Information on the Space. Systems Transdisciplinary Aspect

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Abstract

The systems transdisciplinary model of spatial unit of order occupies a Central place among other models of the systems transdisciplinary approach. This model demonstrates the structure of potency of objects, which gives it the ability to expediently manifest and transform. This circumstance inextricably connects space, information and time. To prove this connection, the article uses two models of a spatial unit of the order. This is an analogue of the static and dynamic systems transdisciplinary model of spatial unit of order. On the example of the first model, the grounds for the appropriate manifestation of potency are described. On the example of the second model, the grounds for an appropriate transformation of potency are described. The author illustrates the practical possibilities of these models by the example of solving fundamental problems of Microbiology, chemistry, astrophysics, and political geography. The examples given in the article show that the basis of sustainable development of modern society can be based on the natural mechanism of self-organization of an object and functional ensembles of objects. This conclusion formed the basis of technologies for managing the state of natural, man-made and social objects, as well as methods for analyzing the risk of their complex interaction.

Keywords: Transdisciplinarity; Systems Transdisciplinary approach; Systems transdisciplinary model of spatial unit of order

Introduction

This is the final of three articles on the philosophy and methodology of the systems transdisciplinary approach, which follows from the general philosophical concept of V. S. Mokiy's unicentrism. This article focuses on space as a factor in this philosophy. In two previous articles on information and time, it has been suggested that the problems of modern society have one foundation. This is based on the difficulty of generalizing disciplinary

knowledge and establishing harmonious relations between people and States, between natural and artificial ecosystems, and between different ideologies and religions. Attempts to resolve these difficulties through knowledge of the subjective factors of social development fail.

Specialists in the humanities and social sciences refer to the theorem of the mathematician Goedel. Goedel argued that it was impossible to solve a problem while inside it (Raatikainen, 2015). This means that no matter how much we try to learn about society, nature, and the universe, we will al-ways have incomplete or contradictory and paradoxical knowledge. Getting a complete and consistent model of these complex objects can only be done by observing them from the outside. But how to do this? To do this, we need to change the method of cognition: to abandon dualistic perception, to go beyond the formal logic of Aristotle, to develop dialectical logic, by combining systems thinking and a transdisciplinary approach.

The purpose of this article is to acquaint readers with the theoretical basis of the systems transdisciplinary model of spatial unit of order, as well as to show the practical possibilities of this model by the example of overcoming the fundamental difficulties of cognition of the world.

Philosophy of space

Space-time is the fundamental construction of every explanatory world picture. In these pictures, space plays the role of an arena where the events of the world process unfold. At the same time, it is a direct participant in this process. This idea of space allowed to apply its image to any processes that are measured by time. As a result, today one can find terms of mathematical, physical, chemical, biological, historical, social and information space in the scientific literature.

Despite the fact that the debate between philosophers and scientists about the essence of space continues, this has not prevented all ideas about it to be reduced to its four most important types: The noumenal space is an intelligible image that forms the potency of the real world. The image of this space allows us to describe the basis of the universal order. Real space is the entire real physical (material) world that exists independently of human consciousness. Conceptual space is a physical, mathematical, and another disciplinary model of the scientific image of the real world that allows displaying the patterns of diverse interaction of parts of the real world as a system. Perceptual space is an image of the real world created by the human psyche on the basis of a direct re-flection of reality by the sense organs.

Concerning the variety of types of spaces V. K. Potemkin and A. L. Simanov (1990) write:

> The apparent evidence of the truth of the concept of space as the receptacle of all things and events for a long time hindered the

> development of the teachings about space. The cur-rent stage of the development of ideas about space gives grounds to assert that it should end with the creation of new theories, both scientific and philosophical, radically rethinking all existing views. This will be a revolution in the development of the doctrine of space. The fact that such a revolution is brewing is due, on the one hand, to the search for the theory of the great unification, and on the other – to the current philosophical rethinking of views on space. (p. 3).

Space is the concept of unicentrism

Trying to understand the essence of existing ideas about space, the author of the article drew attention to the fact that any kind of space is clearly or intuitively associated with potency – what can arise; the prospective future of the material world. It is potency that determines the physical and logical boundaries of the world; the ability to manifest (inform about yourself) and transform (achieve goals in appropriate processes). This is evidenced by the fact that none of the existing types of space in philosophy, in science and in ordinary life are not used without binding its logical extension – the existence of laws or the expectations of their manifestations; the presence of objects or waiting for their appearance; the availability of different types of movements or expectations of such movement; the availability of physical, psychological, historical and social processes or expectations of these processes. Therefore, space, as a form of existence of the potency of a One Orderly Medium, can play the role of a generalizing or generic concept of all types of spaces. More detailed results of philosophical research on this topic can be found in the relevant literature (Mokiy, 2009, 2011, 2013, 2019c).

Structure of the systems transdisciplinary model of temporal unit of order

In previous papers on information and time, it was shown that models of informational and temporal units of order implement static and dynamic aspects. Therefore, the systems transdisciplinary model of spatial unit of order has analogues of these aspects.

Analogous to the static systems transdisciplinary model of spatial unit of order

In accordance with the structure of static models of informational and temporal units of order, the analogue of the static systems transdisciplinary model of spatial unit of order consists of four specific spatial fragments (see Figure 1). These fragments determine the existence of potency, which are associated with etalon and real information of a quantitative and qualitative type. The potency of the etalon information sets the parameters of an appropriate transformation of matter, limited by strict development programs.

The potency of real information sets the parameters for an appropriate transformation of matter, limited by soft development programs.

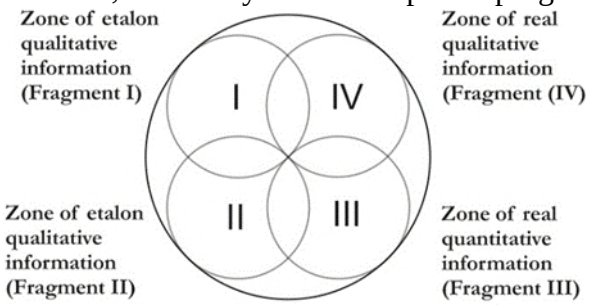


Figure 1. Analogous to a static systems transdisciplinary model of spatial unit of order (Zones of natural functional belonging)

On this basis, the results of the transformation of matter in fragments I and II will be as stable as possible to the influence of external factors. In turn, the results of the processes in fragments III and IV will depend on the influence of various external factors. More precisely: in fragment I, the desire to show the reference result will be experienced by the information of a qualitative form; in fragment II, the desire to show reference the result will be experienced by the information of quantitative form; in fragment III, the desire to show real the result will be experienced by the information of a quantitative form; in fragment IV, the desire to show real result will be tested by the information of a qualitative kind (Mokiy, 2019a).

Due to these circumstances, the spatial fragments of the systems transdisciplinary model of spatial unit of order are called zones of natural functional belonging (NFB). The natural functional be-longing of spatial fragments, as an invisible organizing force, determines the nature of the processes occurring in them. Examples of this characteristic influence can be found in various fields of science.

Confirmation of the structure of the systems transdisciplinary model of spatial unit of order in microbiology

From 1928 to 1935, the Swedish biologist, S. Horstadius, in a series of experiments, separated different layers of early sea urchin embryos with needles and observed their subsequent development. When the 8-cell embryo was divided in half through the animal and vegetative poles, normal pluteus larvae developed from both halves (see Figure 2b) If the embryo was divided along the equator (i.e. into the animal and vegetative halves), then none of the parts developed into a normal larva. The animal half turned into a hollow ball formed by ciliated epidermal cells (a delayed blastula), and the vegetative half developed into a slightly abnormal embryo with an expanded intestine (see Figure 2a).

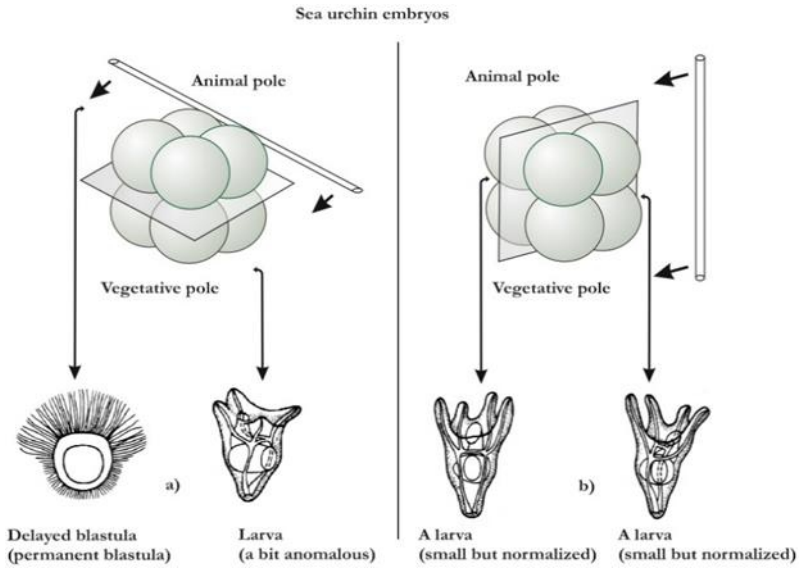


Figure 2. Illustration of S. Horstadius experiments with sea urchin larvae (by Gilbert 1994, p. 44)

Horstadius obtained similar results by cutting sea urchin eggs in half and fertilizing both halves separately. When the egg was cut meridianally, normal embryos developed from both halves of the egg (Figure 3b). However, if the egg was cut equatorially, then after fertilization of both halves, the fragments formed either a ciliated animal ball or an embryo with an expanded vegetative gut (see Figure 3a).

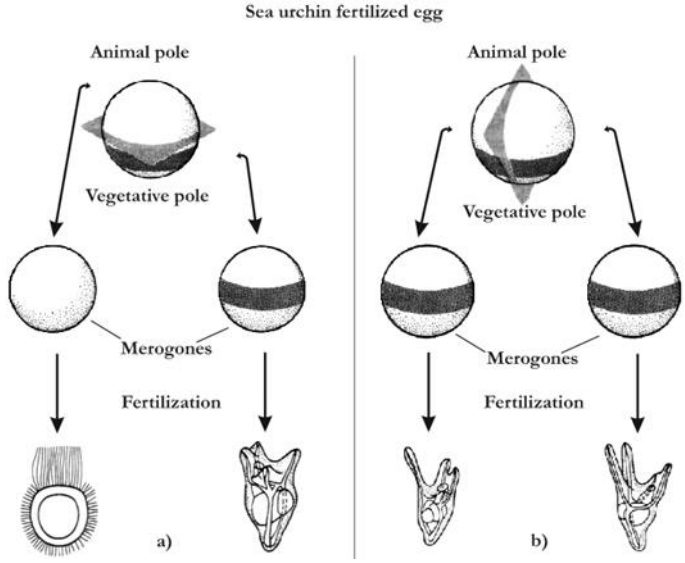


Figure 3. Illustration of S. Horstadius experiments with sea urchin eggs (by [Gilbert 1994, p. 44])

Despite the fact that experiments with the separation of a fertilized egg and the embryo of a sea urchin gave similar results, in the egg and embryo, it was not possible to isolate vegetative and animal factors. Also, failed to notice the influence of chemical elements or substances on the suppression or enhancement of the gradient of animation or vegetation. Therefore, as early as 1767, the German embryologist K. F. Wolff suggested that this force acts like gravity or magnetism (Gilbert, 1994).

This behavior of sea urchin embryos in experiments was explained in the framework of a systems transdisciplinary model of spatial unit of order. If the experimenters chose a zone of embryo space that included a set of complete information (quantitative and qualitative species), this led to the development of normal larvae. However, if a zone of information of only quantitative or only qualitative type was selected, this caused characteristic changes in development. When choosing a qualitative type of information zone, the embryo reproduced the image of the larva, but could not fully reproduce all its quantitative characteristics. When selecting information of a quantitative type, the embryo developed into an abnormal object, since there was no information about the qualitative characteristics of the larva. The formation and development of normal larvae determined the presence and constant interaction of the reference and real information of a quantitative type and a qualitative type.

Thus, the systems transdisciplinary model of spatial unit of order has solved the fundamental problem of "life force" in Microbiology. This explanation led to a deeper understanding of the mechanisms of embryonic development and the management of this development.

Experimental verification of a systems transdisciplinary model of spatial unit of order, with the participation of non-biological test objects

Experimental testing with quartz generators

In experiments conducted in the period from 1995 to 2001 at Kabardino-Balkar state University, the role of test-objects was played by quartz generators (Mokiy, 2009). All other things being equal, the left zone generators (G1, G2) tended to increase the number of fluctuations relative to their passport data. Generators of the right zone (G3, G4) tended to reduce the number of oscillations or were characterized by extreme instability (see Table 1).

Table 1. Quartz generators periods change under the influence of an organized space

GEOMETRY OF THE EXPERIMENT'S SPACE	GENERATOR (FREQUENCY 256 kHz)	NUMBER OF OSCILLATIONS PER 10 MICROSECONDS					
		01.11.95	21.11.95	22.11.95	27.11.95	28.11.95	29.11.95
G1 G4 Θ Θ Θ Θ G2 G3	G1	3,906272	3,906291	3,906284	3,906279	3,906287	3,906291
	G2	3,906271	3,906279	3,906274	3,906271	3,906276	3,906280
	G3	3,906268	3,906263	3,906259	3,906258	3,906260	3,906262
	G4	3,906265	3,906265	3,906259	3,906257	3,906260	3,906263

In 2008, the results of these experiments made it possible to create a hardware-analytical complex for monitoring the general state of the territory. For 12 years, this complex has been undergoing testing in one of the regions of the North Caucasus. In the course of testing, it was possible to establish a correlation between the current indicators of generators G3, G4, with the maximum probability of negative events: natural disasters – earthquakes, hurricanes, fires, negative social phenomena and man-made accidents.

Experimental testing involving supersaturated solutions of chemicals

In experiments on the study of zones of natural functional belonging, which were conducted in 1998 At the Centre for engineering safety at the Moscow State Construction University, the role of test objects was played by oversaturated solutions of chemicals (Tamrazyan et al., 1999). In experiments, other things being equal, the natural formation of crystals occurred (see Table 3).

Table 2. Results of experiments on growing NaCl crystals

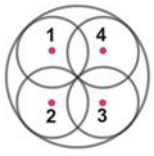
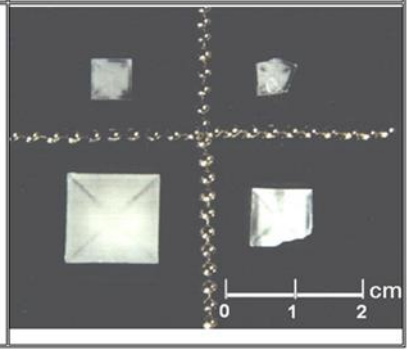
GEOMETRY OF EXPERIMENT'S SPACE	RESULTS
	

Table 2 shows the results of an experiment involving an oversaturated solution of table salt (NaCl). According to theoretical assumptions, the salt crystals showed their quantitative and qualitative characteristics depending on

the location of the laboratory vessel in the experimental space. Small crystals were formed in the zone of high-quality information (I, IV). Large crystals were observed in the quantitative zone (II, III). The results of such experiments demonstrate the current state of the territory where the experiment was conducted. In turn, the state of the territory is influenced by many natural, man-made and anthropogenic factors. Therefore, the size of salt crystals from experiment to experiment, conducted over the course of a calendar year, changed significantly but maintained the identified trend. This circumstance allows us to talk about new technological possibilities for more effective management of the transformation of the potency of chemicals, the formation of properties that are difficult or impossible to obtain under normal conditions.

Confirmation of a systems transdisciplinary model of spatial unit of order in astrophysics

The basis of the nuclei of chemical elements is protons and neutrons. These elementary particles differ from each other in the arrangement of quarks – special fundamental particles. According to the Gell-Mann quark model, a proton consists of three quarks: two "upper" (u) and one "lower" (d) - (quark structure: u-u-d). Neutron consists of one "upper" (u) and two "lower" (d) quarks - (quark structure: u-d-d) (Vasiliev, 2016). In accordance with the systems transdisciplinary model of spatial unit of order, the bunch of "upper" (u) quarks and "lower" (d) quarks provides the proton and neutron with the necessary set of complete information: reference information of quantitative and qualitative form (see Figure 4). This shows the same "life force" effect that the microbiologist S. Horstadius discovered. Figuratively speaking, this bundle of quarks plays the role of "dogmatic axioms" of matter.

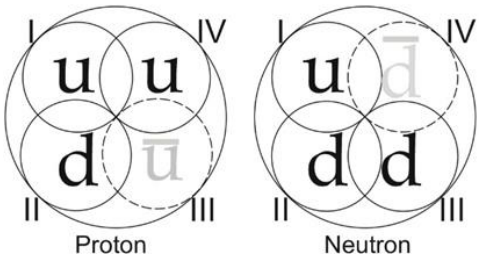


Figure 4. Quark structure of proton and neutron in a system transdisciplinary model of a spatial unit of the order

The addition of the "upper" quark (u) to the quark structure, which is the carrier of real information of a qualitative kind, allows the elementary particle to become a proton. As a carrier of real information of a qualitative type, the proton is characterized primarily by an electric charge. So adding a proton into space formed the nucleus of an atom leads to the finding that the core of a new identity, to the formation of a new atom of a chemical element.

Adding a “lower” quark (d) to the quark structure, which is a carrier of real quantitative information, allows the elementary particle to turn into a neutron. As a carrier of real quantitative information, the neutron is characterized by mass. Unlike a proton, a neutron preserves the identity and stability of an atom of a chemical element. Therefore, an increase in the number of neutrons with a constant number of protons makes the chemical element an isotope.

Examples of describing the self-organization of modern society using the model of ternary counterpoints

The knowledge that modern humanity possesses is classified according to the need to justify it. The basis of the first group is the knowledge that does not require substantiation. We accept this knowledge without much reasoning. They fully meet our sense of life, and which we do not want to question. The basis of the second group is the knowledge that requires substantiation. Moreover, not only the fact of justification is important here, but also the methods of obtaining information, as well as methods of substantiating them (Nikiforov (2009).

The knowledge that does not require its justification includes knowledge of the unconditional (ab-solute) and intuitive type. This knowledge corresponds to knowledge of religion and myth. The knowledge that requires its substantiation through logical and empirical evidence obtained using inductive or deductive methods should include knowledge of the speculative type and empirical type. This type of knowledge includes knowledge of philosophy and science (Mokiy, 2019b). Taking into account these characteristics, knowledge can be generalized within the framework of a systems transdisciplinary model of spatial unit of order (see Figure 5).

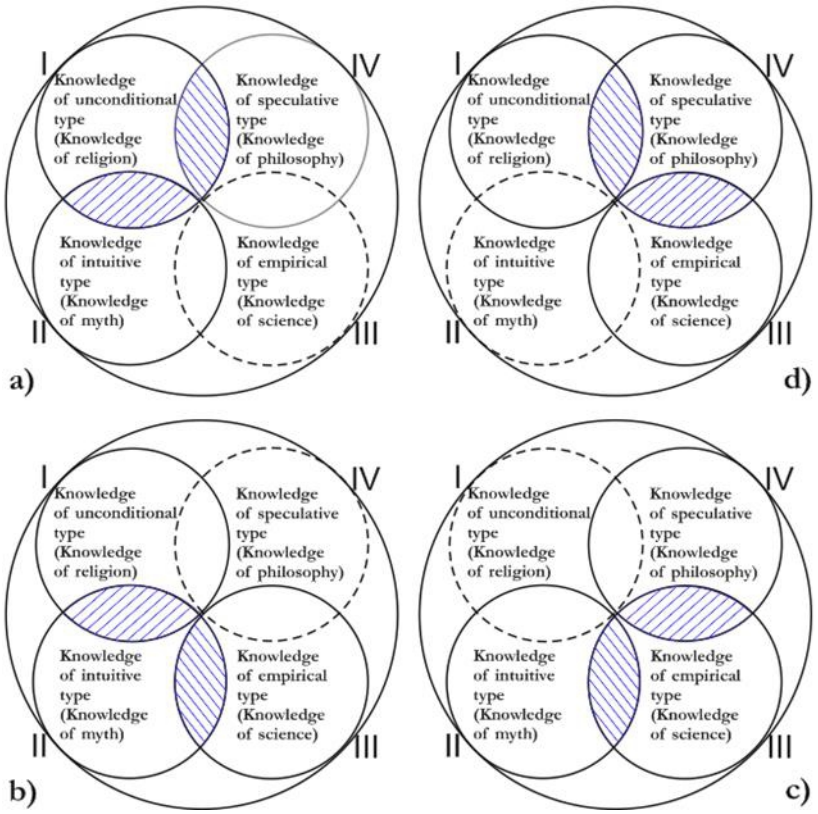


Figure 5. Relations of the main types of knowledge in the structure of the universal human worldview

The results of this generalization allow describing the natural mechanism of knowledge relations of various kinds, which can become the basis of the universal human worldview. Knowledge of religion (I) and myth (II) play the role of dogmatic components of the human worldview, which are characterized by dogmatic axioms. Dogmatic components of the worldview mutually control the meaning and content of their own knowledge. In turn, knowledge of science (III) and philosophy (IV), under certain circumstances, play the role of verification and falsifying components (see Figure 5 a, b). In the appropriate situation, they support and strengthen dogmatic axioms, or refute them. What is fundamentally new in this case is the statement that knowledge of religion and myth must play the role of verification and falsifying components in relation to knowledge of philosophy and science (see Figure 6 c, d). The relations of knowledge, as well as their role in strengthening, proving and refuting the logical completeness of the basic axioms based on specific knowledge, are shown in Table 3.

Table 3. Axioms of strengthening basic types of knowledge

AXIOMS OF AMPLIFICATION THAT DEFINE AND/OR CONTROL THE LOGICAL COMPLETENESS OF THE AXIOMS OF BASIC KNOWLEDGE	THE SET OF AXIOMS OF BASIC KNOWLEDGE, WHICH ARE SUBJECT TO AMPLIFICATION (PROOF OR REFUTATION)	AXIOMS OF AMPLIFICATION THAT SUPPORT AND/OR DEVELOP THE LOGICAL COMPLETENESS OF THE AXIOMS OF BASIC KNOWLEDGE	FALSIFYING COMPONENT
Intuitive type knowledge axioms	Unconditional type knowledge axioms	Speculative knowledge axioms	Empirical type knowledge axioms
Unconditional type knowledge axioms	Intuitive type knowledge axioms	Empirical type knowledge axioms	Speculative knowledge axioms
Intuitive type knowledge axioms	Empirical type knowledge axioms	Speculative knowledge axioms	Unconditional type knowledge axioms
Unconditional type knowledge axioms	Speculative knowledge axioms	Empirical type knowledge axioms	Intuitive type knowledge axioms

The content of each basic axiom, as well as the axioms of its confirmation, strengthening and refutation, is the subject of research in many scientific disciplines. Therefore, when forming a universal worldview, it should be taken into account that the same axiom described within the same discipline can play the role of a basic axiom, or an axiom of verification, or an axiom of falsification.

Analogous to the dynamic systems transdisciplinary model of spatial unit of order

In accordance with the structure of dynamic models of informational and temporal units of order, the analogue of the dynamic systems transdisciplinary model of spatial unit of order consists of successively decreasing spatial fragments. Fragments with the same radius form the fabric of space (see Figure 6).

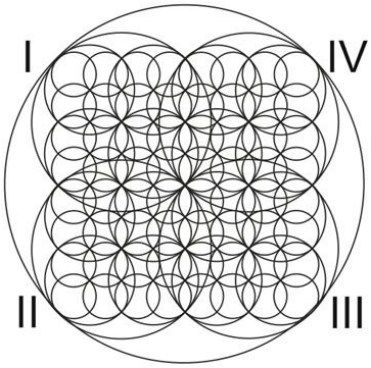


Figure 6. Systems transdisciplinary model of spatial unit of order (Fabrics of space)

The first fabric is represented by a single (basic) spatial fragment. The second fabric consists of four spatial fragments. The third fabric consists of 16 spatial fragments. And the fourth fabric consists of 64 spatial fragments. The size of each tissue fragment is reduced by half. If necessary, you can exit this spatial unit of order. If there was a necessity to look deep into space, the role of the basic spatial fragment of the next unit of the order can be executed by each of 64 spatial fragments. If you need to look beyond the outer boundary of space, then the base spatial fragment itself will perform the role of one of the 64 spatial fragments (Mokiy & Lukyanova, 2017).

This variant of the systems transdisciplinary model of spatial unit of order makes each spatial fragment distinguishable in the fabric of identical spatial fragments. You can apply a static model of spatial unit of order to each fragment. As a result, each fragment acquires characteristic features of the corresponding zones of natural functional belonging.

Confirmation of the spatial unit of order model in soil science, political geography

Drying of the soil leads to the appearance of cracks on its surface. Pieces of soil separated by cracks are called takyrs (Lobova & Habarov, 1983). The space of a large takyr is divided into a certain number of smaller takyrs. It can be argued that micro-ecosystems (biogeocenoses) are formed with-in the boundaries of takyrs; their own cycle of chemical elements and substances is formed; its intensity and individual characteristics are established (Gorelov, 2008). For this reason, the territories of modern States and state unions tend to fit into the size of certain takyrs (biogeocenoses) (see Figure 7).

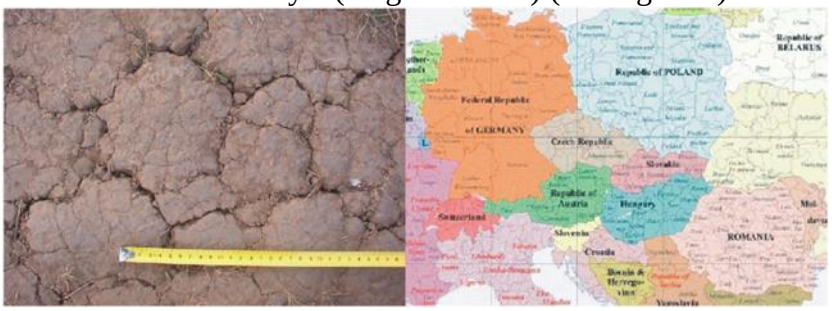


Figure 7. The natural structure of takyrs and the borders of the European States

If we create the same socio-economic conditions on the entire territory of the state, the union of states, and promote the idea of a single market and a single currency, then the state borders begin to blur. Also, the borders between takyrs begin to be erased, in conditions of sufficient soil moisture. Increasing differences in socio-economic conditions, as well as the lack of sufficient moisture, causes increased differentiation of takyrs and the closure of state borders.

The territory of a state, in some cases, may be located in a space that does not belong only to one spatial unit of order. For various reasons, it may also include some spatial fragments belonging to another spatial unit of order (the territory of another takyr). In Figure 7, this follows from the non-classical (non-model) outlines of the borders of states and takyrs. This circumstance will inevitably affect the nature of the state's development. For example, in specific spatial fragments, there will be, at first glance, an unjustified decrease or increase in the diffusion of socio-economic processes. It is due to the fact that in some places the "erosion", diffusion is more intense than in others, and there is, according to synergetics, localization of the socio-economic process, its "glueing and growth" (Malinetsky &.Potapov, 2000). That this is true is evidenced by the fact that the same scenarios of stabilization of the socio-economic situation in countries with approximately the same economic situation, or even in one such country, but in different regions, are difficult to achieve the same development result.

Confirmation of the systems transdisciplinary model of spatial unit of order in urban planning

Photos of different sections of the territory show the different intensity of takyrization. This intensity is manifested in the multi-level and multi-dimensional structure of spatial fragments of the territory. Systems transdisciplinary modelling of these structures is shown in Figure 8.

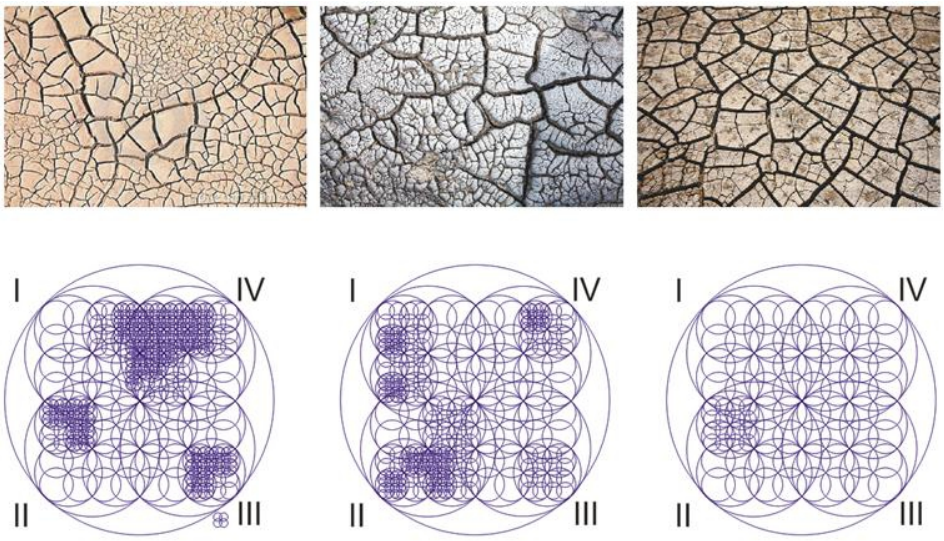


Figure 8. Takyr structures and their systems transdisciplinary models of spatial unit of order

The results of special research have shown that, unlike States, the natural location of localities corresponds to the boundaries of the corresponding spatial fragments. in turn, different intensity of takyrization

determines the different density of urban development (Mokiy, 2016). These results are directly relevant to solving the problems of urban planning and territorial planning. The main condition that allows the urban planner to make sure that it takes into account the individual characteristics of the territory of an urban settlement and urban agglomeration, will be a comprehensive justification of the organization of their territory through a systems transdisciplinary model of spatial unit of order. Using this model, it is possible to justify the allocation of objects of industry, energy, transport and communications, recreational facilities and residential areas, kindergartens, schools and universities in the areas of natural functions of ecosystems, to justify the density of such zones, etc.

This circumstance is of fundamental importance for the analysis of the risk from the implementation of territorial planning plans executed according to existing state standards. Since these standards do not take into account the objective influence of natural factors, these factors may significantly reduce the expected effectiveness of spatial planning in the future.

Conclusion

Completing the introduction to the systems transdisciplinary model of spatial unit of order, it can be argued that States, regions and cities, as mixed functional ensembles, in their creation and development, strive to reproduce and preserve on their territory the structure of the systems transdisciplinary model of spatial unit of order, consisting of zones of natural functional belonging (NFB). Consequently, the management of the development of the territory of these entities, the artificial transformation of their natural environment will be harmonious, provided that it is carried out with the preservation or exploitation of the functions of the NFB zones. Therefore, any artificial eco-system, different objects, for example, territorial-industrial complexes, nuclear power plants and the burial of radioactive waste, refineries and factories, residential areas and places of mass entertainment, embedded in a specific territory and becoming its fragments must be combined its purpose with features areas of its NFB.

An important conclusion follows from this statement: combining objects intended to perform certain functions with the corresponding zones of the NFB in a specific territory will support the functions of objects. However, their mismatch will contribute to the extinction or blocking of these functions. This conclusion formed the basis of technologies for managing the state of natural, man-made and social objects, as well as methods for analyzing the risk of their complex interaction. In this case, we are talking about a wide range of systems transdisciplinary technologies for ensuring the sustainable development of States and state unions, technologies for restoring the ecology of the region, as well as technologies for predicting and preventing extremism,

environmental and man-made disasters, and the intensity of negative natural phenomena.

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