2.11. How science develops and discoveries are made.

Author: Author: Kondrakov I.M.

Every ground squirrel is an agronomist!

After getting acquainted with the work of the Russian scientist A.M. Khatybov, who called modern science “horse literacy”, having grounds for this and indicating specific reasons, his expression began to be used appropriately and inappropriately by a number of his readers. This was sometimes facilitated by the discoverers themselves, and those who created myths about them and their work. Obviously, this is due to the fact that having "mastered" the "horse literacy", they continue to talk about science at the appropriate level, without bothering themselves with at least a superficial acquaintance with the laws of scientific creativity, laws and trends in the development of science as a huge system, where along with false concepts are created, the vector of development of which is directed to the Truth. Therefore, when presenting New Knowledge, it is necessary to know about them and adhere to constructive criticism of science and its apostles, because the time will come when the current New Knowledge will be critically perceived by the next generation, and this will be a natural process. It must be remembered that without the science that is built on "horse literacy", N.V. Levashov, A.M. Khatybov and other great scientists would never have appeared, because even their original true scientific base would not have been perceived by any person without at least elementary concepts and ideas about the surrounding world, at the level of "horse literacy. These scientists would have to create all the basic concepts themselves. Alas, science, as a system, is being developed by people who tend to know the world, gradually moving from simple to complex, while creating a huge number of stamps due to psychological inertia, etc. So far, the thinking and mind of a person are arranged. But the path of knowledge can be changed. At the same time, it must be remembered that the laws of nature are the same for both Light and Dark forces. And, since it so happened that we had to live and be enlightened during the period of management of the parasitic CPS, we need to learn and adopt the useful things that humanity has developed in this difficult period for civilization in all matters and not be "gophers-agronomists"...

How should I hunt?

If you ask any person: how should I hunt? He will certainly ask: and for whom? And indeed, if you hunt an elephant, you need one tool (weapon), and another for a mosquito. So, it is in

science. The tasks are different. Here we will only briefly touch on the features that distinguish a high-level task from a low-level task.

The first level of solving a scientific problem is characterized by the use of known representations in new conditions, i.e., the use of a ready-made model. For example, it is found that some stars rotate around the "void" in a circle. To explain this phenomenon, it is enough to attract the idea of a black "hole".

To solve the problem of the second level, it is enough to apply the most suitable scheme, model, representation to explain this phenomenon. Here representations change in relation to this phenomenon, but the conceptual apparatus of the theory remains unchanged. For example, to explain the scattering of alpha particles backwards, Rutherford - out of several possible models of this phenomenon, chose the most suitable, i.e., a planetary model of an atom with a heavy nucleus in which the entire mass of the atom is concentrated.

When solving problems of the third level, the use of known schemes, models, representations leads to a violation of the correspondence between them and real reality; i.e., to the emergence of a contradiction. At the third level, a change in representations entails a change in the conceptual apparatus of the theory. For example, a photoelectric effect, from some ideas it follows that light should transmit energy continuously, because it is a wave process, and from others - light should transmit energy instantly, because it is not a wave process. The resolution of this contradiction has led to a change in ideas about light.

There is also a fourth level of scientific tasks, but the available knowledge is insufficient to solve them - we have to come up with models for new phenomena and, if necessary, indicate the ways of their discovery. The change in representations is hypothetical - until the task is reduced to a lower level. For example, the quasar problem. There are a number of "unknowns": the distance to quasars, how many stars they consist of, what the nature of the redshift is (cosmological expansion of the Universe or the usual Doppler effect), etc. The solution to this problem will depend on the choice of initial assumptions and the interpretation of "unknowns".

From the given characteristics of the levels, it is clear that the peculiarity factor for high-level scientific problems is a contradiction. Thus, the solution of problems of the third level is a source of development of the conceptual apparatus of the theory.

Depending on the nature of the tasks being solved, there are three types of tasks in the literature: discovery, scientific and research. They are not clearly defined and the boundaries between them are not established. An attempt is made below to give a general definition of these types of tasks.

Discovery tasks are tasks related to obtaining a new discovery. The methodology for solving these types of problems should reflect the technique of searching for new discoveries based on existing representations of the SS.

Scientific tasks are tasks related to the part of scientific creativity that is associated with the invention and development of SS based on existing discoveries.

Research tasks are tasks related to the search for methods of making discoveries, accumulating, clarifying and analyzing facts, establishing the relationship between all of the above and philosophical attitudes.

All three types of tasks are united by a common technology of the creative process, which consists in the transformation and restructuring of ideas about the systems under study.
In the process of solving problems, there is a transition from one view to another. And each such transition is a single step in the development of science... The totality of individual steps gives an idea of the development of science as a whole. For example, the quantum hypothesis is replaced by Bohr's theory, which is eventually replaced by quantum mechanics.... But how do you still need to hunt for scientific discoveries?

Take it and try it!

This recommendation was given by psychologists and researchers who studied scientific and technical creativity. Even the great Mendeleev D.I. did not avoid such advice to those seeking the Truth. There was a similar situation in technology. The technology for solving inventive problems, as in science, was the same - the “poke method” or the technology of trial and error: take it and try it! There were other recommendations, for example, from psychologists or scientists themselves (for example, Academician Migdal), who suggested pushing yourself to an extreme state so that an epiphany, a flash, an insight (!) would arise, which eventually brought some to Ward No. 6.

The results from the development of science by trial and error are obvious - they are associated with the loss of time, the delay of inventions, discoveries and theories, and often the cost of tens of millions of lives (physicist Tindall in 1875 and the delay in the discovery of penicillin by 50 years), and in our time - with the loss of huge funds allocated for the development of science and technology (for example, a collider).

Example 1. One day Finzen noticed a cat basking in the Sun. With the appearance of the shadow, the cat moved to the sunny side again and again. Looking closely, he noticed a purulent wound on the cat's skin, and it was with this side that the cat turned to the Sun. Finzen drew attention to this fact and ... in 1903, he received the Nobel Prize ...

Example 2. Ehrlich, the discoverer of salvarsan and neosalvarsan, spent two decades obtaining these drugs, studying more than 500 different dyes and performing 600 (for salvarsan) and 914 (for neosalvarsan) experiments.

Example 3. Having created the special and general theory of relativity, Einstein spent more than 30 years searching for a "Unified field Theory", without having created it.... And when creating

the SRT, as he writes, every two minutes he put forward a new hypothesis, which he analyzed and immediately discarded.

Externally, there is nothing in common between these discoveries. But they are all obtained by the same method - trial and error, ignoring any patterns. But, despite this, in general, science develops naturally, but at the cost of many trials. It was this technology that created the conditions under which “horse literacy” was formed.

The scientific and technological revolution raised the question of the need to reorganize the existing technology of invention and discovery. Two paths have emerged:

First: activation of the thinking of the person solving the problem (impact on intuition, work of the subconscious, etc.) , , ;

Second: identifying objective laws according to which one technical system is replaced by another or one scientific concept is replaced by another.

One of the founders of the theory of creativity, A. Poincare, directly stated that success in revealing the secrets of scientific creativity and, ultimately, the progress of science depends on solving the problem of intuition. This opinion is shared by S.E. Zak, A.N. Leontiev, S.R. Mikulinsky, V.A. Engelgard, M.G. Yaroshevsky, G. Simond and other researchers of scientific creativity. This leads to the conclusion that the presence of unpredictable (random) elements in the creative process excludes the possibility of a positive influence on the course of the latter, its algorithmization and that the creative process, as well as intuition, is a highly individualized phenomenon.

The understanding that the final result depends to some extent on the intensification of the search of options, led to the creation of a number of methods for intensifying the creative process, such as brainstorming, the Method of Focal Objects (MFOs), synectics, the method of psychointelectual generation, etc., as well as the compilation of various lists and heuristics similar to list A. 5,6. However, the basis of these methods remains the same: a search for options and metaphysical ideas about the unknowability of scientific creativity.

The second way is to identify objective laws[6] - a way similar to the development of the national theory of inventive problem solving (IPS)[5]:, i.e., using the same research methodology, but in this case the nature of scientific creativity: collecting the necessary array of information, dividing by levels of complexity, determining the factor of peculiarity, identifying and formalizing the structure of the creative process, etc. The procedure of the creative process in solving inventive and discovery tasks coincide at the first stage and differ at the stage of implementation of the solutions found: in technology, the idea of the solution is embodied in "metal", and in science, the conformity of the ideas arising from the received scientific system (model) to the natural system is checked. At the same time, a number of techniques for eliminating physical contradictions have been identified in IPS.[5]

Any discovery or solution of a scientific problem is ultimately connected with the development of existing ideas about the object under study or nature as a whole. The degree of variability of representations gives an idea of the complexity of the problems arising in the development of scientific systems. In this sense, the technology of solving scientific problems, which T. Kuhn refers to as "solving puzzle problems", is also important in the theory of cognition.

The process of cognition of any phenomenon is purposeful in general, but messy in every creative act due to the lack of a unified and integral methodology of cognition. A complete picture of the phenomenon under study is created gradually by studying the parts that make up the phenomenon.

As in invention, in science, different mechanisms of development operate at different levels of the hierarchy, different patterns manifest themselves.

Based on the systematic nature of the world and the dynamic development of the ways of cognition, we can offer the following ideas about the development of scientific systems (NS) - systems of ideas about the object under study, serving to explain the phenomena observed in it, properties and patterns within the existing paradigm.

1. Science is a large hierarchical system in its development, it goes through several qualitatively different levels from each other: ideas, theories, laws, science itself. The foundation of any science is the ideas about the phenomena and objects being studied.

2. The technology of scientific creativity has two distinct components.

The first is the "extraction" of knowledge by reflecting reality and inventing new ideas about it.

The second is the invention of methods of "mining" and the transformation of these representations. These components complement each other. In the most general form, the process of scientific creativity looks like this: first, a model of the object under study (phenomenon) is invented, reflected in our consciousness in the form of an image, and then it is compared with a real object (phenomenon) and, if it does not correspond to a real object (phenomenon), it is transformed into a model in which this discrepancy is eliminated.

3. The source of knowledge of the objective world is the constant interaction between experience and theory. The discrepancy between the ideas arising from experience and the ideas of theory is expressed in the form of a contradiction. It is the source of the development of ideas, and hence of science itself.

The contradiction expresses the correlation of opposite ideas about the object. On the one hand, it reflects the objective development of material objects or representations in which opposites exist, and, on the other hand, the incompleteness of our knowledge about the object under study.

Example 4. In 1935, Keez discovered that the thermal conductivity of helium 2 (at That below 2.2 C) in narrow capillaries is a million times greater than that of the most thermally conductive metal - silver. But other experiments have shown that the viscosity of helium is a thousand times less than that of water, and an additional decrease in viscosity was observed during the transition from helium-1 to helium-2. How do you explain this?

It is known that the more strongly the atoms interact (are bound) with each other, the higher the thermal conductivity and, consequently, the viscosity. In this case, viscosity is considered as the friction force between adjacent layers of atoms. A contradiction arises: in order to have a high thermal conductivity, the layers of atoms must be strongly bound to each other and, in order to have a low viscosity, they must be weakly bound to each other.

Pre - paradigm period
scientific school scientific school scientific school scientific school
Left Side: mature science
Normal Science paradigm
3-Anomalous facts 2-Just facts Facts confirming the paradigm
Normal science in a period of uncertainty and crisis 4-paradigm
Anomalous facts Just facts 5-new theory Facts confirming the paradigm
7-The Scientific Revolution - The emergence of a new paradigm that explains some anomalous facts
The development of science by T. Kuhn

The development and transformation of ideas in science does not entail a change in the objects under study. Natural objects develop themselves, regardless of the ideas that are their reflection in our consciousness. But the ideas about the object under study change, and these

changes also obey certain laws that can be known and used for the conscious development of our ideas, without waiting for inspiration, overshadowing from above, hope for chance, etc.

Science, according to T. Kuhn's ideas, goes through a number of periods in its development: the pre-paradigm period, the period of normal science, the period of uncertainty and crisis, ending in some cases with a scientific revolution. At the same time, the revolution in science follows the following pattern: first, there is an awareness of "anomalies", i.e., the fact that the "paradigm" is unable to cope with specific problems arising in the development of "normal" science; then numerous attempts are proposed to overcome anomalies, which, in case of failures, lead to a crisis situation. As a result, the old paradigm is replaced, i.e., local or global revolutions (see the scheme of the development of science by T. Kuhn).

Similar ideas about the development of science through scientific revolutions can be found in B.M. Kedrov, who points out that overcoming emerging dialectical contradictions during crises occurs dialectically according to the scheme: from the singular to the special, and then to the universal through overcoming the cognitive-psychological barrier (PPB); in V.A.

Kuznetsov, who identified four stages in the development of ideas about the studied object in chemistry: the study of the composition of a substance as determining its properties, then its structure, showing different properties with the same composition; behavior, i.e., dynamics of molecules of matter, and, finally, self-development, evolution of molecules. One more point should be added here - the dependence of the properties of a substance (object) on its location in space.

However, the schemes proposed by T. Kuhn, B. Kedrov and V. Kuznetsov reflect only the form of the course of scientific revolutions, and not their content. They do not point to technology, mechanisms for overcoming crisis situations and solving the so-called "puzzle problems" facing science.

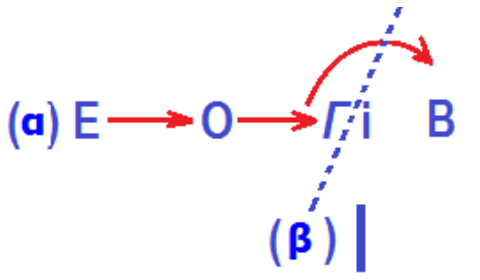


Схема академика Б.М. Кедрова

Scheme of academician B.M. Kedrov

From contradiction to discovery

So, the main source of the development of scientific systems are contradictions. There are several types of contradictions in the development of the National Assembly. Let's consider

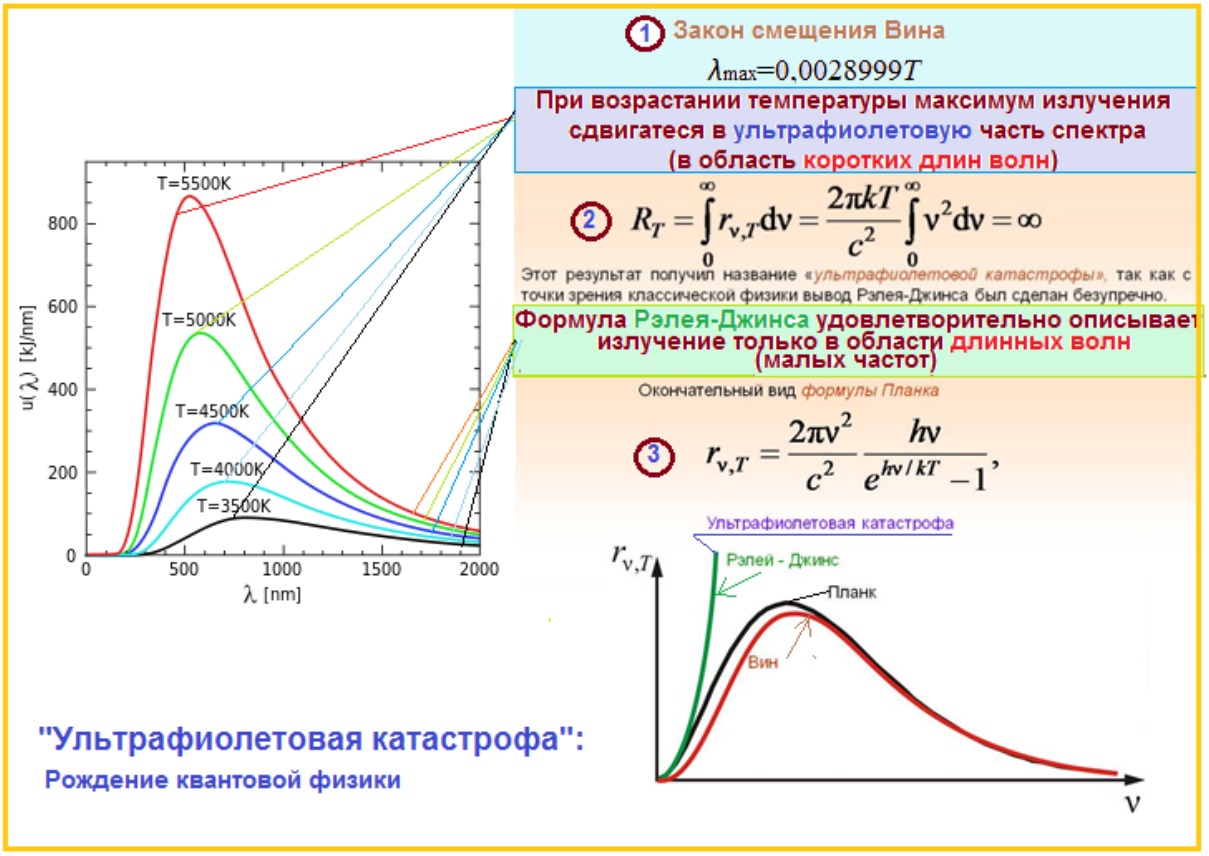
them, which of them are the reason for the development of NS and are a good incentive for creativity, i.e., they have a certain heuristic power.

a) On the surface of any task lies the so-called administrative contradiction (AC): something needs to be explained, but it is not known what ideas to attract for this. The heuristic strength of these contradictions is zero.

Example 5. It is generally accepted that quasars are star-like objects - galactic nuclei whose radiation spectrum has a large red shift; they are many times brighter than any of the known galactic nuclei, although they are on the "edge" of the Universe; quasars are variable radiation sources - they "blink"; they do not have "neighbors" with the same red mixing. How to explain these contradictory facts? Which of the representations should be used to explain, for example, the nature of redshift: the cosmological scattering of galaxies or the usual Doppler effect? Not clear.

b) The administrative contradiction is based on a scientific contradiction (SC): when trying to explain a new phenomenon with the help of an existing SS, the unity of ideas between the existing NS and ideas arising from experience or between two existing SS is violated. A scientific contradiction (SC) does not give a concrete answer when solving a problem, because it expresses the relationship between different representations or objects, but allows, like a Technical Contradiction, to discard all "empty samples" at once. In a simpler form, the SC looks like this: we will explain one thing, but we will not explain the other.

Example 6. By the end of the 19th century, 2 laws were established describing the distribution of energy across the spectrum of light: - this is Wien's law for short waves and Rayleigh's law for long waves. If we apply Wien's law for the entire spectrum, then for long waves it diverges from the distribution curve constructed according to experience. If we use Rayleigh's law, then it will not coincide with the real curve in the short part of the spectrum. So, SC: we will explain part of the spectrum (long or short), but we will not explain the whole spectrum (radiation intensity).



1- The Law of Wien's Displacement

As the temperature increases, the maximum radiation shifts to the ultraviolet part of the spectrum (in the region of short long waves)

This result was half the expectation of an “ultra-violet catastrophe". so from the point of view of classical physics, the conclusion of the Rayleigh-Jeans was made flawlessly.
The Rayleigh-Jeans formula satisfactorily describes radiation only in the region of long waves (low frequencies)
The final form of the Planck formula

Ultraviolet catastrophe
The Birth of Quantum Physics

At the heart of the NTP is a physical contradiction or physical incompatibility (PC or PI): mutually contradictory physical requirements are imposed on the same object of the NTP or its part. Here, the PC in scientific systems is no different from the PC in technical systems, since they deal with the same objects of the material world. It follows from the very fact of the coincidence of the PC that the main part of the arsenal of IPS tools can be transferred to scientific creativity.

The PC takes the opposite ideas to the extreme, pointing out the reason for their discrepancy, i.e., the specific physical states of the object underlying the ideas about it.

Example 7: For instance, when trying to explain the photoelectric effect, an PC arises: in order for the velocity of the departing electron not to depend on the intensity (or energy) of the light beam, the electron must take a strictly defined portion of energy, but in order for the number of electrons flying out of the material to depend on the intensity (energy) of the beam, the electron must take a different amount of energy. But a photocurrent is a flow of electrons. Hence, the way to resolve the PC is clear.

In contrast to PI, PC gives a clear direction for solving the problem. It reflects a conflict between the properties of an object or a PS. The properties that make up the PC are related to the conceptual content of conflicting representations.

For example, the property of an electron to accept a strictly defined amount of energy and a different amount of energy is associated with the concept of light as an object carrying a strictly defined energy.

In addition to the above types of contradictions, there is another type of contradiction: logical (LC). Logical contradiction reflects confusion, logical errors and inconsistency of thought. It usually occurs when "linear" generalization of any experimental data or knowledge to the area to which they do not belong.

The LC reflects the discrepancy between the level at which the object is located and the representation describing this object.

Example 8: The statement of the Cretan Epimenides: "All Cretans are liars."

Epimenides is a Cretan himself. Therefore, he is a liar, then his statement all Cretans are liars is false. So, the Cretans are not liars. Meanwhile, Epimenides, as defined by the condition, is a Cretan, therefore, but not a liar, and therefore the statement "all Cretans are liars is true." Thus, we have come to mutually exclusive proposals. One of them claims that the statement is false, and the other qualifies this statement as true.

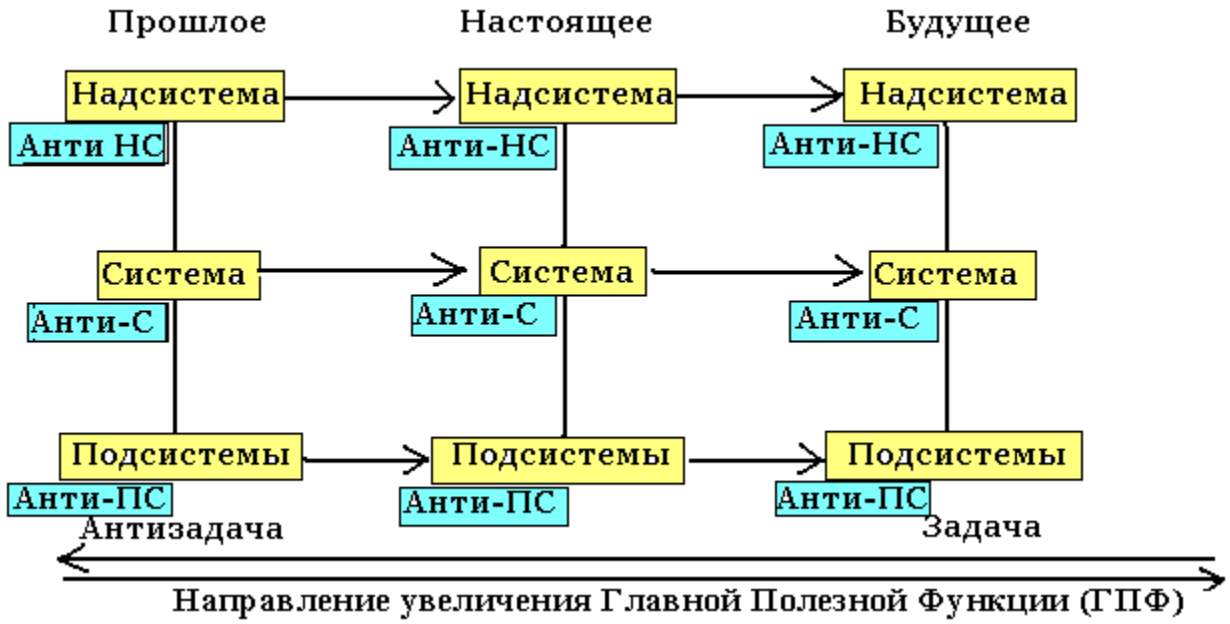
Such contradictions in the literature are called in different ways: sophisms, paradoxes, logical contradictions, etc. Obviously, such LC should not be resolved, because its resolution does not make sense.

To be able to correctly identify and formulate contradictions, you need to see the object from all sides, and for this you need to learn to think using elements of strong thinking reflecting continuous logic.

Elements of Strong Thinking

It is known that scientific creativity is the mechanism by which science develops. In order to move further in the question of cognition of scientific creativity, first of all, it is necessary to answer the question, what is creativity?

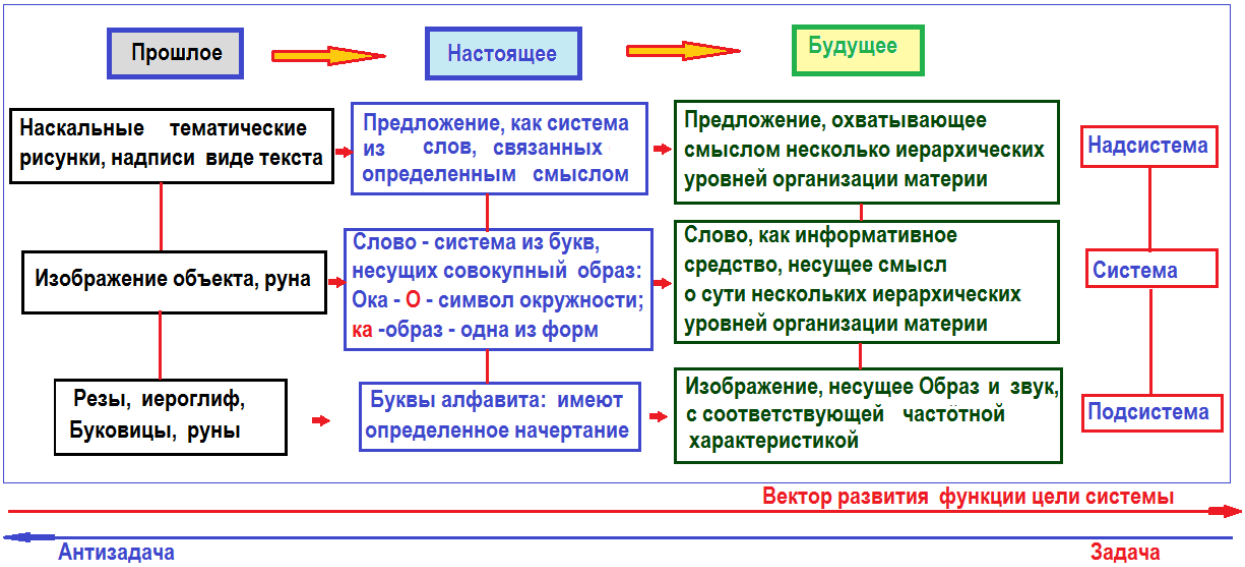
"Creativity," explains the Soviet Encyclopedic dictionary, "is an activity that generates qualitatively new and is distinguished by uniqueness, originality and socio-historical uniqueness." Thus, by definition, creativity presupposes uniqueness and non-standard approaches to solving creative tasks, when their product is something that was not there before.



In science, nature, technology, we always deal with systems that have their own hierarchy. Let's imagine this in the form of a multi-screen diagram, where three hierarchical levels (or more) of the system are indicated, while each of them has a past, present and future. Besides. Each level has its own antipode - its own anti-system. Thus, creative tasks can arise at any hierarchical level - on any of the 18 screens.

Example 9: As an example, let's consider a word - at the system level - an inscription on some medium. Then at the level of the suprasystem it will be a sentence, and at the level of the subsystem - the letters of the alphabet, each of which has its own image. In the past, the word was hieroglyphs, inscriptions on media. Even earlier - these are cuts, runes. In the future, it may be an informative tool that carries meaning (content) about the essence of several hierarchical levels of the organization of matter.

In order to read the inscriptions on various material media, V.A. Chudinov invented a method of microepigraphy - enlarging the image of the product and searching for micro-inscriptions on it.



Left Column: Past
Rock-themed drawings, inscriptions in the form of text
Object image, rune
Cuts, hieroglyph, Letters, runes

Middle Column: Present
A sentence as a system of words connected by a certain meaning
A word is a system of letters bearing an aggregate image: Oka - O is a circle symbol; ka - image is one of the forms
Letters of the alphabet: have a certain shape

Right Column: Future
A sentence encompassing several hierarchical levels of the organization of matter
The word, as an informative means, bearing meaning about the essence of several hierarchical levels of the organization of matter
An image that carries an Image and a sound, with an appropriate frequency response

Far Right:
Suprasystem
System
Subsystem

Lower Right:
Vector of development of the system's goal function

Bottom:
Anti-Task **Task**

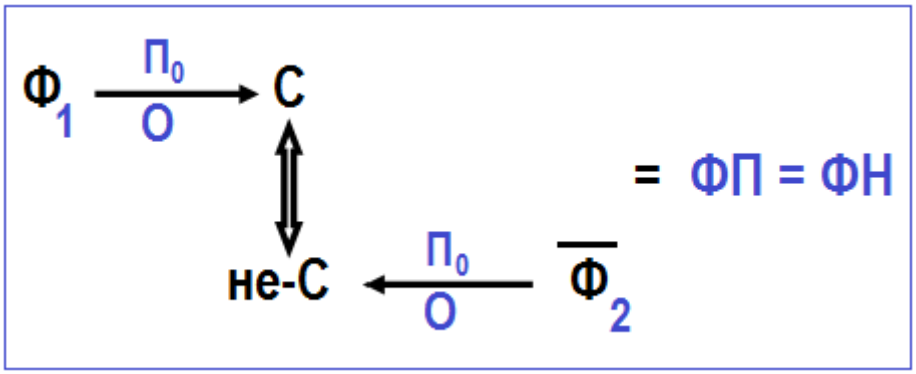
And in order to increase the clarity and reveal the image of the inscription itself, he uses inversion (transition from system to anti-system): the positive of the image translates into a negative.

Development is a constant change of the unity of opposites by their conflict and its elimination by the unity of opposites, but each time at a new qualitative level. Consequently, the discovery task may arise when, in the process of cognition, the unity of ideas about the object under study is violated. It is during this period that a physical contradiction or incompatibility (PI) of ideas arises, arising in the scientific system from the standpoint of the existing paradigm (Po), can be represented in the form of opposites expressed in the form of identity: And there is a non-A.

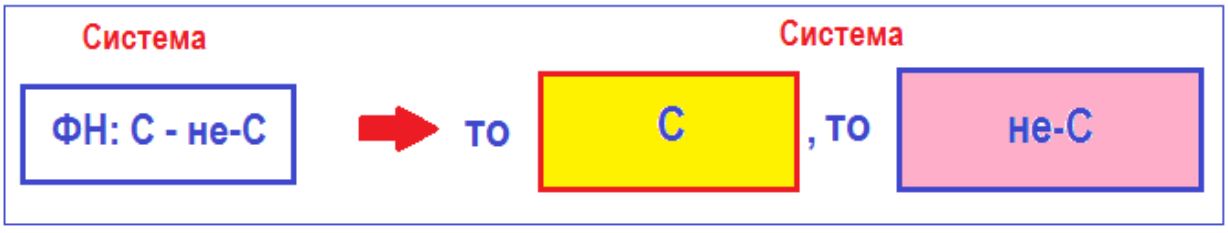
Then the very physical contradiction or incompatibility of mutually exclusive requirements can be formulated as follows: In order to explain the fact F1 from the standpoint of the existing Ps paradigm, the object under study O must have the property C, but in order to explain the anomalous fact F2, the object O must have the property not-C.

To eliminate such contradictions, some techniques identified as a result of the analysis of the development of scientific systems can be used:

1. Separation of incompatible properties in time: Let the system have either the C property or the non-C property.



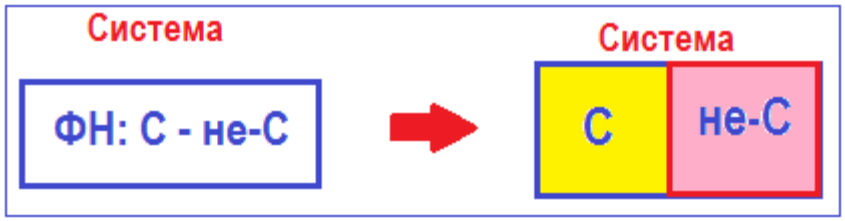
ФН (PI) - ФП (PC)



Example 10. In 1865, Kekule proposed a structural formula for benzene. It followed from this formula that there must be two isomers. But benzene stubbornly behaved as one substance. How to explain it?

Solution: the bonds in the molecule oscillate: each molecule is in one or another state.

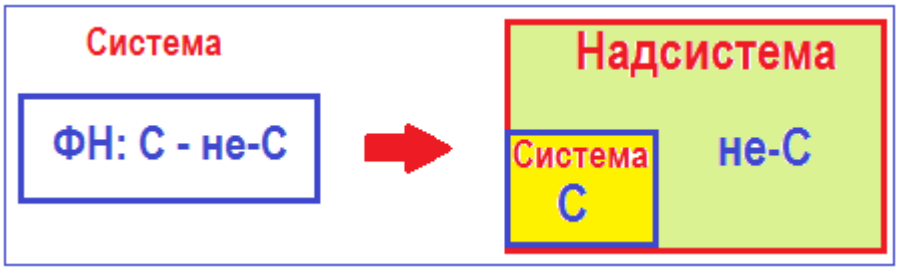
2. Separation of incompatible properties in space: let a part of the system have the property C, and the other has the property not-C.



Example 11. A variable X-ray radiation source has been detected in the large Magellanic Cloud. According to A. Epstein, the source is the remnant of a Supernova that erupted 5200 years ago. But all known Supernova remnants are permanent sources of radiation. How to explain it?

So, we have a contradiction: in order to be a Supernova remnant, the radiation of the source must be constant, but in order to correspond to observations, the radiation must be variable. Solution: The X-ray source in space is located behind the Supernova remnant - there was an overlap of two radiation sources along the observation line.

3. Separation of incompatible properties by a system transition-1: let the system have the property C, and the suprasystem including this system have the property not-C. Or let the system as a whole have the C property, and the subsystems have the non-C property.



System Supra-System

Example 12: The stretching of the crystal occurs due to an increase in the distances between the ions of the crystal lattice. But how does rubber stretch? The bonds between the atoms in the rubber molecule are covalent, the distances between the atoms cannot increase. At the same time, the rubber thread stretches along its entire length at any time and with any stretching methods.

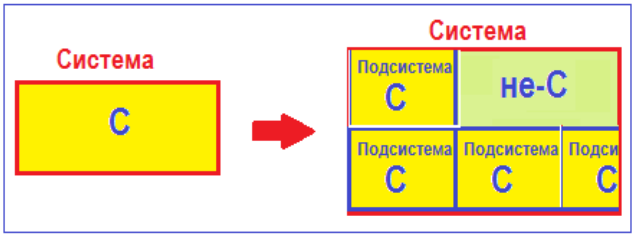
Solution: rubber molecules (subsystems) are inextensible, but the chain of such molecules (systems) can be lengthened due to the unfolding of rigid links.

Example 13: Doctors noticed that after cutting out a cancerous tumor, in its place over time (about 5 years later) a cancerous tumor appears again. They tried to find pathogens or carriers of cancer, but they were not found in the body. How to explain it?

PI arises: In order for cancer cells to reappear in place of the excised tumor, tumor carriers must remain in the body, and they should not be there, because they were not found there.

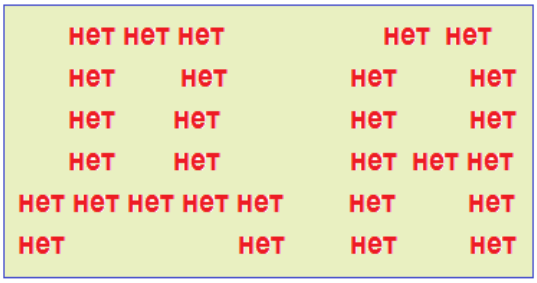
The solution proposed by N.V. Levashov: at the physical level, after surgery, a cancerous tumor is removed and it is not there, and there are no cancer carriers there, but they are at the etheric level in the form of a matrix of cancer cells, which after a while creates exact copies of cells at the physical level.

4. Separation of incompatible properties by restructuring the structure (organization) of the system: to move from a system with property C to a system with property not-C, and to endow the subsystems of the system with property C.



Systema – **Sub-system**

Пример:



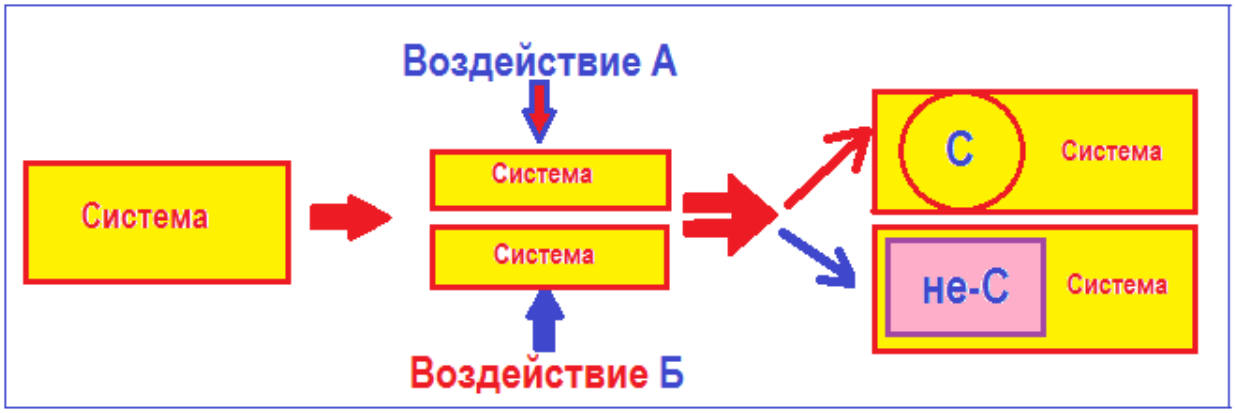
Example – **Not**

Examples 14. Observing particles suspended in water, Brown noticed that they were all continuously moving. But experience shows that water is stationary and these movements are not caused by either water flows or its evaporation. How to explain this?

PI: Water must be mobile (at the system level) in order for suspended particles to move, and must not be mobile (at the system level) in order to correspond to observations.

Solution: Water as a whole is stationary, and each of its molecules is mobile, hence the particles are mobile.

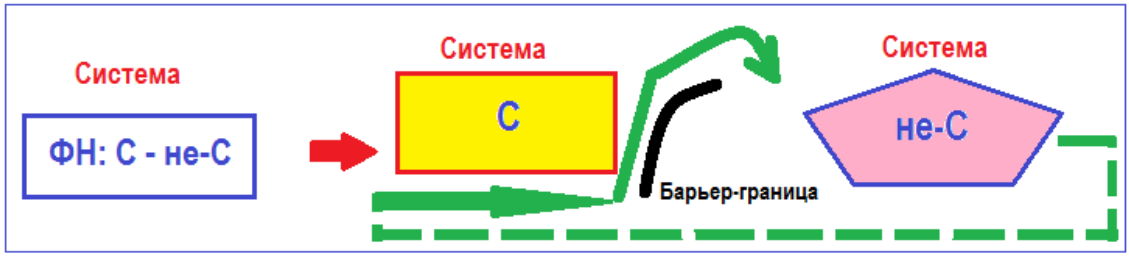
5. Separation of contradictory properties, allowing different interactions with different external environments: let the C property manifest itself in some interactions (under some conditions), and the non-C property in others. At the same time, the manifestation of the C and non-C properties does not require changing the object itself.



Impact A
Impact B

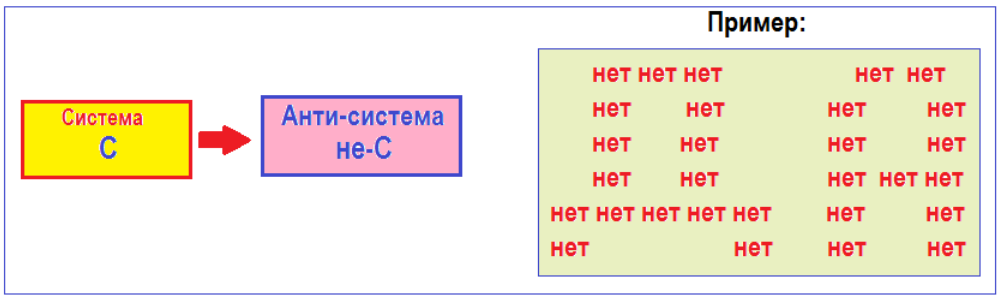
Example 15: A free neutron decays in 12 minutes, and in a tritium atom - in 12 years.

6. Separation of contradictory properties by using transitional states, in which opposite properties coexist or alternately appear: let the system have the property C up to a certain state, and when passing through it, it has the property not-C, changing at the same time.



Example 16. It is known that at normal temperatures, the polymerization reaction in solids does not occur, and at low temperatures, when the molecules acquire sufficient mobility and self-consistency relative to each other from some kind of influence (for example, due to polymer deformation), it begins to run violently.

7. To get rid of the contradiction, you need to move from the system to the anti-system.

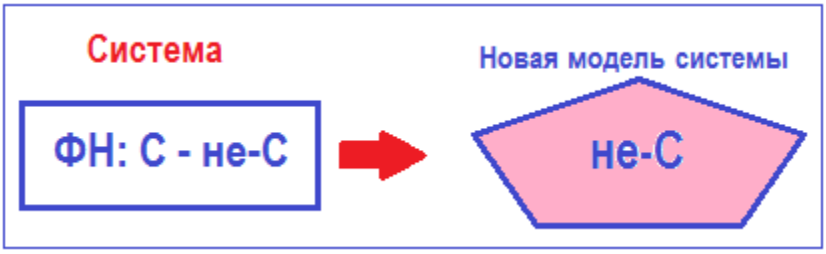


System → Anti-system

Example 17: Transition from Ptolemy's geocentric system (with the Earth at the center of the world) to Nicolaus Copernicus' heliocentric system (with the Sun at the center of the solar system).

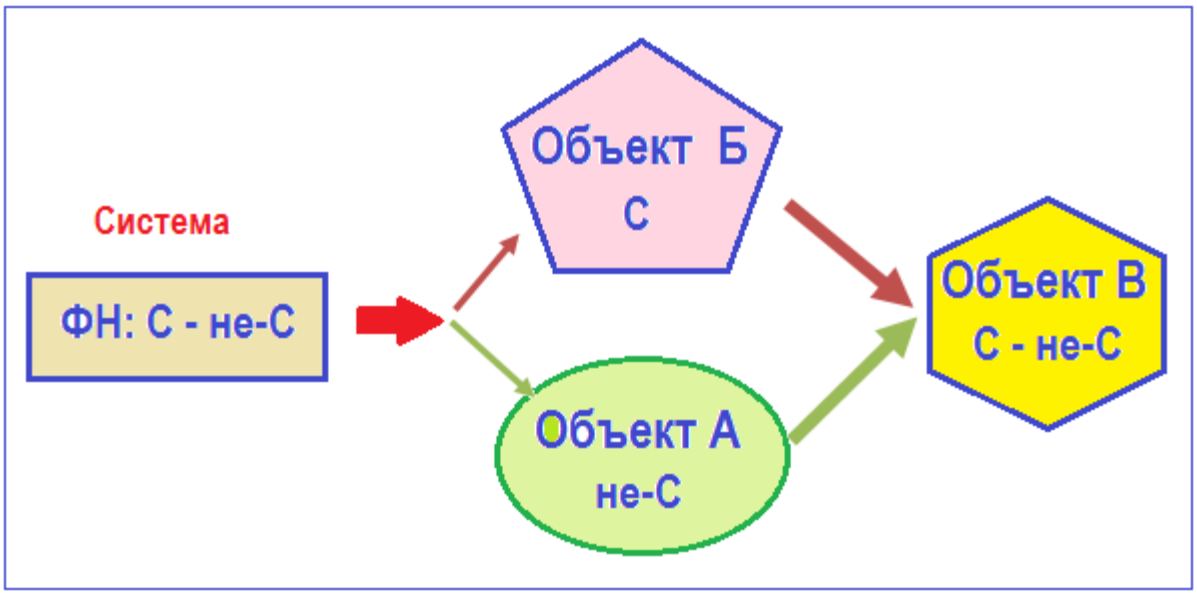
Example 18: An example of N.V. Levashov's solution of the problem of an antimatter cyclone in a six-beam (lesson 16).

8. To get rid of incompatibility, it is necessary to abandon the system that carries them: let the system have the property C and the property not-C to explain the observed phenomena, but one of the properties, for example, C is not confirmed by observations, then you need to go to the idea of an object with the property not-C and come up with a new model of the phenomenon.



Example 19. The first theory explaining the nature of solar energy was based on the fact that there are external sources of energy: meteorites fall on the Sun - hence the energy. Incompatibility: there must be a lot of meteorites (otherwise the Sun will go out) and few (otherwise we found a fall). I had to abandon this idea, assuming that the Sun warms itself. now, from N.V. Levashov's concept, it is known how the "activity" of the Sun is supported, and until what period it will last.

9. To get rid of the contradiction, you need to combine in one object the contradictory properties inherent in different objects, but manifested simultaneously in this object, and then come up with a new model of the object: let the object, showing the properties of C inherent in object A; and the properties of non-C inherent in object B, is object B.



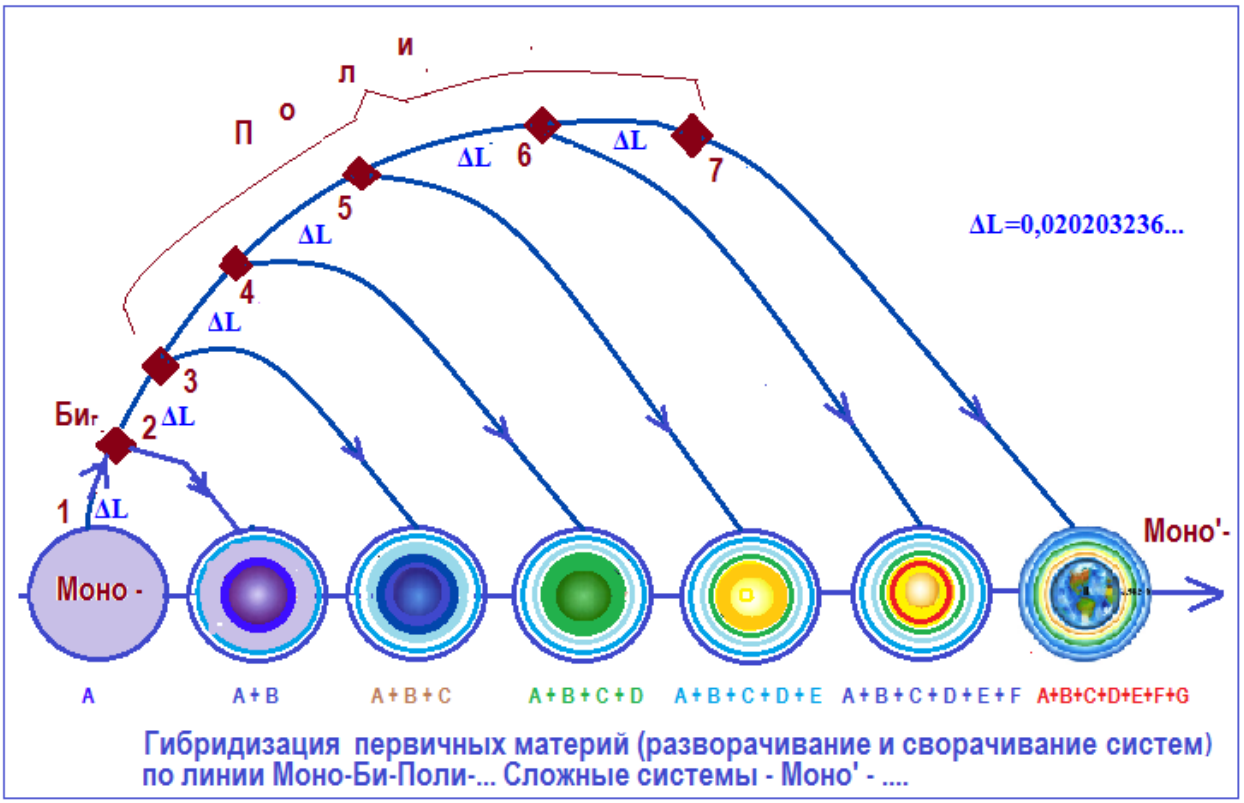
Example 20: According to the ideas existing in the 50s, the formation of a protein in a cell should occur according to the scheme: DNA □RNA □protein, i.e., a certain sequence of parts of the DNA composition should determine a similar sequence of parts of the composition of the RNA molecular matrix, causing a wide variety of types of proteins. But other studies have shown that a large species diversity of DNA composition is not accompanied by a similar species diversity of RNA composition, because the process occurs according to the DNA-protein scheme. How can this be?

PI: in order for protein formation to occur according to the 1st scheme, RNA must be homogeneous in composition with DNA, but in order for protein formation to occur according to the 2nd scheme, RNA must not be homogeneous in composition with DNA.

The contradiction is resolved by a systemic transition: in general, the RNA molecule is heterogeneous with DNA, but one of its subsystems is homogeneous with DNA, and it contributes to the synthesis of a large species diversity of proteins. At the same time, the technique of homogeneity - heterogeneity of interacting objects is applied here: heterogeneous systems interacting with each other or forming a new system must have homogeneous parts (subsystems) - through which interaction or synthesis is carried out.

10. To get rid of the contradiction, the development of systems must be considered in the form of a chain: Mono-system (C) □ bi-C □ poly-C □- complex - C□ collapsed systems ...□.....□ Mono-C1 □...

Example 21: Hybridization of primary matter.



Poly Big Mono

Hybridization of primary matters (unfolding and folding of systems) along the line of Mono-Bi-Poly-... Complex systems - Mono' - ....

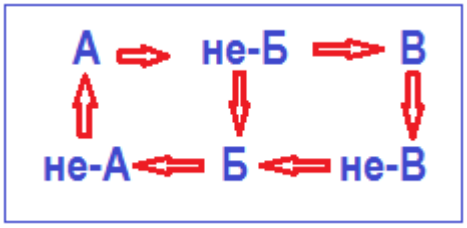
Example 22: The octave increase of any tangible and intangible objects is proportional to the degree of n, according to the dependence Y = 2n.

Task: From the book by N.V. Levashov "The Tale of the Clear Falcon. Past and present", it is known that even 1544 years ago people could move between star systems on whitemars - which Nastenka took advantage of in search of her beloved. This indicates a high level of technological development at that time and that these people were beyond the control of the Ebrov CPS. After all, at one time, the ancestors established a Source of life (their CPS) in the bowels of Midgard-Earth. It is also known that the Dzungars were able to destroy Asgard-Iria only in 1530 A.D., having previously turned off the city's energy protection. And 18,000 years ago, the Ebra managed to begin the conquest of Midgard-Earth. How to eliminate the contradictions that arise here?

The arsenal of techniques for eliminating incompatibilities in opening tasks is not limited to the above list. These are just some of the most powerful simple techniques for resolving contradictions in opening problems. Techniques are operators for transforming representations of systems. When solving most of the opening tasks, as a rule, combinations of techniques are used.

The analysis of the development of scientific systems over time shows that the development of each NS goes through the resolution of a certain chain of contradictions (CC). CC is a kind of logical chain in the development of SS. At the same time, the chain has the property that it is enough to break such a chain in some place, as it all crumbles and other contradictions are removed automatically.

The use of CC for solving scientific problems shows that, depending on the chosen contradiction, a number of solutions are obtained from the general chain. Therefore, some kind of criterion is needed here, allowing you to choose one single correct solution.



Example 23. According to the planetary model of the Rutherford atom, small planets - electrons - rotate around the massive core - the sun, which are located in different orbits, like planets around the Sun. But according to classical concepts, which considered the process of radiation and absorption as a continuous wave process, an atom must constantly emit energy, i.e., an electron rotating around the nucleus must fall into it after a while. But experiments show that the atom is stable. How to explain it?

So, we know the following facts:

A - electrons in an atom revolve around the nucleus.

Non-A - electrons do not revolve around the nucleus.

non-B - electrons emit energy when rotating.

B - electrons do not emit energy when rotating.

B - atom is stable.

non-B - atom is not stable.

We postulate that Maxwell's equations are valid for a rotating electron. Therefore:

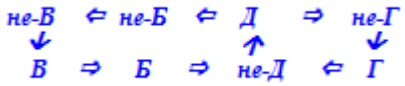
non-G - electron radiates energy continuously.

G - electron emits energy discontinuously.

Maxwell's *D-equations* are valid for an atom.

Maxwell's *non-D-equations* are not valid for an atom.

Let's build a chain of contradictions:



To resolve this ***СР***, Bohr rejected the 1st condition and postulated the 2nd (***В ð Б ð не-Д ï Г***): the atom is stable; electrons do not radiate when rotating around the nucleus; Maxwell's equations are not valid for the atom; the electron radiates discontinuously. Now it is not difficult to come to two well-known Bohr postulates.

So, representations, theories, laws,... serving to explain some phenomenon of the material world, constitute a scientific system (SS). Scientific systems, let it be bad, but develop in accordance with the objective laws of the development of the system.

But how does the formation (synthesis) of systems occur? Let's take a brief look at this process using the example of the synthesis of a technical system associated, for example, with the puncture of a well.

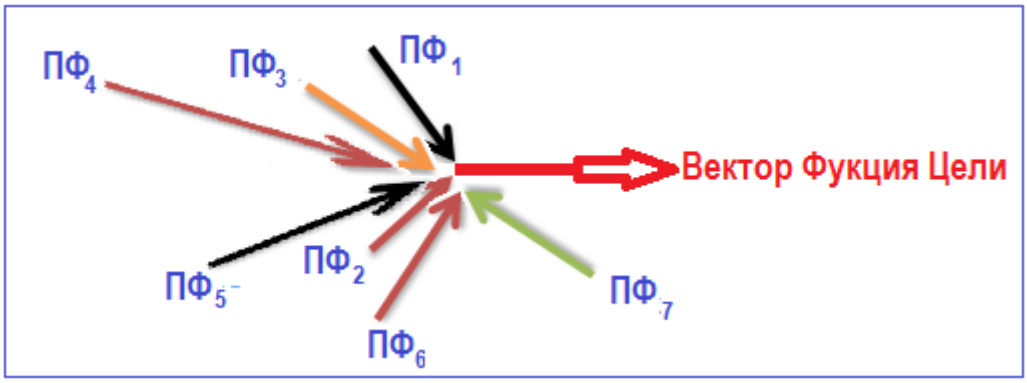
In general, the synthesis of a vehicle at the stage of searching for its composition can be schematically represented in the following sequence:

1. To form a target vector based on the need: the main function of the target of the future system is formed (for example, a well puncture with a sharp tip).

2. Build a mental model of the vehicle using the available knowledge and observing the conditions of the future system functioning.
Pmeh

3. Provide a list of useful functions that ensure the fulfillment of the goal function, and make a structural diagram of the vehicle.

Example: PF1 - creating a powerful force; PF2 - ground puncture; PF3 - creating a well; PF4 - transferring force from the jack to the tip; PF5 - creating a stop).

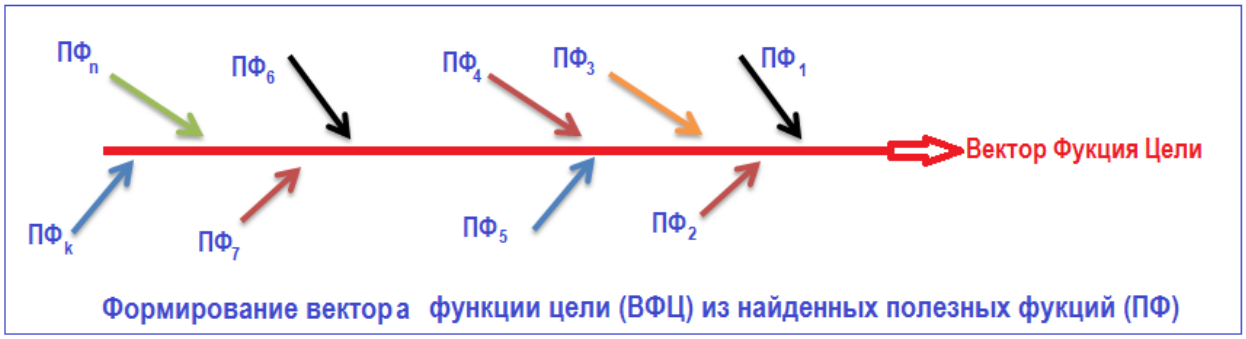


Vector Function Target

4. Find vehicle subsystems for puncture with the necessary useful functions and properties.

Example: PF1 - the use of a powerful jack (D- Mech.); PF2 - a pointed tip (PO); PF3 - the promotion of a tip having a given shape in cross-section; PF4 - the transfer of force from the jack to the tip (T); PF5 - the use of a plate to create a stop; PF6 - control of the puncture process.

5. Form a goal function vector (GFV) from the useful found functions (FF):



Formation of the goal function vector (GFV) from the useful found functions FF)

Each of the useful functions (PF) of the subsystems of the technical system performs its own function, but working for the main function of the goal.

6. To form the composition of the vehicle from the found subsystems in accordance with the laws of synthesis and functioning of the system.

Engine - D, transmission - T, working body O, control body OU, support element - B.

7. Find the most rational vehicle structure that ensures the fulfillment of the goal function.

8. To develop the found structure of the vehicle in accordance with the laws of development and the new requirements imposed on the system. In this case, it is necessary to return to paragraph 1 again and repeat the entire analysis up to paragraph 8.

9. Thus, we got acquainted with some tools of scientific creativity that can be used for the development of scientific systems in any field.

We need technology to create new knowledge

Technology has its own theory and methodology for solving inventive tasks, set out in IPS 5. The world of technology is the world of technical - artificial systems. Technical creativity is engaged in their development. The representations that arise in this case are reduced to a system of representations (SR) about a specific group of technical systems (TS). The development of these systems of representations entails the development of the vehicle.

There is also the world of natural systems (NrS). Their study is engaged in scientific creativity. The representations that arise in this case are reduced to systems of representations (SR) about a specific group of NrS. With the development of the SR, the degree of compliance of its representations with the real NrS increases.

Both natural and technical systems are united in their material essence. The ways of the development of the SR about them are also the same, because they are equally subject to the laws of nature and the laws of cognition. This is convincingly evidenced by the solution of a number of scientific and research tasks with the help of IPS representations transferred to scientific creativity. For example, the explanation of the paradox associated with the Russell effect, the discovery of plant wind power, the invention of a method for searching for extraterrestrial civilizations, the study of defects in silicon dioxide films, the hypothesis of quasars, etc.

The development of the theory of technical and scientific creativity shows that at this stage there are two approaches (two ideologies) to the problem of creativity: dialectical - the path of development of IPS - based on the idea of the natural development of systems of ideas about TS and NrS and the possibility of cognition and conscious management of it, and metaphysical - the path of absolutization and the development of trial and error - a path that ignores the objective laws of the development of ideas about the vehicle and the NrS. These two ideologies came into conflict with the advent of IPS. But the increase in the scope of IPS convinces of the inconsistency of metaphysical ideas about the unknowability of the nature of creativity and the impossibility of its formalization. This is a natural process of formation of any cognition. And so it will be until a new teaching about creativity and the methodology of cognition is established in the technology of the production of new knowledge. And for this we have a powerful theoretical knowledge base, set out in the works of N.V. Levashov, A.M. Khatybov, N. Morozov, B.V. Makov, etc., which allows us to see many processes deeper and at a completely different level.

Conclusions:
To effectively solve creative problems, it is necessary to follow two parallel paths:

1. to study and discover the patterns of development of the systems under study;

2. to study and develop oneself, developing new bodies of the essence, and for this to actively develop intuition, creative imagination, system thinking.
Further, it is possible to move to the level of the CREATOR, when the development will provide an understanding of the essence of the surrounding world.

KONDRAKOV I.M. 1.06.2014

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