., Kharlamenkova, N.E. (2018). A dynamic approach to human mental life study. *Institute of Human: idea and reality / Ed. in-chief G.L. Belkin, ed.-comp. M.I. Frolov. Moscow: Lenand, P. 280–290* (In Russian).

Zhuravlev A.L., Kharlamenkova N.Ye. Dinamicheskiy podkhod k issledovaniyu psikhiki cheloveka // *Institut cheloveka: ideya i real'nost' / Otv. Red. G.L. Belkina; red.-sost. M.I. Frolova. Moskva: Lenand, 2018. S. 280–290.*

54. Znakov, V.V. (1998). Human spirituality in the mirror of psychological knowledge and religious beliefs. *Questions of Psychology. 3*, 104–114 (In Russian).

Znakov V.V. Dukhovnost' cheloveka v zerkale psikhologicheskogo znaniya i religioznoy veri // *Voprosi psikhologii. 1998. No 3. S. 104–114.*

55. Znakov, V.V. (1999). *Psychology of Truth Understanding. St Petersburg: Aleteya* (In Russian).

Znakov V.V. Psikhologiya ponimaniya pravdy. St Petersburg: Aleteyya, 1999.

56. Znakov, V.V. (2016). *Psychology of Human World Understanding. Moscow: "Institute of Psychology RAS" Publishing house* (In Russian).

Znakov V.V. Psikhologiya ponimaniya mira cheloveka. Moskva: Izd-vo «Institut psikhologii RAN», 2016.

57. Znakov, V.V. (2021). *Psychology of the Possible. Moscow: "Institute of Psychology RAS" Publishing house* (In Russian).

Znakov V.V. Psikhologiya vozmozhnogo. Moskva: Izd-vo «Institut psikhologii RAN», 2021.

Funding. The work was supported by the RF State Assignments nos. 0138-2021-0006