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THE SYNTHETIC CHARACTER OF SYSTEMIC THINKING AND COGNITIVE PROCESSES

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Abstract. A general approach to problem solving based on the synthetic nature of thought processes is considered. The cognitive approach considers human thought processes as a systemic property of an open self-organizing sociobiological system. There is a transition from what can be called the "century of analysis" to the "century of synthesis". The changes that are taking place are already putting pressure on real decision-making processes in management practices, and people who consider these changes and understand their meaning are better equipped to take advantage of the opportunities presented to them.

Keywords*:* analytical method, synthesis, holism, imagination, mind, intuition, system thinking, cognitive science.

THE SYNTHETIC NATURE OF SYSTEMIC THINKING

The general approach to problem-solving is presented as a cyclical process. To solve the problem, systemic study is carried out, including decomposition, analysis and synthesis, as a result of which the problem is removed. The main creative component in the named process is synthesis. The result of synthesis is a completely new formation, the property of which is not only the external sum of the properties of the components, but also the result of their interpenetration and interaction. Therefore, the true synthesis is not an aggregate, but a creative synthesis. However, analytics and so-called analytical thinking used to be the main cognitive tools for a long time. The essence of the method of analytical thinking, by R. Descartes, was created to the complex phenomenon into parts and understand the behavior of the whole based on the properties of these parts. [1].

Ideas raised by scientists in the first half of the XX century (A. A. Bogdanov, biologists L. fon Bertalanfy and J. Haldane), contributed to the emergence of a new way of thinking – *systemic thinking* based on connectivity, relationships and context.

In accordance with the system views, the essential properties of the living system are the properties of the whole, which does not have any of its parts. New properties arise from interactions and relations between parts.

The belief that in any complex system the behavior of the whole can be fully understood via the properties of its parts was central to the Cartesian worldview. In an analytical, or reductionist, approach, the parts themselves can be analyzed further, only by reducing them to even smaller parts. Western science developed in this way, and at each stage had to deal with a certain level of fundamental components, to analyze that was not possible.

However, the system cannot be understood by analysis. The properties of parts are not their intrinsic properties, but can only be understood in the context of a larger whole and can only be derived from the organization of the whole. Systemic thinking does not focus on the basic elements, but is interested in the basic principles of the organization. It is contextual, which is the opposite of analytical thinking. Analysis means the separation of something in order to understand it; systemic thinking means the placement of something in the broader context of the whole.

In the transition from mechanistic thinking to systemic thinking, the interrelation between the parts and the whole becomes the opposite. But, ultimately - it is shown by quantum physics –there are no parts at all. What we call a part is just a pattern (object, image, construction, repetitive action) in an indivisible web of correlations.

Experiments and studies of recent decades have discovered the dynamic nature of the world of particles. Any particle can be transformed into another; energy can be transformed into particles and conversely. Existing at this stage of cognition models of description of subatomic reality reflects the deep unity and the mobility of matter. They show that the properties of a particle can only be understood through its activity, that is, its interaction with the environment, and that the particles should not be considered as independent units, but as inseparable parts of the whole. The results of studies of all these complex processes and phenomena of the microcosm and their philosophical understanding were carried out by many physicists of the XX century [2-6].

Therefore, the transition from parts to the whole can be seen as a transition from objects to relations. Thinking systemically, we can understand that the objects themselves are networks of correlations, included in the larger network. For systematically thinking man correlations are primary. The boundaries of the discernible patterns are secondary.

However, the new approach to science raises an important question. If everything is connected to everything, how can you hope to understand anything? The discovery of approximate knowledge makes it possible to turn a systematic approach into a science. The new paradigm recognizes that all scientific concepts and theories are limited and approximate. Science can never provide a complete and definitive understanding.

The science of the twentieth century, appeared out of the Cartesian separation, now overcomes its limitations and returns to the idea of unity expressed by the ancient philosophers of Greece and the East. In the first half of the last century the doctrine of integrity – holism (from greek. *holon* - whole) was born. The doctrine was founded by J. Haldane and presented in his work "Philosophical basis of biology" [7]. Holism comes from the integrity of the world as the highest and all encompassing integrity —both qualitatively and organizationally, — integrity, encompassing the area of psychological, biological and external, the most rational physical reality. All these areas represent a simplification and isolation of this encompassing integrity.

In recent decades, the interpenetration of the cultures of the rational West and the intuitive East has been increasing. There is a confirmation of the idea of the need for a *dynamic balance* between *the rational* and *the intuitive*, between the external and the internal, that is, applied to our century – between *technology* and *psychology*.

Paradigm shift requires improving not only our perceptions and thinking, but also the value system itself. Changes in thinking gradually lead to changes in values. These processes can be seen as a shift from self-affirmation to integration. Good and healthy is characterized by dynamic equilibrium; bad or painful is caused by imbalance – overestimation of one tendency and neglect of another. Turning to Western industrial culture, one can see a clear reassessment of self-assertion and underestimation of integration. This dominates both in thinking and in the value system.

The German philosopher I. Kant made a fundamental contribution to the theory of knowledge, to the development of its analytical and synthetic component. He established that fundamental scientific solutions lie in the field of reflexive analysis of the concept-predicate relation. Reflection can be seen not on the diode, but on more complexly organized social groups, united by significant joint activities; for example, a corporation, the stock market and others. Space and time are understood as the most important elements of such reflection. They create conditions for experience.

Kant singled out three *cognitive* (active) abilities: 1) *the imagination,* 2) *the reason* and 3) *the mind*; and one *perceiving* (passive) ability – *the sensual intuition*. Thus, the active part of the mind Kant associated with intelligence, and passive, receptive part of the mind he called intuition [8].

The most important value of imagination is that it allows the subject to present the result of the activity before it starts, thereby orienting him in the process of this activity. The imagination acts in unity with thinking during the activity. The inclusion of imagination or thinking in the process of activity is determined by the degree of uncertainty of the problem situation, the completeness or lack of information in the source data of the problem. If the initial data are known, the course of solving the problem is subject mainly to the laws of thinking; if these data are difficult to analyze, the mechanisms of imagination. The value of imagination is that it allows you to make a decision in the absence of the necessary completeness of knowledge necessary to perform the task. However, in this case, the ways of solving the problem are often not accurate enough, not strict and cause the limitation of imagination.

The processes of imagination have *analytical and synthetic character*, as well as the processes of thinking, memory, perception. The main trend of imagination is the transformation of memory representations, providing, ultimately, the creation of a deliberately new, previously non-arisen situation; reflection of reality in new, unusual, unexpected combinations and connections. *The synthesis of representations* in the processes of imagination is carried out in different forms: agglutination - connection of qualities, properties, parts of objects that are not connected in reality; hyperbolization — increase or decrease of objects; sharpening — emphasis of the attributes; schematization – smoothing of the differences and identification of similarities; typification — selection of significant, repeated in homogeneous phenomena.

The reason and the mind in the philosophical and psychological tradition are two types of logical thinking. Reason, being one of the moments of the movement of thought to the truth, operates within the existing knowledge of these experiences, arranging them according to the established rules. Reason provides material for the mind through the formation of concepts and judgments through reasoning.

The mind gives knowledge of a deeper and more generalized nature. It has the ability to analyze and summarize both the data of sensory experience and its own forms, thoughts and to develop concepts reflecting the dialectics of the objective world. Going beyond the limits of available knowledge and the generation of new concepts is the main difference between mind and reason. The mind is constructive, reflective, focused on social goals of the highest level. The desire to understand the world through the mind and to transform it according to mind is called *rationalism*. Along with sensual intuition, the mind is the basis of our knowledge.

The intuition is knowledge that occurs without comprehension of the ways and conditions of its receipt, whereby the subject has it as a result of "direct discretion". It is considered as a necessary, internally determined by the nature of creativity moment of going beyond the existing behavior stereotypes and, in particular, a logical program to find a solution to the problem.

A key provision of the I. Kant: *reason can give nothing to the intuition, the feeling of anything can't think. Only through their "union" (synthesis) can one come to knowledge.* It brings you closer to the understanding of the "paradoxical" relations between the reason and intuition and has much in common with the above-mentioned conceptions of philosophers on the necessity of dynamic balance between the *rational* and the *intuitive*.

According to Kant, *analytical (or explanatory)* judgments are judgments, the predicate of which is already contained in the subject in advance. *Synthetic (or expanding)* are judgments that *add* to the concept of the subject a predicate, which is not yet implied in the knowledge of the subject. Here lies the answer to the central question of "Criticism of pure reason": How are a priori synthetic judgments possible? Synthetic means: adding (philosophy adds or expands previous knowledge); productive (philosophy develops knowledge of the "beyond").

Habitual causal thinking does not work when you have to deal with systems, because it tends to see everywhere the action of simple, localized in space and time cause-effect correlations, rather than combinations of mutually influencing factors. In systems,

cause and effect can be far separated in space and time. The consequence can appear only after a few days, weeks and even years, and we need to act now. If we are unable to establish links between causes and effects, it will be difficult to learn from experience and make intelligent decisions. But logical analysis can also be misleading, and obvious solutions can make a situation worse than it was, and getting out of it can turn out to be somewhat counterintuitive.

It is obvious that each area of human knowledge in its development goes from analytical and descriptive methods to synthesis and integration. Trends in the transition to synthesis and systemic thinking can be observed in business. Humanity is in a state of transition from one era of thinking and activity to another – from what can be called the "century of analysis" to the "century of synthesis". The changes are already putting enormous pressure on the real decision-making processes in business, and people who consider these changes and understand their meaning are better equipped to take advantage of the opportunities presented to them [9].

MECHANISMS OF COGNITIVE PROCESSES

The development of computer technologies and advances in neurophysiology and artificial intelligence research have provided new opportunities and allowed to clarify and refine the formulation of some fundamental philosophical problems and made it possible to implement some simple functions of the human brain on the computer.

However, the purpose of research in these areas and the development of intelligent systems are not to replace the human brain with a computer, but to create an effective symbiosis between a human and a computer equipped with appropriate intellectual modules, models and methods. This approach is based on the fact that when faced with complex systems, the brain exhibits abilities far superior to the most complex methods implemented on computers.

Despite the success of artificial intelligence, as well as neurophysiology, psychology and other Sciences, there is a reason to believe that some of the abilities of the human brain will never be fully understood. The most valuable properties of the human brain are intuition, insight, ability to global reach, possession of metaphor.

However complex systems have often properties that cannot be intuitively understood and globally evaluated. These properties often push people to wrong ideas. In this respect, the brain is not very strong and limited in its capabilities, and detailed analysis is exactly the area where the computer surpasses it. This property of the computer allows it to play an important role as an amplifier of intuition. Using a computer as a guarantor and an amplifier of intuition with the support of management decisions and solving system problems is one of its two most important applications. Another is its use in research related to the world cognition and knowledge about man. In this case, it is used for experiments with systems modeled on it.

Cognitive psychology. At the end of the 50-ies of the last century, scientists are increasingly interested in cognitive topics - attention, memory, pattern recognition, problems of language and thinking; however, these processes were discussed at a new level. The beginning of a new approach can be found in the works of the psycholinguist J. Miller, his apprentice W. Neisser, and J. Bruner, who are the founders of cognitive psychology as a scientific direction [10-12]. The authors used the term "cognitive psychology" to contrast behaviorism, aiming to engage not only the study of behavior, but also mental processes and proof of the decisive role of knowledge in human behavior.

The theory of cognitive dissonance explains the impact on human behavior of the system of cognitive elements that can cause a negative incentive state in a situation where a person simultaneously has two psychologically contradictory knowledge about one object. The state of dissonance is experienced as discomfort, which is sought to get rid of either by changing one of the elements of dissonant knowledge, or by introducing a new element. L. Festinger defined dissonance as a consequence of insufficient justification of choice [13]. In an effort to strengthen the jus-

tification of the act, a person either changes his behavior, or changes his attitude to the objects with which the act is associated, or devalues the value of the act for himself and the others.

Cognitive science. Simultaneously with the development of cognitive psychology began to develop the science of cognitive processes and thinking – cognitive science (from the Latin cognition - knowledge, cogitation - thinking) [14]. It studies the laws of the processes of perception, cognition, understanding, transformation, representation, thinking, reflection and learning, and models the principles of organization and operation of natural and artificial intelligent systems, based on analytical, synthetic and synergetic approaches. Cognitive science unites a whole family of disciplines with a single problem and similar methodological principles.

SYSTEMIC COGNITIVE THINKING

Human cognitive processes are analyzed both in their connections and interactions with each other and with other areas of the human real world. Based on the awareness of the importance of the above-discussed synthetic nature of thinking, systemic mechanisms of cognitive processes and principles of synergetic thinking, we can say that the cognitive approach considers the cognitive processes of man as a systemic property of an open self-organizing sociobiological system.

The current wave of the cognitive revolution is different from the one considered by G. Miller in article [15]. It is more related to cognitive approaches to understanding and understanding the importance of not only rational human activity, social groups and computer systems, but also to explaining its emotional manifestations and intuition. The development of cognitive science is on the way to more and more deepening in such "irrational" areas as intuition and creativity.

Researchers and people from the field of practical management are faced with the need to describe and comprehend the rapid processes of finding solutions; separate meaningful results from chaotic, often meaningless initial information; unpredictability of the course of development through critical states; observation and description of the processes of ordering at the macro level through the disorder at the micro level. Today we can speak about the dynamic development and implementation of management practices the system of cognitive-synergetic approach [16].

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