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Abstract: introduction of the idea about multidimensional thinking and its main concepts and methods. Multidimensional thinking is analyzed within thoughts about complex thinking developed by E. Morin and G. Deleuze. Multidimensional thinking is viewed as an efficient way of exploring

Multidimensional thinking as way of exploring complexity: civilization challenge

From the beginning of the 20th century, complexity in all varieties of its manifestations has become an increasingly attractive research topic. For example, nowadays there are special centers – French Association of Complex Thinking, headed by E. Morin (Association pour la pensée complexe) and German Society on Research of Difficult Systems and Nonlinear Dynamics (Deutsche Gesellschaft für Komplexe Systeme und Nichtlineare Dynamik) – that are developing methods of interdisciplinary analysis to study complexity. In addition, there are the Santa Fe Institute of multidisciplinary studies and the Centre d'Études Transdisciplinaires (Sociologie, Anthropologie, Histoire, CETSAH) at the National Center for Scientific Research (CNRS) in Paris that are also involved in this field.

The problem of *difficult thinking* or "*thinking in complexity*" (K. Mainzer) takes a special place among numerous problems that manifest themselves in the process of exploring complexity. Ideas about complexity emerge and differentiate due to the perfection of people's powers of apprehension. The developing thinking facilitates the discovery of a new level of complexity. For that very reason, researches of complexity should accompany the corresponding apprehension of new opportunities of thinking.

In 2013 Ukraine published a book "Philosophy of Thought" in which a number of Ukrainian and Russian philosophers reflect on new ways of thinking, which have originated recently. Presented publications deal with *complex thinking* (V.I. Arshinov, E.N. Knyazeva, and Ya.I. Svirskiy), *nonlinear thinking* (I.S. Dobronravova, I.V. Yershova-Babenko, and *multidimensional thinking* (L.N. Bogataya, F. V. Lazarev).

First, ideas about *complex thinking* originated in the European tradition and simultaneously have continued to develop in several research perspectives.

E. Morin is working in one of these directions. He is the president of Association of Complex Thinking, i.e. the special organization that focuses on studying new cogitative aspects. According to Morin, complex thinking means *free thinking* capable of overcoming fragmentation and divide, which define modern intellectual environment. Edgar Morin calls for the cultivation of variety along with the corresponding development of thinking capable of encompassing this variety as a single unit. E. Morin set forth principles of complex thinking [3].

A German philosopher K. Mainzer associates development of complex thinking with the actualization of nonlinear thinking, with the development of innovativeness, with the controlled emergence, and with researches of trends in the development of complex systems.

A well-known Chilean neurobiologist F. Varela linked complex thinking with ideas of autopoiesis and enactivism. According to them, an observer or a conscious subject become part of continuously changing environment (evolutionary constructivism).

It is possible to consider separately the development of ideas about complex thinking in connection with the idea of the network organization of complexity (M. Castells).

Creative works of two French thinkers G. Deleuze and F. Guattari directly deal with practice of complex thinking. The consecutive reflection of this aspect of complexity development is an extremely interesting research task.

However, the analysis of existing attempts to explore complex thinking suggests that the majority of relevant studies are *descriptive* in nature. They form a great number of terms describing and defining complex thinking, but they do not consider practical aspects of complex thinking.

In our opinion, the development of *multidimensional thinking concepts* is the practical way to explore complexity.

Nowadays there are many definitions of complexity. Perhaps the main features of modern understanding of complexity can be described as the following: complexity is *the entirety (holism), existing as the simultaneous manifesting multiplicity in a state of continuous changes*. The fact that a subject observing complexity is located inside this complexity and makes up a whole with it is very important. Due to the subject's involvement (incorporation), *complexity* does remain in a state of continuous change (evolutionary constructivism).

Ideas about multidimensionality allow taking steps to complexity exploration. For the first time, a number of Russian researchers used a term multidimensionality to develop the methodology of social researches (V.L. Altukhov, V.Zh. Kelle, M.Ya. Koval'zon, etc.). For example, economic, political, cultural, and social aspects of development in one or another social system were considered as its various dimensions. Thereby any social system became multidimensional. Unfortunately, these ideas were not practically developed. At the same time (without the use of the multidimensionality term) researchers were developing the interval approach that was forming the methodology for the development of intervals of abstraction (F.V. Lazarev, M.M. Novoselov). These ideas are closely connected with the modern formation of understanding about multidimensionality.

The new stage in development of ideas about multidimensionality began due to the introduction and subsequent analysis of ideas about multidimensional thinking (L. Bogataya [1]).

The word *multidimensionality* originates from the term *measure*. Multidimensionality is virtually the simultaneous implementation of a variety of dimensions. The real number of dimensions can change according to cognitive skills of a subject. Thereby, multidimensionality comes across as a way of development of complexity because one of the main characteristics of complexity is the unity of many complexity fragments that differentiate significantly as for their nature. Therefore, they demand for various ways of measurement. Due to multidimensional thinking, there is a possibility to understand (explore) complexity.

In 2010 L. Bogataya published a book "On the Way to Multidimensional Thinking," which contains ideas about multidimensional thinking and defines its main methods.

The updated ideas about *thought, sense, focused semantic space, and concept*, became the philosophical basis for multidimensional thinking.

Thought is defined as a *complex formation* developed with the help of terms. The thought is explored in the course of thinking. *Thinking* is the processing, i.e. "digestion" of thought. *Senses* originate and reveal themselves in the course of thinking. Every thought is able to generate a great number of senses.

The *focused semantic space* is the specific manifestation of grammar environment. Each focused semantic space is formed with the help of terminological basis, i.e. a set of key terms that form this space. For example, a single scientific publication can be considered the focused

semantic space. The key terms in this publication are the terminological basis for the corresponding space. The process of thinking takes place in such semantic spaces. Taking into account this approach, it is the discovery and explication of meanings that emerge in the development of one or another thought.

The terminological feature plays a key role in the formation of focused semantic spaces. Any focused semantic space contains both *conventional, traditional, and typical* terms and terms that have again manifested themselves. If we examine focused semantic spaces from the perspective of complex self-organizing systems, we may speak about the existence of a unique terminological emergence that results in the discovery of crucially new terms defining new order parameters. Studying focused semantic spaces, we can examine their coherence and the degree of their homogeneity or heterogeneity. Concepts help to bring order to the focused semantic spaces.

Concept in this approach is regarded as *term*, which corresponds to an open set of senses. The concept serves as a so-called order parameter for some varieties of senses that exist in focused semantic spaces. The study of this concept is originally the study of senses, which correspond to the concept, and the study of their subordination.

Methods of work with senses

To understand clearly different types of work with senses, the developing concept of multidimensional thinking introduced an idea about four methods of sense operation.

Manifestation of sense is the first method. It is associated with the first detection of sense from thought. The terminological construct helps the manifestation of sense become real. The terminological construct is a number of terms that help clarify thought in the first place (see more details on this topic in the monograph []).

Clarification of sense is the second method. It is an attempt to bind a newly discovered sense with other senses that already exist within the focused semantic space.

Confirmation of sense is the third method. Due to this one, it is possible to state fully the discovered sense with the help of terms that are efficiently operating in the given semantic space. On the one hand, clearly confirmed new sense deforms the preexisting semantic space, but on the other hand, it facilitates its development.

Use of sense is the fourth method, which is related to the free flow of manifested, understood, and confirmed senses from one focused space to another. For example, if someone wants to use the idea of *multidimensional thinking* in his or her arguments, it will be a simple example of terminological diffusion and, partly, diffusion of senses.

From the above mentioned it is understood that any interdisciplinary studies can be viewed as a practical attempt to develop various focused semantic spaces simultaneously. Complex disciplinary fields are reduced to focused semantic spaces. In their turn, these fields can be represented by a number of individual focused spaces.

On the one hand, the work with focused semantic spaces is implemented due to practice of *understanding* that was traditionally developed in philosophy and cognitive science. On the other hand, the work with focused semantic spaces allows their unique implementation of *measurement*. For that very reason, the view of the *multidimensional thinking* – thinking that simultaneously performs multiple measurements – is actualized.

It is possible to confirm the following cognitive chain: *thinking – measurement – understanding*. In addition, *measurement* is conceived as the correlation, i.e. the binding of newly detected senses with senses that were detected earlier.

Figuratively, multidimensional thinking can be described as three methods that are implemented at the same time.

The *first method* is associated with the development of specific focused semantic spaces.

The *second method* is the **simultaneous actualization** of a number of explored focused semantic spaces. It is important to emphasize that many of these spaces are actualized spontaneously, as if surfacing from memory.

Finally, the third method. Virtually the act of multidimensional thinking is carried out for the sake of it. It is the emergence of a new thought that manifests itself as a result of a sudden,

rational unpredicted integration, i.e. collision of sufficiently different semantic spaces (individual senses). Spontaneity of space integrations allows us to assume that multidimensional thinking is the manifestation of *bounded rationality*.

It is important to emphasize that a thought emerging during the multidimensional mental activity is developed in the very specific focused semantic space. Thereby, the multidimensionality that is used for the stimulation of processes of thought formation collapses to one-dimensionality, i.e. to one focused space.

Finally, to sum up we can conclude the following. **Multidimensional thinking** – is a set of specific cognitive methods aimed at the organization of thinking about *complexity*. For that very reason, *multidimensional thinking* can be considered the manifestation of *complex thinking*. Due to the development of ideas about multidimensional thinking, there is a way to develop many problems of complexity – plurality, instability, innovativeness, and a number of other problems. Multidimensional thinking does not exclude traditional formal thinking but supplements it, allowing comprehension of some modes of manifestation of complexity at the same time.

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Her fields of research are gnoseology, thinking theory, synergetics, philosophy of science, and cultural studies.

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