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SYSTEM-FUNCTIONAL APPROACH TO THE ANALYSIS OF THE DEVELOPMENT OF THE MATTER OF THE UNIVERSE

Shokin Anton Nikolaevich

RATRIZ, St. Petersburg, Russia

Abstract

The evolution of matter is investigated through the prism of the basic approaches of TRIZ: system-functional and dialectical. The evolutionary principle of sequential structuring of matter by reducing the randomness factor is revealed. Based on the influence of system-functional hierarchies on human development, the following hypotheses are proposed:

1. The behavior of society and man in society as a consequence of the reflection of the system-functional hierarchy in the physiology of the human brain.
2. The influence of ZRTS on the development and competitive interaction of suprasystemic social formations.
3. Technological development of mankind, as a consequence of the implementation of the trend of the matter ordering.

Keywords: matter, system, function, system-functional approach, information, entropy, TRIZ

1 Introduction

TRIZ, based on dialectical materialism, studies the patterns of structure and development of systems common to any objects and processes of the material world, which makes it possible to apply the basic approaches of TRIZ for research in any field.

In this paper, the principles of the development of the matter of the Universe are investigated through the prism of the system-functional and dialectical approaches of TRIZ.

2 Concepts

A model is a material or mentally represented object, which in the process of cognition (study) replaces the original object, retaining some of its typical features that are important for this study.

[1]

Models are used to highlight important features of objects or processes and present them for the purpose of research (analysis).

A system is a model that displays a set of elements and relationships between them that give rise to new properties. [1]

Function is a model of change in an object under the influence of another object [1]

A functional system (FS) is a set of interacting components acting on other objects, causing changes in them. [1]

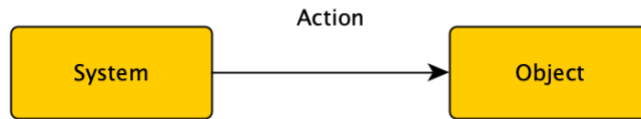


Figure 1 Function model

The main useful function (MUF) is a model for the purpose of a functional system [1]

A subsystem (SubS) is a part of the FS that contributes to the performance of its main function. [1]

A supersystem (SS) is a part of the structure within which the FS plays a significant role in the implementation of the purpose of the SS by performing its own functions. [1]

3 System-functional approach to the analysis of the development of matter

3.1 Evolution of matter

Initially, from the moment of its occurrence, all the processes of transformation of matter in the Universe occurred under the influence of the laws of physics, chemistry, and other natural sciences and were determined by the randomness factor, so the information entropy of the Universe, at least, did not decrease.

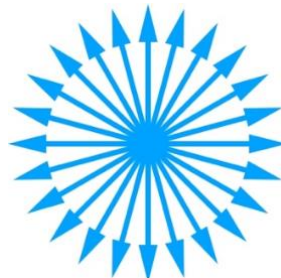


Figure 2 Non-directional development of matter

Such stochastic transformations occurred before the appearance of structures of matter capable of remembering and replicating information about their structure - the special order of a set of inorganic elements. Thus, it was the way of organizing the arrangement in space that became the key difference between living matter and inanimate matter and formed the basis of various definitions of the phenomenon of "life":

"Life is the ordered and regular behavior of matter, based not only on one tendency to pass from orderliness to disorder, but also partly on the existence of orderliness, which is maintained all the time."

Erwin Schrödinger. [2]

"Life is an ordered matter capable of remembering and transmitting its choices"

Henry Kastler. [3]

In the future, the mechanisms of the struggle for existence, natural selection and hereditary

variability became the driving force behind the evolution¹ of organic life, which took the path of increasing the complexity of the internal structure of organisms and the interactions between them.

It should be noted that the basic mechanisms of any modern theory of evolution are descriptive and are considered natural, since, among other things, they can be explained by the fact that their carriers have survived to present day, and representatives of fundamentally different ones have not.

However, such a statistical approach, unlike the instrumental one, is not able to explain the principles underlying the mechanisms of evolution.

3.2 Functional systems "information" and "antiformation"

The phenomenon of "information" is one of the most controversial in science and at the moment many different definitions have been developed for it. This study, without giving preference to any of the known concepts, studies the properties of system-functional models of this phenomenon and its impact as a functional system (tool) on matter (product).

Since the beginning of the universe, all inanimate material objects and phenomena could only be represented as models of systems (not functional), since they consisted of interacting subsystems, but did not have a purpose. Changes and transformations of matter occurred unpurposefully under the influence of chance and physical laws until the formation of structures of matter capable of remembering information about their structure and reproducing this structure from the elements of the environment. Therefore, we can say that the purpose of such ordered sets of elements was the fixation of information and its replication in time and space.

Thus, it is possible to consider "information" as a functional system, since if its reflection, that is, the result of influence, is structured matter, then, therefore, the "information" itself is structured, that is, it has elements and connections, and therefore is a functional system by definition.

A formal record of the above will look like models of direct and inverse functions [4].

A function model where:

- The instrument is matter, living matter
- Product – FS "information"
- Action – to capture (reflect, remember) or replicate (distribute, increase the measure)

(Living) matter captures information

(Living) matter replicates information

Also, since, according to Shannon [5], an increase in the measure of information is a decrease in the entropy of the system, therefore, the result of the work of these functions will be a decrease in information entropy.

¹ According to Darwin's theory of evolution.

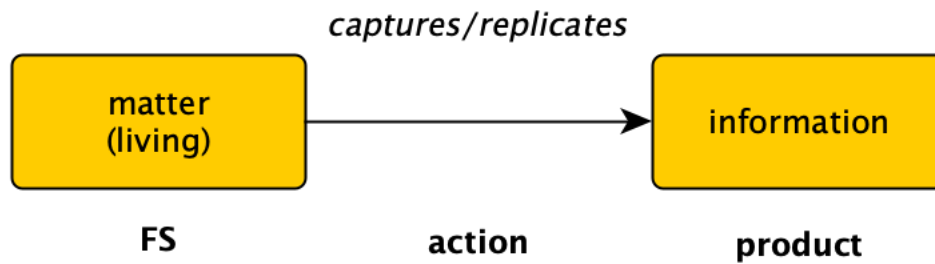


Figure 3 Model of the purpose of a living matter

The model of the inverse function will be:

- tool – FS "information"
- product –matter
- Action – structures

Information structures matter

The processes of structuring matter are opposed by the processes of its destruction, providing, in aggregate, changes in space-time.

In this case, the anti-entropy effect of "information" can be contrasted with the entropic effect of the factor, which can be conditionally designated by the term "antiformation".

This approach allows to build a model of changing an object under the influence of another object where:

- tool – "antiformation"
- The product is matter
- action – destructures

Taken together, graphically, the model of the interaction of "information" and "antiformation" with matter can be reflected as follows:

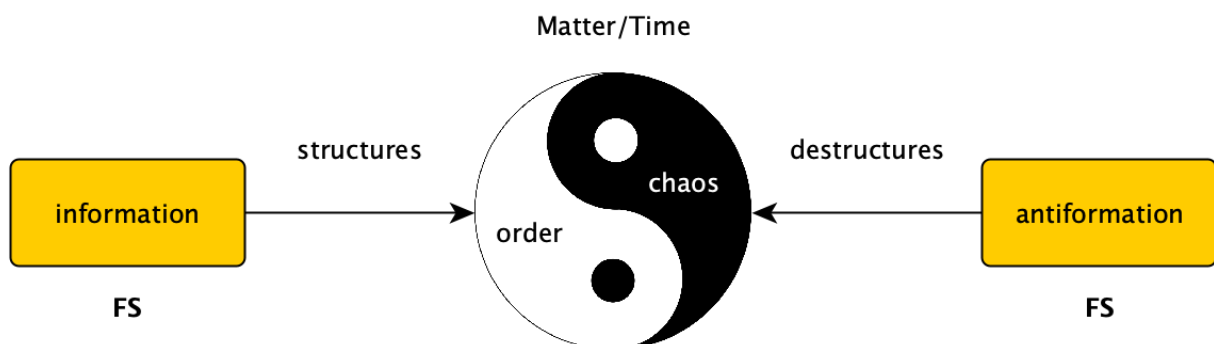


Figure 4 Matter as a field of interaction between Information and Antiformation

Such a mapping reveals the way of interaction of immaterial objects through matter, the dialectical opposition of the actions of functions, and consequently, of functional systems (tools) "information" and "antiformation".

Opposite objects, according to the provisions of dialectical materialism, have complementary properties, and are in a state of unity and struggle, which can be illustrated by example. Suppose that there is a limit to the degree of structuring of matter. Then, in the limit, the functional system "information" completely structures matter, depriving itself of the possibility of further activity, and vice versa, the FS "antiformation" will cease to function, finally destructuring the space.

Thus, the obtained models make it possible to instrumentally identify the entropy and anti-entropy factors that affect the change in matter and to investigate their properties.

3.3 Systems development

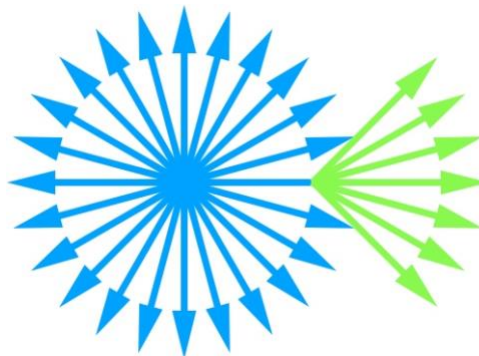
As noted earlier, the transition to building up order in matter occurred with the advent of structures capable of remembering and replicating information about their structure, that is, living organisms. In turn, the conclusion obtained about the "inclination" of information to structure matter allows us to consider the phenomenon of life as a result of the impact on the substance of the functional system "Information".

3.3.1 Transition from systems to functional systems

Considering inanimate matter and living objects as systems, it can be noted that the former are organized arbitrarily, and the elements-subsystems of the latter are designed to perform the tasks necessary for the activity of a larger system, that is, they are systems with a purpose.

Thus, if the organization of inanimate matter occurs under the influence of physical laws and the randomness factor, then with the advent of living matter in the Universe, the principle of purpose appears, as well as a new type of systems - systems with a purpose, that is, functional.

Such functional systems, the emergence of which occurs as a result of random mutations, we'll call functional systems of the first kind.



Rice. 5 Reducing the influence of chance on the development of matter with the advent of purpose

If we consider the functional system «information» through the prism of its influence on matter, we can assume that living organisms are subsystems that perform the task of structuring inanimate matter, and the mechanisms of evolution serve to select the optimal form of these instruments.

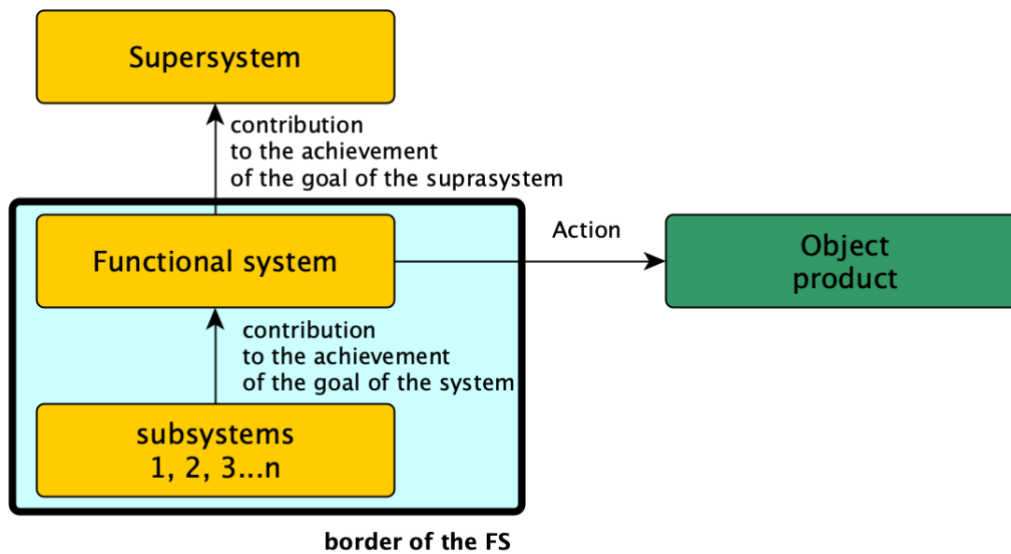
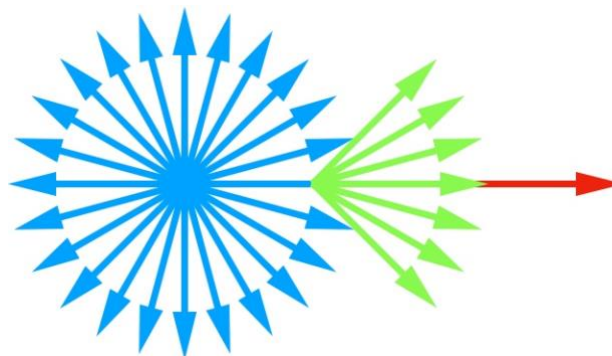


Figure 5 Interaction of subsystems and supersystems in the hierarchy, relative to their purpose

3.3.2 Functional systems with a given purpose

The growth of the orderliness of matter was reflected in the growing of complexity of living organisms and their internal hierarchies. Further development of the order led to the emergence of tools outside living beings, that is, the creation by living organisms the objects of a new type - functional systems with a **given** purpose or functional systems of the second type, also included in the system-functional vertical, with the main useful function of «structuring matter»:

- supersystems – societies.
- systems – living beings
- subsystems – tools of labor



Rice. 1 The trend towards a further decrease in random factors in the FS with a given purpose

Also, like systems of the first type, they meet the definition of "functional systems" and have all their properties, but the process of their creation and development has significant differences:

- Creation is dictated by the system's need to obtain a result, that is, in an intensive, rather than extensive way, as in systems of the second type
- The source of the evolution of the object is not a random mutation, but the analysis of shortcomings and the overcoming of contradictions that are the product of the activity of the mind.
- The effectiveness of the object is assessed not by the objective discrete fact of death, but by the assessment of the parent system. Thus, the speed of evolution increases many times over.

- Information about successfully functioning systems is accumulated and can be analyzed and transferred to other systems.

These features not only focus the direction and increase the speed of development of man-made systems, and hence the structuring of matter, but also have a significant impact on the mind and brain itself, since the design and creation of each new system is a product of human intellectual activity as a result of modeling, analysis of shortcomings, search for ways to overcome contradictions and synthesis of solutions.

The next revolutionary step in the development of matter is the transition from the design of systems by random trial and error to the conscious design of functional systems with a given purpose on the basis of identified, objective laws of system development. Consequently, the activity becomes the more reasonable, the more guaranteed the projected result in it and the less the influence of random factors.

Thus, we can say that the degree of reasonableness is a factor inverse of the degree of influence of random factors. At the same time, an increase in the degree of reasonableness occurs under the influence of the analysis of the feedback of the activities of functional systems, that is, the process of achieving their set goals.

Historically, the process of increasing the degree of efficiency of ordering matter takes a long time. So, the emergence of the first living organisms from the chaos of random interactions of matter in the Universe, took about 10 billion years.

Since then, it took about 4 billion years for the emergence of functional systems with a given purpose, and only about 200 thousand years from that moment it took to identify the patterns of development of systems. At the same time, in the last 2000 years, the pace of progress has been growing dramatically, and in our time, technological breakthroughs have already become everyday events.

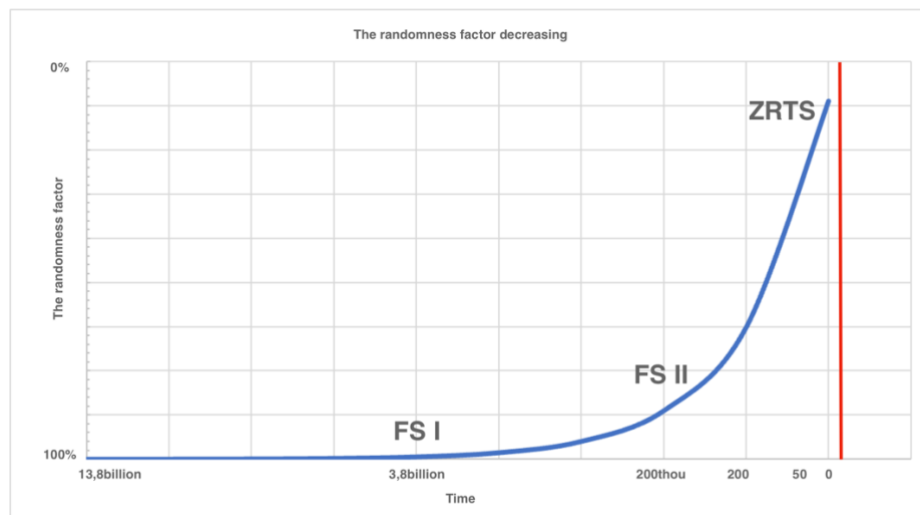


Figure 6 Reduction of the randomness factor in the structuring of matter

The graph shows that the growth curve of the rationality of activity is approaching a certain point, which should characterize the complete exclusion of the randomness factor. It can be assumed that this should lead to the use of the laws of development of systems that were identified by Heinrich Saulovich Altshuller and his colleagues and ordered within the framework of the theory of inventive problem solving.

However, after reaching this point, at least two ways are possible: stopping development, which can occur, for example, by destroying humanity when crossing the Peters barrier [6], or

entering a new stage.

The technological destruction of humanity, and life on Earth in general, became possible due to an imbalance in the development of functional subsystems and supersystems of man: tools and societies. To increase the pace of development of society, the growth of its efficiency, it is necessary not only to understand its purpose as a functional system, but also to assign goals based on the principles of the system-functional approach and entering them into the global hierarchy of functions.

4 Hypotheses based on the study

4.1 Reflection of SF hierarchy in brain physiology

Suppose that some parts of the human brain are formed in a modern form by the influence of society. Since society is a functional system with a given purpose and for its participants is a supersystem, therefore, a person must contribute to the achievement of the goals of society, as well as obey the principle of "corrective action of the supersystem" [1], that is, be in society as long as it contributes to the achievement of goals.

An in-depth study of the influence of the system-functional hierarchy on the social structure and humanity was carried out in the article by Alexander Vasilyevich Kislov "The Search for the Image of the Future" [6].

Studies of the system-functional structure of perception on behavior and learning strategies were carried out in the 1950s and 1970s by anthropologist Gregory Bateson and psychologist Robert Dilts [7].

In these works, researchers independently and in different ways came to the conclusion that the phenomenon of the need to serve society is natural and necessary for man.

Unfortunately, at the moment the author is not aware of other studies of this kind. At the same time, people use tools based on this mechanism, for example:

- formulated missions in commercial organizations, where the mission is the meaning of the activities of organizations, directed outward, that is, not to satisfy personal needs in the form of profit, earning money or any other, but to benefit society. Practice shows that this technique works and quite successfully motivates people to work.
- boards of directors, parliaments and any collegial governing bodies, the task of which, according to this hypothesis, is to exclude such a situation when a person single-handedly manages the community and is above it in the hierarchy. So, it is possible that for a person, because of evolutionary selection, physiologically is unnatural when society as a tool serves someone's personal interests. And a hierarchy of several societies, one above other, is quite acceptable.
- ideology. The development and complication of the hierarchies of societies and the desire to exclude one-man management, to which, in any case, any collegial body slides, naturally led to the exclusion of a person from the system and the emergence of ideologies, such supersystems that, setting the vector of development and moral guidelines, leave people only the function of operational control of movement towards given goals.

Of particular note is the reflection of the principle of service to society in culture: absolutely all active positive heroes of all compositions, from myths and fairy tales to novels and operas, go to the goals of society, act in its interests in the first place, simply respect others or even sacrifice themselves. And also absolutely all negative heroes are selfish, pursue personal gain or behave provocatively.

Based on the foregoing, it is possible to assume that the violation of the society-person hierarchy has an extremely negative effect on the society and on the person, and often leads to serious consequences for the psyche, provoking the degradation of the individual, since the brain of such a character is forced to function contrary to its structure. Conversely, building activities in accordance with natural physiology will provide the individual with psychological comfort.

4.2 Competition of cultures

The development of human information supersystems has led to a significant increase in social formations, which are also developing, obeying the main suprasystem goal - "to organize matter". The evolutionary selection of the most effective of them occurs both through integration and through collisions. For example, one of the largest social supersystems today are "nations", the information accumulated by which is called "culture". The cultural code contains not only values, religions, the structure of society, but also how to dress, how to eat, how, with whom and what to talk about and interact. Such information is absorbed by the carrier throughout life and cannot be changed at will.

In an effort to spread their way of life, national systems either integrate, bloodlessly mixing cultures, or force some of their subsystems to be aggressively disposed towards the carriers of alien cultures, developing hostility up to armed conflicts. It also explains the ease of involving the masses in the ideas of superiority of a certain nation.

Given the development of technologies, including nuclear weapons, such a method can no longer be evolutionary and requires deterrence, which, among other things, should be facilitated by an understanding of the system-functional structure of the world, as well as the suprasystem goals of society and man.

4.3 Striving for greater orderliness

The desire to structure matter is reflected in all spheres of human activity. For example, the development of management systems as methods of obtaining feedback on the results of activities and applying them to achieve goals, the development of technologies for generating and storing data, such as calculating cryptocurrencies, photos and videos, databases. From the point of view of ordering matter, the essence of this activity is to create "casts" of reality in the present and send them to the future.

At the same time, the degree of reasonableness of the activity increases with an increase in the accuracy of achieving goals, or, in other words, a decrease in the randomness factor. Thus, awareness of goals is a necessary criterion for effective activity.

Within the framework of the system-functional approach, the technological and social activities of mankind are aimed at increasing the amount of information in the Universe through the structuring of matter, that is, it has a MUF (main useful function), which allows you to build a system-functional hierarchy in accordance with the nature of natural processes.

Today, on the one hand, there is an exponential growth in the development of technology, and on the other hand, humanity does not have an agreed scientifically based goal of its development, which continues to be chaotic.

This order of affairs leads to an increased expenditure of resources and threatens the existence of humanity as a whole.

5 Conclusions

The system-functional approach made it possible to detect the tendency of the development of matter from inanimate to animate and man-made and to fit social structures, man and technology into a single hierarchy. Within the framework of the functional model, the common goals of man

and humanity are instrumentally identified and hypotheses are proposed that connect the tendency of matter to be ordered with the labor and social activity of man.

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