

TRIZ

History of the Instruments

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*History of the
Instruments*

TRIZ Master's Book

**Excuse, the part of the text is not translated.
Please, use the original Russian text.**

WARNING!

Please, use it for preliminary reading only.

Unfortunately, we have no opportunity for qualitative translation now.

Therefore for some parts of the book we used computer translation.

For the advanced reading try to use the original Russian text.

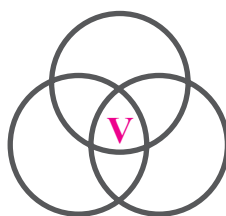
You can use any opportunities for translation.

Nataliya N. Narbut
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Survey lecture
Short version



TRIZ Master's Book

2005



 Introduction	3
01. First step into new science	7
02. Information Funds	15
03. The Account of Personal Time	17
04. Qualities of the Creative Person	21
05. Strategy for Life	25
06. ARIZ	29
07. Method MMP	31
08. Operator STC	39
09. «Floor» designer	43
10. Principles of phantasing	45
11. Scale «Phantasy»	49
12. Vepol Models	51
13. Laws of development	53
14. System of Standards	57
15. System of Effects	59
16. The Register for fantastic ideas	61
17. The Multiscreen Scheme	65
18. Ideal strategy of creative	67
19. «TRIZ teams»	69
20. Further development of TRIZ	71
21. History of TRIZ development	73
22. The Literature	75
23. Education Plan	77
24. Education Tasks	79
25. Terms which are used in TRIZ	81
26. Altshuller	91
27. Examples of TRIZ-solutions	97
 The little about the future	145



Introduction

I was not going to entertain proud people...
(A.S.Pushkin, «Eugeny Onegin»).

Science was created in antique Greece. The great, but modest Aristotle considered the person by name Thales as the first among all scientists. This is the same Thales from Miletus who turned philosophy, mathematics and astronomy into real sciences. Certainly, many things were known hundreds of years before Miletus Ionian School, but Thales and his students started using not only observations and not only reasonings to apply to reception of new knowledge. They were the first who used **proofs**.

The new approach, new techniques for intellectual work not only allowed to discover something new, but also permitted to accurately evaluate, determine and sometimes even predict new events. Thales was the one to teach his friends sailors to use the Polar Star as an orientation point. He was the one to find out how to measure the distance from the ship to the shore. Even the solar eclipse was for the first time predicted by Thales.

Thales' main interest was the science itself and the process of justifying it. He also discussed the justification process with his own students. For the science and for his students, whose number grew with each year, Thales left all other activities, such as traveling, structural design and military art, although in all these areas he achieved excellent results.



As it commonly happens, the new work was not immediately recognized. Exercising ***pure science***, which is what Thales was doing, often causes misunderstanding and calls forth mockery and even hostility from others. New students, who were only starting their studies, had the hardest time. It was difficult for them to prove to others and to themselves that what they were doing really was time worthy. Under such conditions, it was hard to think about science. Eventually, it got to a point when scolding went too far...

When the time came, Thales successfully solved that problem. He proved that exercising science might indeed be very useful; moreover, it could give a financially profitable result. But more about this later.

This book talks about one of many sciences. Of course, it does not cover all of it, for no science can be fully covered with just one book. Here, we only talk about ***history of basic instruments of TRIZ***.

The title of the theories is an abbreviation for ***Theory for Solving Innovative Problems***. Then came the difficulties present in every science. What is a ***mechanic***? Fixing a bike is job for a specialized mechanic. To design plans of a big ship is also a job for a mechanic. Calculating the flight trajectory from Earth to Saturn is practically pure mechanics. Nevertheless, it is clear that these jobs are very different from one another. In each case, a high order qualification is required, but they are all different kinds of qualification.

TRIZ also requires different kinds of qualification. There are many types of innovative problems whose solutions depend on relatively simple instruments. But ***a hard problem can be understood only after its solution is known***. Thus, it is impossible to identify the necessary instruments and their use right away. Moreover, many problems change halfway through the solution process, – and often enough they do not become easier.

There is one solution: You must prepare yourself for hard work from the very beginning. ***Every Student can become a Master***.



This does not mean that every Student must become a Master. Moreover, it is simply not possible, because there is plenty of work for every level of qualification. It is not possible to create a strong army consisting of only generals. There must be officers, even more sergeants and the most privateers. Yet, a good soldier must understand his general, because only then he can accomplish what is required of him. This is the way any group functions. This is the way of life.

Thales from Miletus took a very trivial approach. Together with his students, he developed a plan in order to justify the value of science. And then he followed it.

At first, it started with astronomical observations and calculations. They showed that next year will have very rich crops of olives. After that, the science team mobilized all the financial resources and purchased almost all the machines for producing olive oil from Miletus and its surrounding areas. Of course, there was a high risk factor associated, but in less than a year these machines were overloaded with daily work, and Phales with his students became some of the richest people in Asia Minor.

There was nothing non-trivial with this plan. All it required was to do exactly what the science predicted. Also, one must discover, understand and learn to properly use this science. It is not important what task you have at hand, what is important is how accurately, skillfully and professionally you are doing it.

TRIZ – is the theory for the practical work.
This is new chance for you.

The science can not be useless.





First step into the new science

The first step into the New Science of TRIZ was made in the summer of 1956. An article «Psychology of innovative creativity» was published in soviet journal «Psychology Questions» #6, 1956, p.37-49. The authors by G.S. Altshuller^{*)} and R.B Shapiro^{*)} (Baku city).

The process of solving innovative problems, as well as the process of developing new technical systems, was always of interest. Moreover, the notion technique (technology) does not only refer to automobiles, ships or cellular phones. It also describes actions taking by a football player or a boxer, playing violin and painting a composition.

***Technique – it is all the instruments
that a man designed for altering nature.***

Certainly, articles and books about how techniques developed and evolved have been published before. However, they described one sided process: either purely psychological, social or purely naturalistic. The world of technique, undoubtedly, was created by the world of humans from the world of nature, but it is a separate world in itself. It has specific objects, which can be described with specific models that are governed by specific laws.

G.S.Altshuller and R.B.Shapiro were the first to talk about this in their article. With this work they opened a door into a new science

^{*)} The phonetic transcription of surnames: [al'tju:ller], [ʃapi:ro].

Analogues situations are present in other sciences as well. For example, the formulas that A.Einstein used to describe his Special Theory of Relativity were known long before and were published by different scientist. Yet, A.Einstein was the first to point out the importance of these formulas, which in turn discovered new laws of nature (speed of light is constant in all frames of reference). So A.Einstein is considered the scientist who discovered the Theory of Relativity.

TRIZ - it is a science, which studies the development of techniques as co-action of humans and nature.

The co-action of nature, humans and technique can be demonstrated with the problem of three intertwined rings. With a careful look, one can see that only together the three rings form a system. If even one of the three elements is removed the system falls apart. Each of the rings 'retains individuality', since it is not tied or connected to the others, but only together they form a reliable and stable system.



This is similar to the three poles that are used for a base of a **tipi**.^{*)} Each pole is held up by the other two and cannot stand on its own.

One of the characteristics of TRIZ is the detection and application of **contradictions**, simultaneous «presence-absence» of some action.

^{*)} A **tipi** – a version of a **wigwam**, dwelling of aboriginals of America.

So going back to the original publication, the following quotation demonstrates the vital changes that authors made:

«...The study of psychology of the innovative creativity cannot be done separately from studies of general laws of technique development. The objective of the inventor should be directed towards creating new inventions, the inventor is part of the technical progress. Hence, the mentality of the innovative creativity is understood only with extensive knowledge of the laws of technique development. The above mentioned certainly does not indicate that the researcher must only be involved in studying the mechanism of the technical progress. Unique psychology of the innovative creativity, as with any scientific discipline lies in the necessity to simultaneously take into consideration objective interconnections among technical development and subjective, psychological factors. First of all, the psychology of the innovative creativity is a subsection of psychology. Thus, the centre of its attention is the psychological actions taken by the inventor, inventor who perfects and completes the technique. The psychology of the innovative process is a bridge between the subjective world of human psychology and the objective world of technology and so it must take into account in the studies of the innovative process the laws of technique development.

The process of developing a new invention has two sides: the materialistic and psychological. In order to identify the materialistic side of the invention it is necessary to know the history of how the technique developed and understand the basic laws of a technical process. Studying such history material and analysis of specific inventions happen to be one of the most important sources of psychology of technical process.

In order to identify the psychological laws of invention systematic observation of the process of the innovative work by the inventor is necessary, as well as generalizing the innovator experience and experimental examination of the innovative creation process through experiment conduction in conditions closest to genuine ones...»

Take a closer look at the last paragraph. It introduced some terms that are important to experimental research of creative processes. It is natural to expect some tool to be developed for such research, but first some of the important basic principles of creative work must be formed:

«...Every creative solution of a new technical problem, regardless of which area it belongs to, has three core moments:

1. The posing of the problem and identifying the contradiction, which prevents solving the problem using a common, well known approach.

2. Eliminating the cause of the contradiction with the goal of achieving a new – more involved – technical effect.

3. Introducing other elements of the perfected system in accordance with the changed elements (the system takes on a new form, corresponding to the new purpose).

In consensus with this, the creative solving process of technical problems typically includes three – different according to their goal and method – stages, which can be conditionally called analytical, operational and synthetic.»

So now there exists an instrument for practical work:

«Based on everything described previously, the creative process scheme can be presented as follows:

I. Analytical Stage

- 1. Select a problem.*
- 2. Determine the goal of the problem.*
- 3. Identify the contradiction preventing the solution.*
- 4. Determine the cause of the contradiction.*

II. Operational Stage

1. Examine the typical solution approaches:

- a) in nature*
- b) in technology*

2. Search for new solution approaches through modifying:

- a) within the limits of the system*
- b) in the surrounding environment*
- c) among the connected systems*

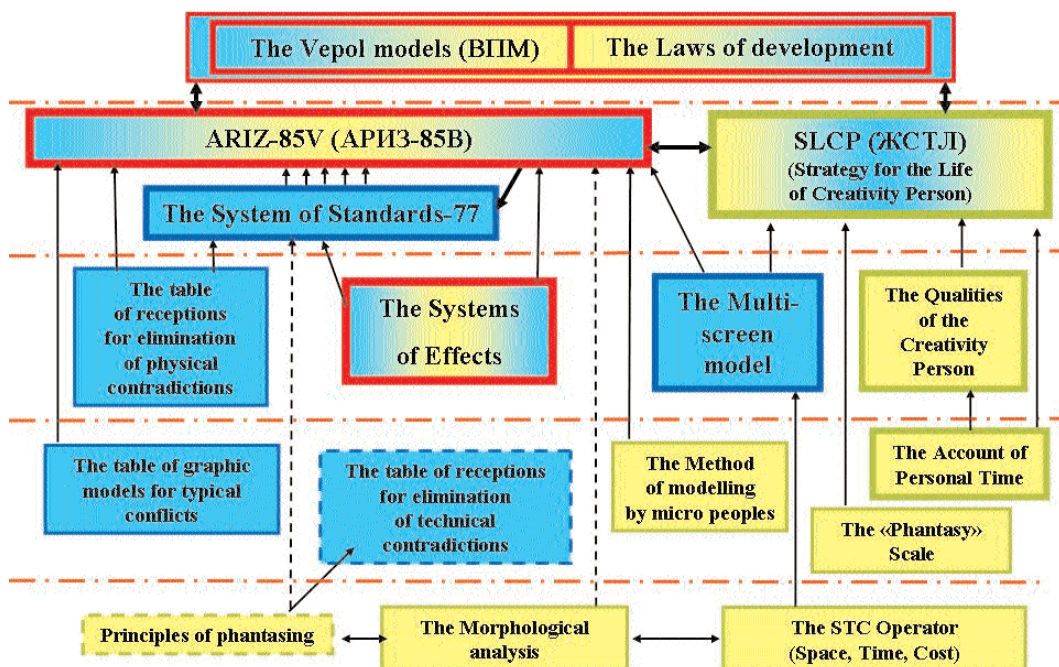
III. Synthetic Phase

- 1. Introduce the functionally favourable changes into the system.*
- 2. Introduce the functionally favourable changes into the methods of using the system.*
- 3. Assess the applicability of the principle to the solutions of other creative problems.*
- 4. Evaluate the new invention.»*

This citation describes the very first ARIZ (Algorithm for Solving Innovative Problems). This classification appears in G.S.Altshuller's works a few years later, but even in the original publication it is a real working instrument. Of course it differs from the modern model ARIZ - 85V in the same way the plane built by brothers Wright differs from a modern aircraft. Nevertheless, it has (even if they are not very prominent) all the important elements of an instrument: process of identifying and eliminating contradictions, control over the psychological factors, and usage of previously obtained information.

From the very beginning of TRIZ, ARIZ was and still remains its most important instrument. As science develops, the old instruments change and some new ones are introduced; however, not all of them are equally effective.

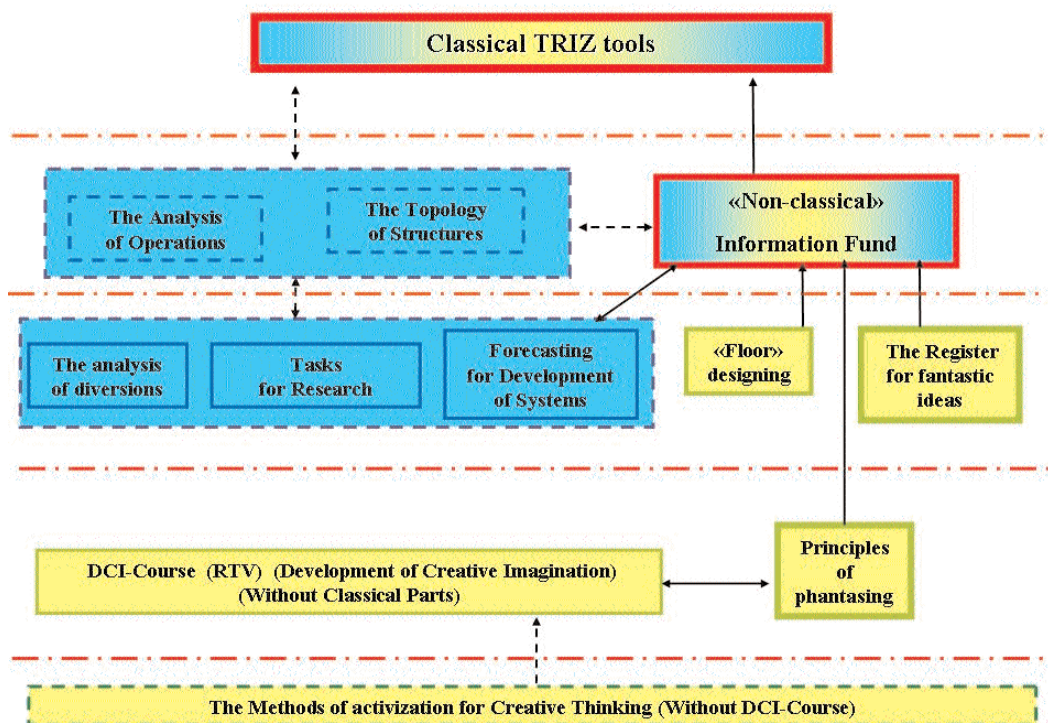
Some of the instruments always give positive results (that is if they are used properly). They are **«classical» instruments of TRIZ**. As a rule, this effectiveness (besides other factors) is ensured by successful application to many problems in different TRIZ-groups. Other instruments, even when used correctly, cannot guarantee such reliable results. They are **«non-classical» instruments of TRIZ**. They may be new and so must undergo active crosschecking to eventually become «classical». Although it is possible that they are the old, merited, formerly «classical» instruments, which reached their improvement quota and migrated into the other group.



This chart demonstrates the correlation between the «classical» instruments of TRIZ. Blue frame corresponds to technological instruments, green - organizational instruments, red - informational instru-

ments. A more detailed explanation of the differences between these instruments will be given in later sections. A **broken frame** indicates that this instrument is starting to lose its effectiveness and becomes a "candidate" for transfer to the other group. **Broken arrows** between instruments also indicated insufficient effectiveness.

The red horizontal dashed-dotted line separates different levels of instruments. The most important instruments are higher up on the chart. Hence, strictly speaking from the chart it follows that **laws of development** and **Vepol models** are more important than **ARIZ**. It is true that these elements are very important, but they are no longer considered to be just instruments. They are now intended for identifying new directions in science, where as solving problems is a job for a fundamental instrument, such as **ARIZ**.

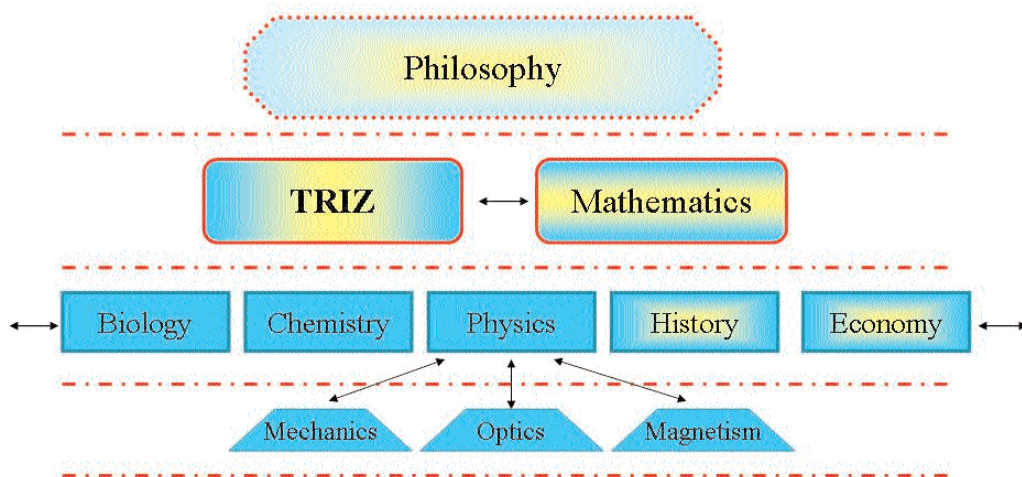


The «non-classical» instruments chart has quite a few **broken lines**. Most of these elements require a serious and time consuming confirmation.

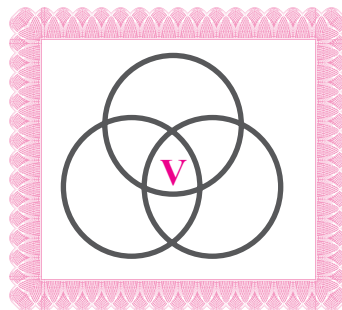
An exception is methods of activation of innovative imagination, which did not become part of the CID (Creative Imagination Development). These **quasi-instruments** have no future in TRIZ.

***TRIZ - it is an applied dialect,
mathematical philosophy.***

Such an understanding of this science did not come with the first day. Far too many years, for different people, TRIZ remained simply a convenient method of solving problems. The proper place of science of TRIZ in the complete hierarchy of science will be understood only after one is familiar with its fundamental instruments. So the chart given below is for now only a chart and it will be justified later...



This book is a very short version of the history of instruments of TRIZ, a guide for first time introduction. The next step into this science would be solving a spectrum of different problems, but first, let's discuss the backbone present in every science – ***information funds***.



Information Funds

Any self-respecting investigation begins with information gathering. TRIZ is no exception. Moreover, this particular science devotes a lot of attention to collecting and organizing information..

This could not be any other way. TRIZ is a science about development of technical systems and how this development can be controlled. In order to have full control it is necessary to know the *laws of development*; to see and understand *the system models*. This can be achieved only through studying an enormous amount of information about these technical systems.

One could say that TRIZ got lucky. Altshuller began his work when he was employed at the patent burro (invention inspection burro) in Caspian flotilla of the Soviet Navy. When Einstein was doing similar work he got the idea for the Theory of Relativity. Altshuller got his ideas for TRIZ.

It was soon understood that work at a patent burro requires more than just well written papers for the invention. More often than not the new invention had to be improved or even completely redesigned. New technique of creating the same invention is needed. But first, one must collect and analyze a lot of information about a variety of already existing solutions.

The basis of the information fund, information cards, may be very simple. On one side of a sheet of paper write down the initial state of the system, and on the other write down what is obtained in the process of solution, that is changes, improvements, development and etc. Also, indicate the purpose of these changes, or reasoning behind them.

While there is a few of these cards, it is simply a collection of isolated solutions with no connection between them. Then from the large mass of information the shape of a particular system gradually comes through.

Altshuller wrote that from 1961 to 1969 he selected and analyzed more than 40 thousand high class invention. To achieve this he had to work though almost the whole patent fund that USSR had at the time. But the product of his work was worth the efforts.

As it turns out, all the inventions can be classified into five levels. The first (lowest) level uses an already existing solution. The next one picks out one solution out of a few available ones. The third corresponds to the initial solution being significantly modified. Then follows the case when a completely new solution arises, and finally, on the fifth level a completely new course of actions comes to life. The choice of a problem and the development of a solution also can be classified in terms of different levels.

Eventually one can see some similarities between the methods which give the strongest solutions. They are ***the methods of eliminating technical contradictions*** and can be considered to be the first, although not very effective at the time, instruments of TRIZ. Already then Altshuller noticed statistical dependence of using such methods and constructed the first ***tables*** for their application.

Of course, these were still some of the simplest instruments of TRIZ, now they cannot even be considered «***classical***» to the full extent. Nevertheless, this work made the important step and began the formulation of the first ***systematic information funds*** of TRIZ. Gradually, the enormous body of potent data began forming an organized structure of the new science.

The Account of Personal Time

Time is our greatest treasure. Time rewards everyone equally, it cannot be bought or lost and hence, there is never enough of it.

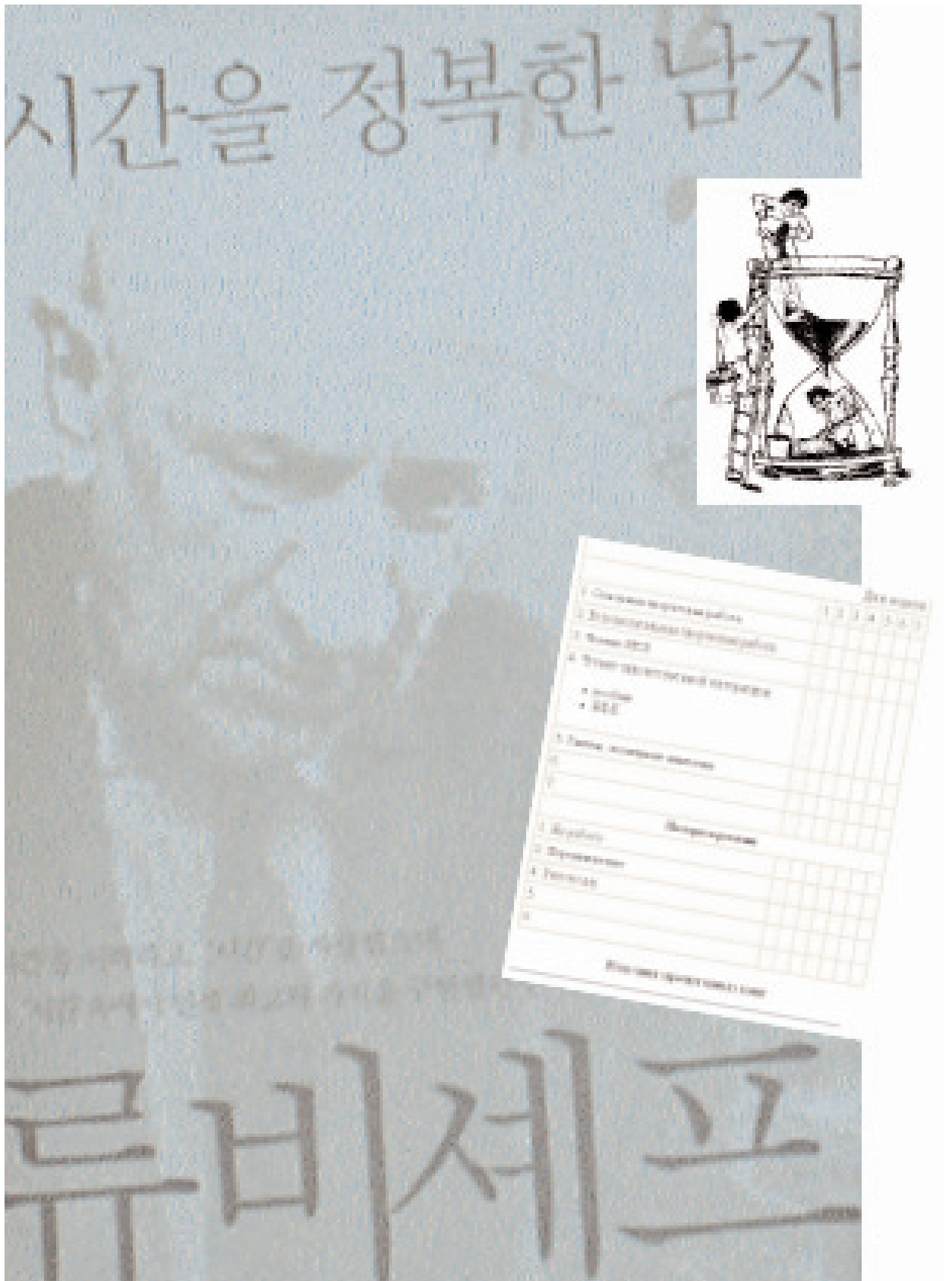
Collection of the information, analysis and systemization of the information cards are all time consuming processes. Tens of thousands of selected inventions mean years of constant daily cumbersome work. Such work requires not only determination and talent but also precise organization, or *account of personal time*.

Since 1975 the account of personal time is a must for everyone who studies or applies TRIZ. This account of time is done using a technique first introduced by Alexander Alexandrovich Lubishchev, hence, it is often called *Lubishchev System*. This is described in more detail in a book by Daniel Granin «This Strange Life»..*)

The idea behind the account of time is to constantly keep track of used personal time. Every day is digested by the minute, as to what the time was spent on. However, this is only the first step in creating the information fund about personal time. Afterwards, comes the analysis process.

The time spent on main (scientific) work, on additional supportive work, on reading various literatures and obtaining other information is recorded in separate sections in a specifically designed cumulative chart.

*) This book is translated to some languages, including on Korean.



Just as important is to account for lost time. Here, one indicates the time that was not spent productively: repeated work, waiting time or «empty» conversations...

Such track keeping over a few days, weeks and months shows the correlation between positive, productive time usage and unproductive losses. These losses may be in the future turned into a particular «reserve» of time and partially or even fully use it for main (scientific) work.

The cumulative table over a week must contain a list of all read books and articles along with their short abstract overview.

It is interesting to see the practical application of this system. Here is what Altshuller has to say about it:

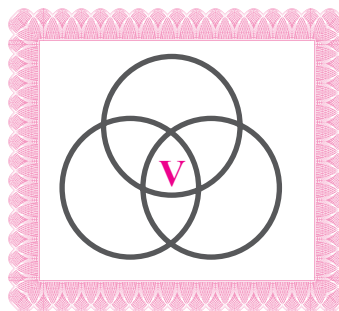
«For quite some time I was following a bad system. It started back in school, in grade 9 when I started to keep track of read pages. Eventually I brought the plan from 100 to 300 pages per day. I discovered that too much quantity over quality; there was too much «light» reading. I switched to recording the number of hours... and the system worked right away. So I had to give some thought to what is «useful time» and what are «losses», and they cannot be identified without formulating the life goals and without a system of plans.

Very soon it was clear that the system does not allow taking away or adding time. So you either have to give up the system and admit your defeat (and then you cannot profess to anything), or start fighting the time losses... and go deeper into the system. I kept track of time (even the details of this track keeping was similar to the form proposed by Lubishev) for about 15 years, until 1956. This also included the 4 and half years up north. During the good years, the wasted time added up to 12-13 hours per day, which is a lot. Up north it was on average 7 hours a day and this was incommensurably more difficult the usual 12-13 hours. After this I have no sympathy for complains about lack of time. I stopped keep-

*ing track when I felt that I no longer need to write things down. I developed a quality to simply **feel** the flow of time. I know how much one or another job «costs». I can feel to what extent the time is productive and if this extent is not great enough I associate it with physical discomfort.»*

By itself, keeping track of time is an **organization instrument**. At first glance it does not have a direct effect on the process of solving problems, but only helps to control one's action (via psychological factors).

Accurate account of personal time makes it difficult and even impossible to waste time. An individual unwillingly feels necessity to plan ahead the use of time, and thus, plan ahead his or her work. At the beginning such planning forecasts the next few days or weeks, but with time the planning extends to months and years ahead. Eventually it comes to a moment when the whole life needs to be planned out. Though for this the Lubishchev system is not enough, but the whole complex of ***qualities of a creative person*** must be used.

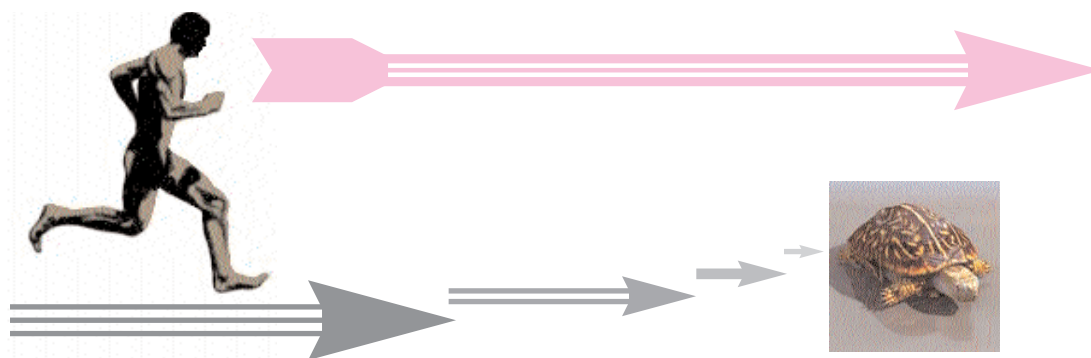


Qualities of the Creative Person

The fastest runner cannot overtake the slowest turtle. By the time the runner gets to where the turtle is now, the turtle moves up ahead by at least some amount. So if all the runner is doing is catching up with the turtle, it is not possible for him to overtake it.

The solution to this contradiction was found back in ancient times. It is important to set a long term goal. This large and serious ***Goal is the most important quality of a creative person.***

The Level of a Creative Person can be easily identified by the goals set in front of that person. The goals of remarkable people go «beyond the horizon» and it takes longer than one lifetime to accomplish them. It is remarkable that today it became impossible to achieve serious and valuable results without setting one's goals so highly.

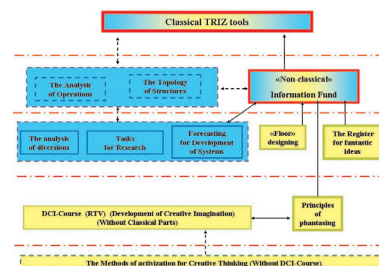
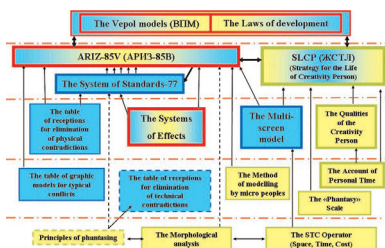


It is still not enough to simply have a great goal. To achieve it one must have a whole ***complex of detailed and well selected plans***; preferably, to span the whole path towards the goal. It is difficult to produce such plans and even harder to consistently carry them accurately. So constant self control and ***account of personal time*** becomes a great aid.

High work efficiency, the ability to perform a large amount of work in a short period of time is a typical requirement. However, for a Creative Person there is another important characteristic: the emphasis is not simply on work efficiency, or «overall productivity», but only on the work, which contributes to the realization of the proposed plans.

The famous science fiction author Jules Verne for many years collected and analysed various scientific information; which he then used to create some of his most interesting novels. He composed a library of 20 thousand notebooks. The information fund collected by Altshuller can be just as impressive, and not only with its size and the quantity of work. This fund was necessary for the foundation and development of TRIZ, and this makes such a fund very valuable.

Still, the Great Goal, detailed plans and even high work efficiency do not guarantee valuable results. One more important quality of a Creative Person is **the problem solving technique**. It is essential to be able to properly use all instruments of TRIZ - technological, organizational and informational. The ability to see the laws of system development and modelling, contradictions in the systems and ways to overcome them - all this pertains to the problem solving technique and it must be studied very seriously for a long time.



All of the above listed qualities are necessary for creative scientific work, but by themselves they do not guarantee success. There are many obstacles on the path towards the Great Goal and these obstacles must be overcome. As they say, «**stand your ground**», not be afraid to defend one's solutions and be able to realize them in any outcome.

And so only when all of these five qualities are present, and can achieve the necessary **productivity**. It must be remembered that the results do not come right away and not to the full extent. On the path towards the posed Goal some of the smaller results come first and then later they become more and more significant.

Through careful organization of work one can be producing results many years later. For example, Jules Verne's son used the information fund organized by his father to prepare for press a few novels that the writer was unable to finish.

Going back to the beginning, that is, to the most important quality of a Creative Person, one might ask: Which goal would be considered worthy enough to spend one's whole life striving towards it? Of course, everyone has their own goal, but general signs of a **Worthy Goal** (WG) can be identified.

First of all the goal must be positive, oriented towards improvement of life. Unfortunately, in quiet a few cases the goal also has negative and harmful consequences. So while achieving a goal, one must always strive to minimize the damage and maximize the positive effect.

WG must be original. Else, the means of achieving it must be original.

A well posed goal is infinite. It may be expanded like a tree grows from a sprout. Then the trees can be put together to make «a forest»...

As a rule, a truly Worthy Goal is not easily accepted by other people at first; it contradicts the familiar ideas and standard beliefs. Thus, it is very important for the WG to be very specific, so it can be evaluated from the very beginning and the path towards achieving it can be controlled.

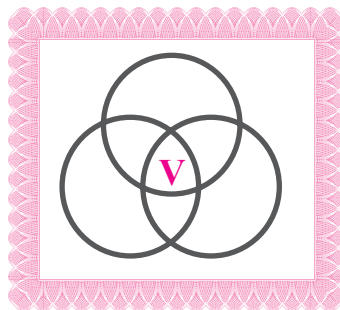
Such a distant and unusual goal has an advantage as well: it does not compete with the goals of other people. So there is no need to haste the progress and carefully follow through with all the steps. This is very important when starting unusual and at first difficult work.

Nevertheless, even with such advantageous conditions, it is still important to demand constant realization of the steps, at least small ones. One a path has been chosen, it must be followed through.

In order to achieve any serious goal it is important to have a large information fund. Sometimes it is possible to use pre-existing information collected by others, though quite frequently one has to spend a lot of time and effort to create personal «information storage».

Finally, the WG can almost always be made independent, that is not requiring high cost and sophisticated equipment for its realization. The core part of the work can be done independently.

Studying and developing in oneself the qualities of a Creative Person has been part of the TRIZ course for many years. The study of grounds for choosing a goal began in 1983. ***The Fund of Worthy Goals*** is constantly reformulated (for both educational and practical purposes). All this allowed identifying certain correlations, which are the base of Strategy for the Life of a Creative Person.



Strategy for Life

Realization of the Qualities of a Creative Person requires a certain technique. This technique is known as LSCP – Life Strategy of Creative Person.

According to the main idea of LSCP, the whole life of a Creative Person (CP) is an ongoing battle with the «External Obstacles» (EO). These «obstacles» may come in form of various objects and actions by those objects: acts of nature, inner problems or external circumstances.

Still, EO is not represented as «absolute evil». EO exist in their own world and abide their own laws. EO interfere with the goal only by not aiding it. For example, rain can prevent arriving on time to an important meeting, however, one mustn't try to fight rain or get offended by it: to prevent being late one must simply take into account the possibility of such interference.

LSCP is written out in form a few dozens of «steps», grouped into four main categories. In each part of his/her life, CP sets specific goals for himself/herself. EO can interfere with realizations of these goals through its actions (its «steps»). In return, CP plans ahead the counter steps to prevent the negative effect of EO. This is similar to a typical chess game. Moreover, separate stages of this «game» are indeed named using the chess terminology, though some important differences are present.

Debut – the choice of a future «game», the choice of the Goal. How can the circumstances interfere? Evidently this interference can push towards alternative, lesser goals. This is similar to obtaining a narrow specialization with no possibility to broaden it further to «vast science». It is important for a CP to be able to choose and then independently identify and develop his or her Goal.

The Debut of LSCP has two parts, both of which have their own main conflicts. The EO of the first conflict steer one towards typical behaviour, towards standard high school and university education. The aspiration of CP towards more serious goals should force CP to obtain more advanced education and develop independence between the through process and behaviour. The second conflict is the battle for time, or more specifically for the right to manage one's time. EO take this time away and the CP must find ways to save it and use it productively.

The Creative Person prevails if a Worthy Goal is chosen and transition to the next stage is successful.

Mittelspiel (middle of the game) begins from the moment the Goal has been chosen. So now it is important to obtain a minimal result which may be of use to others.

Mittelspiel has three part (and three main conflicts).

The first conflict is again the battle for time. CP strives to maximize the time saved for working towards achieving the Goal. EO still force the CP to spent time on many other unproductive activities.

The second conflict is the incompatibility of social status of the Creative Person and the important Goal that CP is working towards. This is rather common in any type of work.

The third conflict comes from the group that forms around the Creative Person. The group is an asset, but at the same time it creates additional complications.

The Creative Person prevails if the group for realization of the Goal is created (formation of a scientific school) and transition to the next stage is successful.

Endspiel (end of the game) presents the development of the system of Goals. CP accomplishes results even if their life span prevents further work.

This stage has two main parts (and two main conflicts).

The first conflict comes from the fact that it is no longer one school working towards the Goal, but a group of schools. A large number of new people can perform more work, but at the same time there are more possibilities for errors and distortions.

The second conflict is that it takes too much time to reach this stage, sometimes a whole lifetime, and the work is not yet finished.

One again, the Creative Person prevails if transition to the next stage is successful.

Post Endspiel. This is not possible in a game of chess – a game after a game is finished, but in Life Strategy it can happen.

Post Endspiel has two parts (and two main conflicts).

The Creative Person is now physically absent; yet, certain results are still produced due to the steps accomplished earlier.

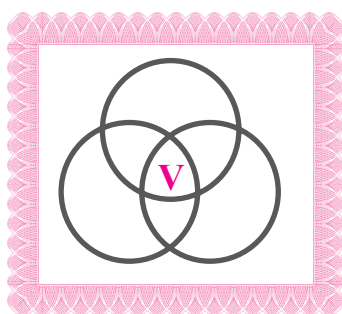
The scientific movement becomes a group of movements («super-motion»). The number of people rapidly increases and even more rapidly decreases the overall quality of work. The «super-motion» takes on a new form of «External Obstacles».

The very first version of LSCP came out in 1985. Finalized versions have been published in various books.* Every stage of this game is comprised of numerous «steps» taken by both the External Obstacles and the Creative Person. Many cases also introduce additional reinforcing steps. The total is 88, but it should be noted that many of the «steps» can be made several times during different stages of this giant «game» and most importantly, this total cannot be complete. As life evolves, new possible interactions between the Creative Person and the External Obstacles come through. They must be studied and used.

*) More in detail about these books look in section 22 «The Literature».

G. S. Altshuller considered LSCP to be one of the most important sections of TRIZ. It is impossible to create a genuine Creative Person without such an instrument and so it is impossible to effectively solve problems. A detailed study of LSCP demands a lot of time (and regular use demands a lifetime), but a brief overview of the main stages of this instrument is necessary even at the introductory level.

Implementation of LSCP requires combined efforts from many instruments of TRIZ. On the other hand, even the basic familiarization with LSCP allows for better understanding of the key instrument of TRIZ – *Algorithm of Innovative Problem Solving* (ARIZ).



ARIZ

The most important instrument of TRIZ is the *Algorithm for Solving Innovative Problems*. All other instruments only assist ARIZ and provide work for it.

One could say that ARIZ was already present in the very first TRIZ publication,^{*)} though the term itself did not come until some time later, in 1965. And the familiar acronym along with its numerical index was first used in the first edition of G. S. Altshuller's book «**Innovation Algorithm**».

ARIZ has been actively developing over the years. This development was ensured by the large number of groups, and then later TRIZ schools, which created TRIZ-motion. Every group and school used a certain general strategy to solve a vast amount of problems. The records of these solutions were studied in detail and analysed. This in turn provided specifications and additions to ARIZ.

For example, more than 5 thousands records analysing a variety of about 150 problems were used for the transfer from ARIZ-68 to ARIZ-71. ARIZ's further development used even a larger information fund.

ARIZ-85V is the latest version of ARIZ, which had to go through a complete and detailed examination. So this is the version used in solving practical and study problems. The study problems in this book are also analysed using ARIZ-85V. ^{**)}

^{*)} More in detail about these books look in section **01** «First step into new science».

^{**)} More in detail about these books look in section **24** «Education tasks».

All of the versions of ARIZ, although different in their spans and volume, contain three main elements:

1. **The Program.** ARIZ is a logical sequence of actions, which is directed towards finding the solution of a given problem.

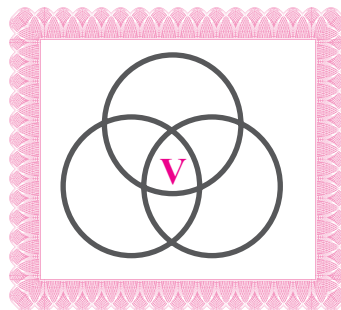
2. **Information Availability.** ARIZ contains a large amount of information, which is needed for constructing the solution. One part of the information is contained within different instruments, and the other part takes the form of footnotes and references to specific information funds.

3. **Control over Psychological Factors.** ARIZ as a whole or as parts of different instruments is intended for controlling psychological factors.

So ARIZ happens to simultaneously be a technological, organisational as well as informational instrument.

Originally ARIZ was used only for solving technological problems, but with further development of TRIZ (mostly the increase of the informational funds) it became possible to use ARIZ for solving problems of different nature, for example, socially-economics problems.

Minimal knowledge of ARIZ (including analysis of study problems) is a must even for most basic beginner stages of studying TRIZ. Application of any other instruments, without the logic of ARIZ, can cause difficulties and it is less likely to get useful results.



Method MMP

Method MMP is the method of modelling with «micro people» or method «Modeling with Micro People».

Task N.6.12.*) Many foods must be stored at low temperature in order to be preserved. If the food is stored for a long time, then the owner must have a way of finding out that the temperature has not increases (and the food didn't go bad).

How can this be accomplished? The use of regular thermometers in this case is insufficient.

When applying the method MMP the most important part are the actions taken by the person solving the problem, and the less important part are the problem conditions and properties of the system which must be changed. Hence, the method MMP is an **organizational** instrument.

This instrument is a must in ARIZ (step 4.1). On the other hand, in order to get the best results with method MMP, one has to first analyze the problem with the first three parts of ARIZ. This analysis brings forwards the technical contradictions of the problem, conflicting pair (item and instrument), the actions of the Eks-element, operational zone and operational time, ideal final result and physical contradictions in the problem. Now, to eliminate the physical contradiction from the operational zone, one has to transform components of the system. This is best achieved with the method MMP.**)

*) *Tasks of N series are taken from the separate collection prepared by authors.*

**) *The explanatory of some terms look in section 25 «Terms which are used in TRIZ».*

In the **task N.6.12** this can be viewed the following way:

There exists a conditional «thermal field»*, temperature, which can change. It is necessary to know for certain whether the temperature went up or not (above a certain threshold). This can be determined with some sort of instrument (a regular thermometer may be unreliable). Therefore, wherever the «thermal field» is active (and where the food must be preserved) some sort of particles must be present (parts of the instrument or the Eks-element). These are the particles that will be the micro people.

This problem requires the micro people to react to the change in temperature. This reaction may be expressed only through interactions and displacement of the «micro people» because these are the only things that can be shown in a drawing.

There must be at least two drawings: the state at the allowed (low) temperature and the state at the not allowed (high) temperature.

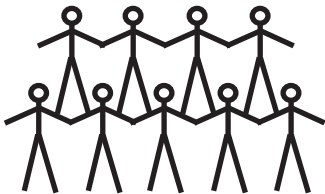


When the temperature rises, the «micro people» stop holding hands and even step away from each other. This is easy to notice and can have both physical and technical correspondence.

However, there is a problem: after some time the temperature may drop again and «micro people» will start holding hands again. How can one know if they ever stopped holding hands?

**) The modern physics considers four fundamental fields. But for the description of technical systems is allowable to use many other conditional «fields». These quasi-fields which can be the most different by the nature, do the description of systems by more simple, and the solution of tasks easier. Certainly, thus it is necessary to remember always, that these «fields» are conditional.*

Evidently, when the «micro people» let go something irreversible must happen. It is very important that this is expressed only through the actions of the «micro people».



Before
(low temperature only)



After
(after high temperature)

At the low temperature, «micro people» pile up into two layers (two storeys). At each level they are holding hands and so the top layer is standing at the bottom one and does not fall through.

Yet, as soon as the temperature goes up (exceeds the threshold) they let go of the hands and the «micro people» of the top layer fall through to the bottom level

Now if the temperature does decrease again (below the threshold) «micro people» will not be able to form two layers, although they will be holding hands. Such a change in the number of levels («storeys») would be a sign that at some point in time the temperature increased and the food may have gone bad.

The easiest technical solution is to use the available *resources*, a substance that is already present in the system and can perform the desired task. In the fridge, such a substance may be ice.

If there are pieces of ice piled up into two layers or a little pyramid. Then after the sudden defrosting (undesired temperature rise) there will be only one layer of ice left and it will be instantly noticed.

More rigid rules of using the method MMP are described in ARIZ as follows:

- a) *build the schematic of the conflict using the method MMP;*
- b) *modify the scheme so that the «micro-people» acted without causing a conflict;*
- c) *move on to the technical scheme.*

Remark:

31. *The essence of modeling with «micro people» method (method MMP) is schematically presenting the conflicting demands in form of a drawing (or a number of consecutive drawings) of a large number of interacting «micro people» (a group, a few groups, «horde»). The «micro people» should represent only the changing parts of the problem model (instrument or Eks-element).*

«Conflicting demands» is a conflict arising from the model of the problem or opposite physical states, specified in step 3.5. It is possible that the latter is preferred, since it would be easier to illustrate the «conflict» in the model of the task, but there are no solid rules governing the transfer from the physical problem (3.5) to MMP.

Step 4.1b can be done by putting two illustrations on the same drawing: the bad action and the good action. If events develop with time, then one should consider having a few consecutive pictures.

Attention!

It is easy to make a common mistake by limiting the drawing to quick and rough sketches. A good drawing should be:

- a) *Self-explanatory and easily understood without word;*
- b) *Provide additional information about the physical contradiction and point to possible ways of eliminating it.*

32. *Step 4.1 is secondary. It is needed to give a better understanding of what the particles must do in and around the operational zone before VPR mobilization. The method MMP helps to see the ideal action*

(«what needs to be done») without the physics («how to do it»). This removes the psychological inertia and focuses on the creative work. Hence, MMP is a psychological method. Nevertheless, because the modeling with «micro people» accounts for laws of system development, it often leads to a technical problem solution. In this case the solution shouldn't be interrupted and the mobilization of VPR (vepol resources or object-field resources) must be carried through

This is the step 4.1 in ARIZ-85V.

An earlier version ARIZ-82 also used the method MMP (in step 3.5), but back then it was not detailed enough and its use was less accurate. For the first time, the «micro people» appeared in 1977 in the book *«Inspiration by Order»*^{*)} (by A.B.Selutskij and G.I.Slugin). G.S.Altshuller wrote the chapter on the course «Development of Creative Imagination» for this book.

A direct and immediate application of the method MMP helps to solve more than simple problems.

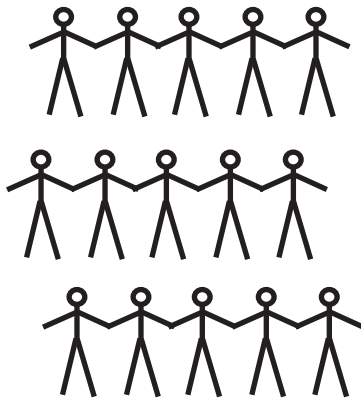
Task N.6.11. Typical lubricant «freezes» when temperature is lowered: its viscosity increase and the lubricating properties decrease.

How can one make the lubricant resistant to the temperature drop?

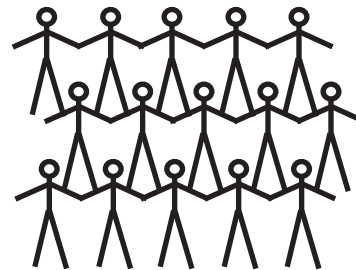
Certainly, at absolute zero any lubricant would freeze (except for greasing from helium), but in practice such low temperatures rarely occur. Sometimes a change in temperature as little as 10 degrees may be very important. And the help of the «micro people» is important here as well.

Let's carefully look at the «Before» and «After» pictures. At high temperatures the layers of the lubricant can easily move (slide); they don't interfere with each other, although in the layer itself they firmly hold hands. This is the «Before» picture. At low temperatures (the «After» picture) the interactions between «micro people» is increased and the layers start to cause interference, prevent motion, and cling together.

^{*)} More in detail about TRIZ books look in section 22 «Literature».



Before
(high temperature)

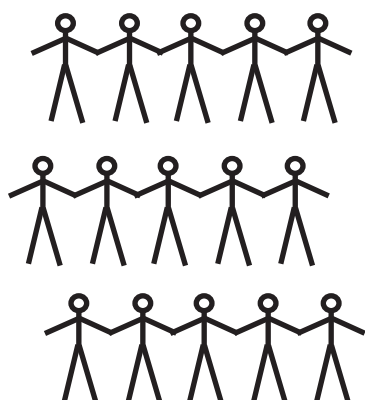


After
(low temperature)

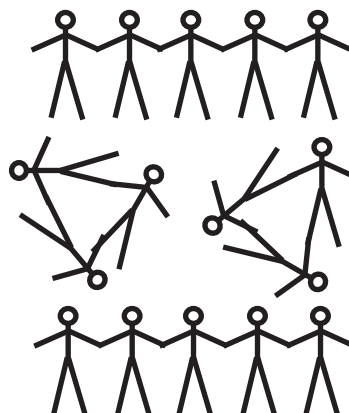
The «micro people» need help. Of course when the temperature is lower they hold on to each other more firmly, but this interaction can be controlled. Let the «micro people» hold hands tighter, but this connection shouldn't prevent the sliding of separate layers.

The result is a rather unusual middle layer: «micro people» are sturdily bound together, but their connection forms rings. Note that the size of a ring may be greater than three. Not only can these rings slide along the adjacent layers, but they can also roll along them. Friction is significantly reduced, which in turn reduces the overall viscosity of the lubricant.

Here, a new problem arises: How can one force the «micro people» into forming rings? Typically they only do whatever is convenient and does not require extra effort. Hence, a new substance must be introduced into the lubricant to «bring order» among the horde of already present particles. That is, this new addition should easily form an ordered structure or already possess such a structure, while still following the *laws of system development* and rules for *Vepol model* construction.



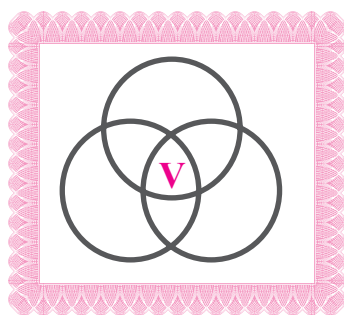
Before
(high temperature)



After
(low temperature)

It is not hard to find a whole group of such substances in the **System of effects** used by TRIZ. They are aromatic carbon compounds, which are known for their benzene rings. Although this connection may seem crude, benzene rings do play a role of a peculiar roller-bearing at molecular levels, which reduces the friction among separate layers of the viscous liquid.

Thus, the solution of this problem requires the use of aromatic compounds, like methylcyclohexane or toluene...And use of «micro people».





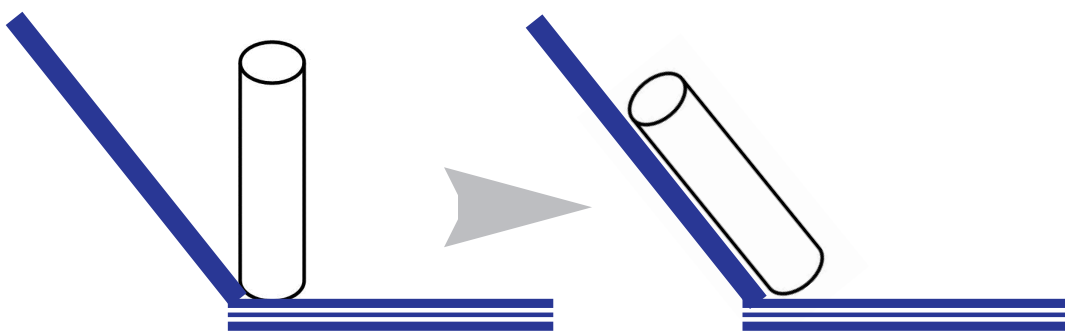
Operator *STC*

Operator *STC* (space – time – cost) has grown from the morphological analysis. The main task for this operator – to change usual representation about system.

In most cases the basic attributes (properties, parameters) any system only three. It is the spatial linear size, time of course of processes and cost. Value of each of these attributes precisely can be described some number. For solution of many tasks it is very important to know these numbers. But the paradoxicality, discrepancy of a situation is, that the same exact values very much frequently prevent.

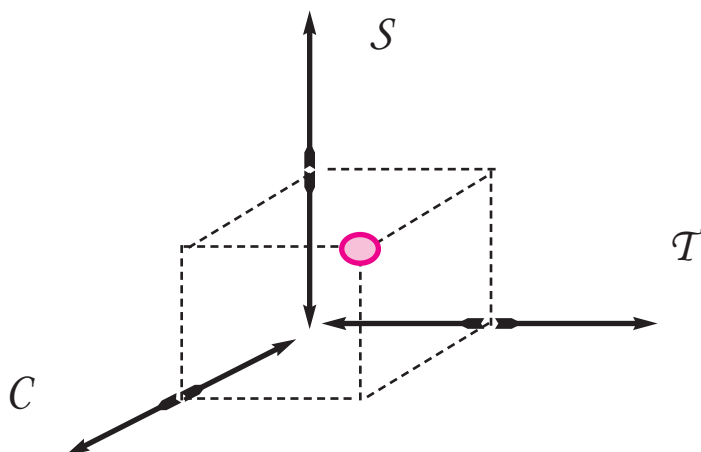
Let's consider such **task**: (from card file of G.S.Altshuller):

On a slope of mountain accurately it is necessary to put a pipe from concrete. Length of a pipe – 30 meters, diameter – 2 meters. To use complex mechanisms in this case it is impossible. To execute a pipe at once in inclined position too it is impossible. What it is necessary to make?



30 meters is a height of a multi-storey house. Accurately «to put sideways» the whole house – psychologically a complicated problem. Especially, if it is impossible to use special engineering. Therefore – the pipe accurately itself should be lowered on a slope of mountain...

It is necessary to know sizes of two more parameters. The concrete pipe was necessary for hydroelectric power station. On conditions of a real task, on such construction it was allocated two years of time and hundred millions dollars.



The rule of performance of operator STC is the following: we take by turns each of three parameters (space, time, cost) and twice we change its numerical value – from existing size up to zero and from existing size to infinity.

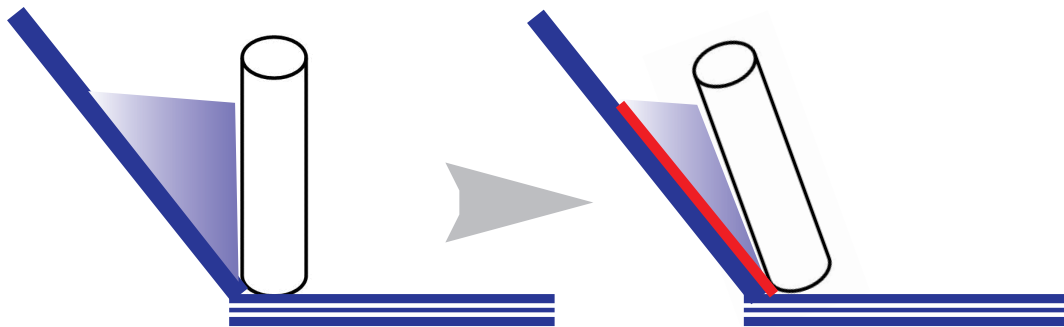
During performance of each of these of six operations it is necessary to check up – as the task has changed. In new conditions its solution can become more difficult and can become easier.

It is very important to not limit itself only to extreme values (zero and infinity). It is necessary to describe a situation for several intermediate values. For example, intervals of time in one day, one month and one year can have essential, qualitative differences. Such differences are connected to occurrence and disappearance of various processes on various «floors» of an axis of time. It concerns all parameters of the operator.

Not less essential requirement is, that all actions with the operator are necessary for writing down in detail. Such records further can be used and during the decision of other tasks, and for updating information funds.

Check up itself – make independently all six records of changes of parameters for a problem(task) about stacking of a pipe. For more exact use of operator STC be guided by such control answer:

The ice place between a pipe and a slope of mountain place ice. This ice «catch» the pipe. Then ice gradually warm up (defreeze) on the part of a slope of mountain. As a result of it ice smoothly falls and simultaneously accurately stacks a pipe on a slope of mountain.



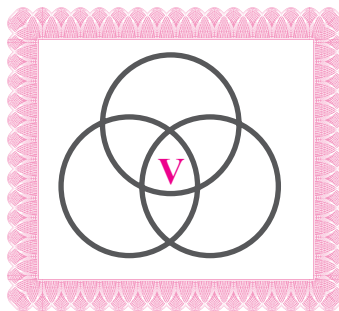
For the better to estimate advantages of operator STC – enter the additional requirement: the decision should be idealer. Ice should appear itself... And then independently to thaw. It is necessary to keep money to construction, but it will be necessary «to pay» for it an expenditure of time and space...

Operator PBC many years was used as a separate step in various versions of Algorithm for Solution of the Invention's tasks (switching ARIZ-77). Further such step from ARIZ was removed, but thus the idea of change of values of various parameters of system has appeared in other steps of ARIZ. It not only helps to strengthen the received solution, but also allows to present all system more full. Accumulation of the information on application of operator STC was the important element in creation of the **Multiscreen Scheme**.

At the same time, operator STC («classical» tool of TRIZ) and its separate elements remain the important part of the general «nonclassical» rate of Development of Creative Imagination.

Originally this rate consist of the most different methods of management of psychological factors. It is a lot of such methods, but their quality not always happens sufficient (even for a «nonclassical» level). Therefore during teaching and application TRIZ these methods were in part eliminated, in part transformed, in part replaced new.

As a rule, new elements of rate STC were based on the information funds received at use of «classical» tools of TRIZ. In particular, change of values of various parameters (including the space, time and cost) can see in many *receptions of imagination*. Use of operator STC and for «*floor*» *designing* is essential.



«Floor» designing

Very simple at first sight «floor» designing is one of basic elements of a rate of Development of Creative Imagination. This rate allowed to use for technical solutions not only patent, the invention information, but also fantastic (including literary) ideas.

The First book about application of a fantasy in invention was published in Tambov (USSR) in 1964 year.^{*)} Then regular updating information fund of fantastic ideas began. The analysis of fund has allowed to formulate such principles of «floor» designing for fantastic ideas:

1. It is necessary to choose inanimate object. To execute the forecast of its development.
2. The object should be fantastic, an artificial origin. The object needs to be considered on all «floors».
3. To formulate the purposes which it is necessary to reach, using the given object. To specify purpose of object.

In the information fund such **list of «floors»** was revealed:

The ground Floor: one fantastic object is used.

The Second floor: such objects (in huge quantity, everywhere) are used many.

The Third floor: the specified purpose is reached without use of this object.

The Fourth floor: situations when absolutely disappears necessity for achievement of the planned purpose are created.

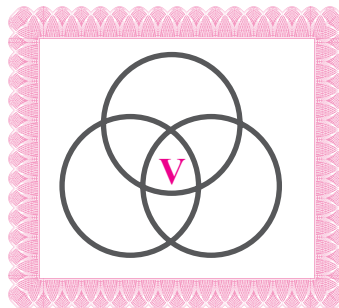
^{*)} V.N.Zhuravliova. *The inventions, ordered by dream.*

«Floor» designing for the first time has allowed to create fantastic ideas systematically, organized, ordered. Also at regular application of this tool the new information fund – fund of use of «floor» designing collected.

Appeared, that this tool is applicable not only for fantastic ideas, but also for real inventions tasks. Moreover, the tool developed, became more detailed, exact and has soon turned to new powerful means of the analysis of systems – the ***Multiscreen circuit***.

At the same time even the initial version of «floor» designing continues to remain one of the strongest ways of creation and development of fantastic ideas. In rate DCI many instruments are shared with «floor» designing.

Therefore acquaintance to the brief systematized list of ***principles of phantasing*** simultaneously is continuation of work with «floors» and preparation for the multiscreen analysis.



Principles of phantasing

Research of the ideas found in a fantasy has allowed to systematize a fantasy. On the one hand it has resulted in creation of «*The Register of science-fiction ideas*». On the other hand - this work has helped to reveal receptions of imagination for designing new technological, изобретательских ideas.

The List of receptions of imagination contains some groups.

The First group is made with «*floor*» *designing* which is the complex(difficult) complex tool.

The Second group represents various datings the morphological analysis, including *operator STC* (space – time – cost).

The Third group is a change of fantastic and real object with the help of receptions of overcoming of technical contradictions.

The Fourth group – *a method of fantograme* – is qualitatively new association of the second and third groups.

The Fifth group - datings of *principles for overcoming of psychological inertia*.

The Sixth group – a *scale «Phantasi»*.

The Seventh group – *the Multiscreen scheme*.

The two first and two last groups of this list are shown separately. In this section the third, fourth and fifth groups of *principles of phantasing* are briefly examined.

Principles for overcoming of technical contradictions – one of the first micro-instrumentation of TRIZ. Such receptions some tens were revealed. G.S.Altshuller studied statistics of use of these tools and on the basis of such analysis has constructed the *Table for application of principles* for elimination of technical contradictions. Different versions of tables defined various quantity of technical contradictions. The quantity of receptions which were used in the *table* was various also. The final version which was included in ARIZ-77, contained 40 principles. In development of TRIZ this table began less effective in comparison with new, stronger tools, therefore in further versions ARIZ it was not used. Some principles of elimination of technical contradictions (especially non-tables which have numbering from «41» to «50») were included in the new tool – *system of standards*.

On a basis of more simple receptions and G.S.Altshuller's transformed table has constructed *the phantogrammes*. These are the tables intended for creation of fantastic ideas. Columns and lines of the table represent various universal parameters and principles for transformation of these parameters.

For elementary education G.S.Altshuller recommended such parameters:

- 1 – substance (a chemical compound, a physical condition);
- 2 – a microstructure (that is a subsystem of object from considered(examined) set);
- 3 – object;
- 4 – super-structure (that is system which includes object from considered set);
- 5 – a direction of development;
- 6 – reproduction;
- 7 – a feed by energy;
- 8 – a way of movement;

- 9 – sphere of distribution;
- 10 – a level of the organization and management;
- 11 – the purpose, the sense of existence.

Principles for the educational purposes were recommended such:

- 1 – to increase, reduce;
- 2 – to unit, separate;
- 3 – «on the contrary» (that is to replace the given property «antiproperty»);
- 4 – to speed up, be slow;
- 5 – to displace in time forward to displace in time back;
- 6 – to change dependence «property – time» or «structure – time»;
- 7 – to separate function from object;
- 8 – to replace connection between objects and environment (including replacement of environment);
- 9 – to change a quantity indicator (constant).

Principles («methods») for elimination of psychological inertia which are used in rate DCI, as a rule are created outside of TRIZ. They concern to «nonclassical» organizational tools and consequently them apply only to educational, training problems.

Most frequently on employment by ТРИЗ use:

- The method of focal objects;
- The method of associations;
- The method of «gold fish» (or «the gin – executor of desires»);
- The method by Arnold (search of the Eks-factor on a planet closed by «conditional clouds»).



Scale «Phantasy»

The phantasy is necessary for any creative work. Reading of the science-fiction literature is strong means of development of imagination. But only it is not enough one reading. The literature on a fantasy is necessary for analyzing, investigating. The scale «**Phantasy**» is the instrument for such research.

The First, initial versions of this tool have appeared in 60th years of the last century. Further the scale «**Phantasy**» varied and in final variant is used thus.

In the beginning each science-fiction product is estimated on such parameters:

- Novelty;
- Persuasiveness;
- Value for studying the person;
- Art value.

To these parameters control value judgment is added.

Each of these of five parameters is estimated on a scale from four points:

- 1 – «it's bad» (there is no novelty and there is no persuasiveness, there is no value);
- 2 – «it's satisfactory» (the minimal novelty, persuasiveness and value);
- 3 – «it's good» (the big, significant novelty, persuasiveness, value);
- 4 – «it's very good» (that is higher than the previous point).



Value judgment can be received thus:

- 1 – nothing it was pleasant;
- 2 – any more it was not pleasant, than it was pleasant;
- 3 – it was pleasant more, than it was not pleasant;
- 4 – all was pleasant.

Certainly, it only the most simple model of a scale «*Phantasy*». For professional use detailed and exact criteria of an estimation of each point are developed.

The Following stage is reception of the *general estimation*: points on all to five parameters are multiplied.

Having received an estimation for some of science-fiction products it is necessary to collect them in the general table, necessarily having specified not only the general(common) estimation, but also values for all parameters.

The operational Experience with a scale «Phantasy» shows, that exact use by different experts of detailed, detailed criteria does total estimations practically identical. Thus, using for comparison existing tables of estimations of science-fiction products, the own understanding of a fantasy independently is possible to estimate.

In G.S.Altshullera's opinion, each estimation of the science-fiction story or even one idea represents mental microresearch. Having executed some such microresearches are possible to get a certain experience of analytical, system thinking, very important for TRIZ

Vepol Models

Each science has the «language». From the elementary particles this language there are most complex, big structures. Such big structures can be much and understand them, not get confused in complex elements – in the beginning it is necessary to understand structures simple.

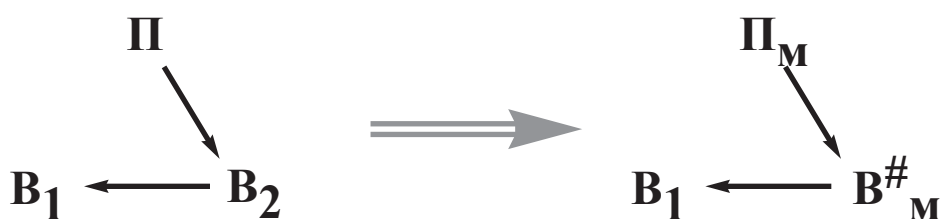
Vepol models is «language» of TRIZ. According to this «language» any system can be presented as set of elementary models from «substances» and «fields». Thus of «substance» and «fields» in vepol models not always correspond to real substances and fields.

The Minimal system should contain three elements. Usually it is two «substances» (B) and one «field» (Π), however there are also other models.



It was originally revealed five key rules of transformation *вепольных* models (other name – rules of the vepol analysis). Further the quantity of such rules has increased. New kinds of vepol models also were received: complex, double, chain...

Separate elements of vepol models changed (developed) also. Transition to disperse and structured «substances» was revealed, structured «fields» more effectively worked. The most interesting results are received from application of **fepol** structures at which there is a magnetic field, and one of substances is disperse ferromagnetic.



In G.S.Altshuller's book «**Creativity as the exact science**» is shown 18 typical vepol models and transformations. On the basis of these elementary structures the system of standards for the solution of invention's problems is constructed. Vepol models are used for formation of modern information funds of various effects.

The first works about vepol models were prepared by students of the Azerbaijan institute of invention's creativity under G.S.Altshuller's management in 1973.

Vepol models are very closely connected to laws of development of systems. On the one hand – development of vepol models occurs according to these laws. On the other hand – laws take into account vepol character of systems.

Laws of development

In the table of interrelation of «classical» of instruments TRIZ laws of development are near to vepol models – at the uppermost level. Actually it is special «instruments for creation of instruments».

Revealing laws of development is traced since the very first works about TRIZ. These laws were entered into a training course in 1976, and then published in G.S.Altshuller's book «**Creativity as the exact science**».

For technical systems there are laws of viability (G.S.Altshuller named their laws of «statics») and actually laws of development (laws of «kinematics» and «dynamics»).

Laws of viability:

1. The law of completeness of parts of system.

The Necessary condition of basic viability of technical system is presence and the minimal serviceability of the basic parts of system.

2. The law of «power conductivity» systems.

The Necessary condition of basic viability of technical system is through pass of energy by all parts of system.

The Important value has consequence from this law:

That the part of technical system was controlled, it is necessary to provide power conductivity between this part and controls.

3. The law of the coordination of rhythmicity of parts of system

The Necessary condition of basic viability of technical system is the coordination of rhythmicity (frequency of fluctuations, periodicity) all parts of system.

Laws of development of systems:**4. The law of increase of a degree of ideality of system**

Development of all systems goes in a direction of increase of a degree of ideality.

All elements of system are superseded to a subsystem, and functions – to supersystem.

It is the main law of development of systems. Other laws «provide» its action.

5. The law of non-uniformity of development of parts of system

Development of parts of system goes non-uniformly; the more difficultly system, the more non-uniformly development of its parts.

6. The law of transition to supersystem

Having exhausted opportunities of development, the system is included to supersystem as one of parts; thus the further development goes already at a level of supersystem.

7. The law of transition from a macrolevel to a microlevel

Development of working bodies of system goes to macrolevel, and then at a microlevel.

8. The law of increase a degree of vepolity

Development of technical systems goes in a direction of increase of a degree of vepolity.

Non-vepol systems aspire to become as vepol.

In a vepol systems development goes in such directions:

Mechanical fields pass to electromagnetic;

The degree of dispersiveness of substances is increased;

The number of connections between elements is increased;

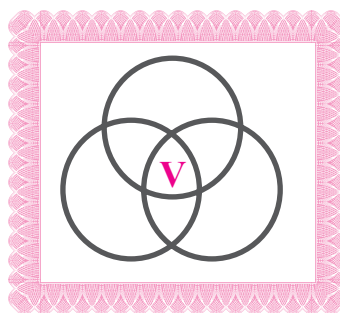
«Responsiveness» between elements is increased.

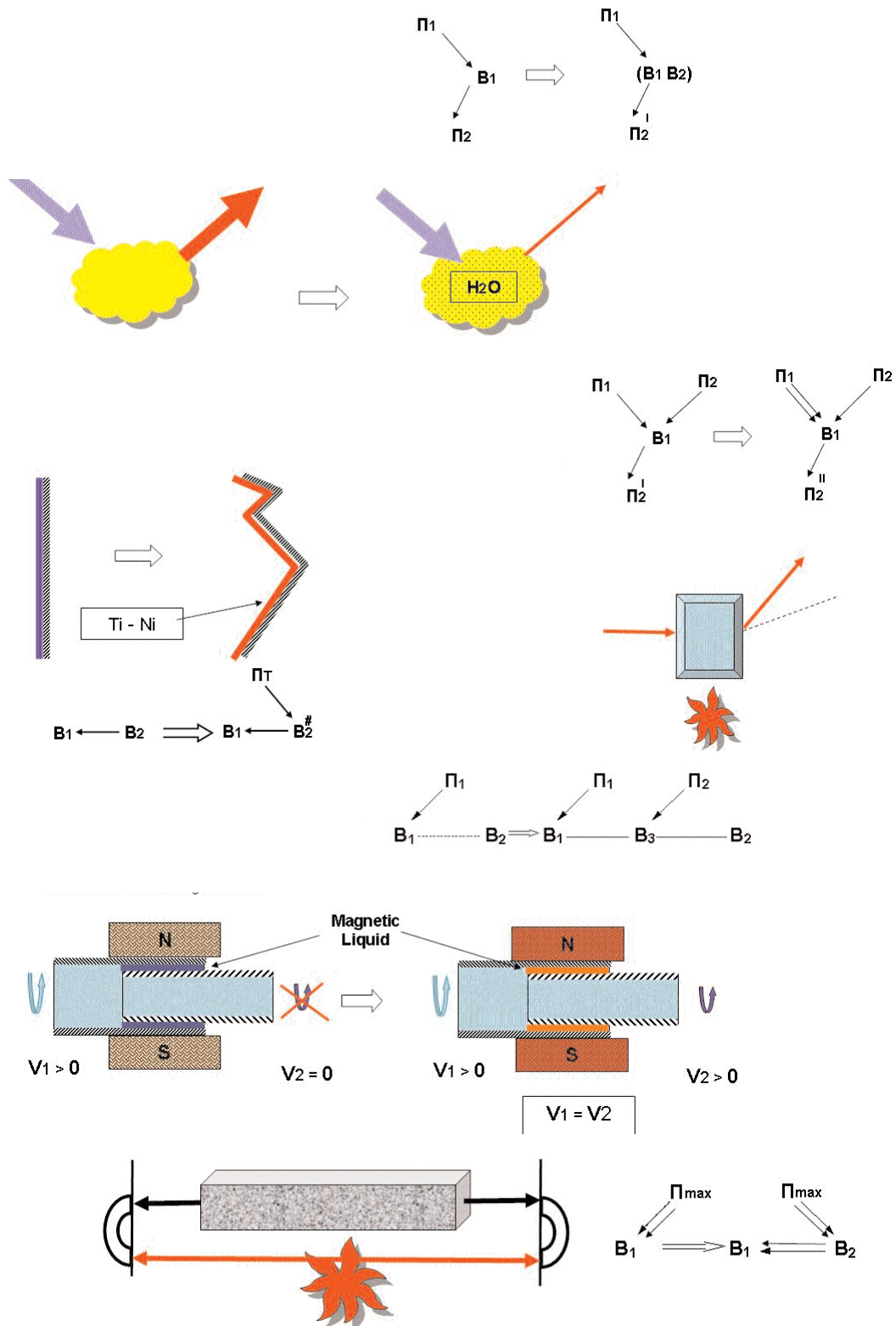
Researches show, that practically all laws of development of technical systems are feasible also for other systems. Only it is necessary to take into account specificity of systems in one of items of the law 8. Instead of «Mechanical fields pass to electromagnetic» (that typically for technical systems) is allowable to specify – «the degree of controllability fields is increased».

In different time numbering of laws of development was various. The version underlining special value of the law of aspiration to ideality here is used.

Graphic lines of development, and also interrelation of lines of development with other parameters of systems (quantity of inventions, levels of inventions, cost of realization) – these questions are considered in more detailed rates.

Laws of development, vepol models and information funds form uniform system by which it is constructed TRIZ.





System of Standards

Practically all instruments of TRIZ are intended for revealing and elimination of contradictions in system.

Originally this process was carried out in each task. But further when the disassembled tasks began much, similar contradictions and similar ways of their elimination have started to collect.

The following step became formation of fund of typical models of tasks and standard ways of their solution. Thus revealing and elimination of contradictions was not carried out for each task as this action was executed beforehand.

So standards for the decision inventions tasks have appeared. In the beginning, in 1975, there was all a little, but they had all necessary elements. In them in common, is interconnected physical effects, the strongest receptions of imagination were used *вепольные* models.

In 1975 to the book «Creativity as the exact science» was published ten standards and the next years the quantity of new standards grew promptly. By 1985 of them became 77. It is natural, that such quantity could not be simple «warehouse», «heap», therefore standards have formed system. This system operates and now.

Now the system of standards consists of five basic classes, each of which has the internal structure. It is very important, that standards are built according to some laws of development of systems.

Now the *system of standards* has such structure:

The Class 1. Construction and destruction of vepol systems.

The Subclass 1.1. Synthesis of vepols.

The Subclass 1.2. Destruction of vepols.

The Class 2. Development of vepol systems.

The Subclass 2.1. Transition to complex vepols.

The Subclass 2.2. Forcing up of vepols.

The Subclass 2.3. Forcing up by the coordination of rhythmicity.

The Subclass 2.4. Fepols (in a complex-forced vepols).

The Class 3. Transition to supersystem and to a microlevel.

The Subclass 3.1. Transition to be-systems and to poly-systems.

The Subclass 3.2. Transition to a microlevel.

The Class 4. Standards for detection and measurement of systems.

The Subclass 4.1. Roundabout ways.

The Subclass 4.2. Synthesis of measuring systems.

The Subclass 4.3. Speeding up «measuring» of vepols.

The Subclass 4.4. Transition to fepol's measuring systems.

The Subclass 4.5. A direction of development of measuring systems.

The Class 5. Standards for application of standards.

The Subclass 5.1. Features of introduction of substance.

The Subclass 5.2. Introduction of fields.

The Subclass 5.3. Use of phase transitions.

The Subclass 5.4. Features of application физических эффектов.

The Subclass 5.5. Experimental standards.

Usually the system of standards (as well as other tools TRIZ) is used not independently, and in a complex with ARIZ. In this case its efficiency really high. It is very important, that the text of each standard of G.S.Altshuller started with the warning: «**To not apply before studying ARIZ and the vepol analysis**».

System of Effects

Development of TRIZ analysis of a plenty of tasks allowed to increase information funds constantly. In due course these funds became specialized – on separate, especially important themes.

Very important information funds are funds of effects. In them the information in physics, chemistry, mathematics, and some other sciences is collected, but this information is organized unusually, not how it is done in traditional directories.

Funds of effects show how it is possible to use various scientific knowledge for elimination of contradictions in systems, for the solutions of the inventions tasks.

First such funds have started to be developed since 1969. Some groups of researchers of TRIZ were engaged in collecting and ordering of the information. Further tables for most productive use of various effects were constructed. Effects were examined and described in language of *laws of development of systems* and *vepol models*. The system of effects thus was generated.

In text of ARIZ-85V it is recommended to use the most developed and checked up part of system of effects – «**the Index of physical effects**» which sections were published in the Moscow magazine «**The Technic and the Science**» in 1981 and 1983, and also in the book «**Impudent formulas of creativity**» (publishing house «Karelia», Petrozavodsk, 1987).



The Register for fantastic ideas

The fantasy, creative imagination are very important for the solution of the most different serious problems. Therefore studying of the literature on a fantasy – an obligatory training course in TRIZ. The important element of this rate – revealing and ordering of fantastic ideas.

From the very beginning of development of TRIZ there were no problems with the information about patents – the detailed, systematized descriptions in which inventions were divided into classes and groups on areas of engineering were constantly published. Work of the researcher thus was facilitated even in the sense that it was not necessary to carry out classification itself.

With fantastic ideas all was more difficult. These ideas are a part of a literary work and long time occurred to nobody to allocate of idea from texts, to make their full list, to lead classification.

In many countries already for a long time there were encyclopedias on a fantasy in which their history and structure were described various sub-genre and directions, However even in the most full encyclopedias there were no attempts of the description and classification of concrete ideas.

At G.S.Al'tshullera frequently arose then innovetio ideas adjoining to a fantasy. In such cases long it was necessary to prove, that the invention all the same is real. It was sometimes easier to write and publish the fantastic story, using idea of the invention.

And then G.S.Altshuller has made the decision to not be engaged more applications for the invention, and the beginnings to write fantastic stories. He argued as follows: if successfully it is possible to solve scientific technical problems with help of TRIZ why to not apply an algorithmic method of the solution for problems of scientific and scientific-art?

G.S.Altshuller has submitted last application at the end of 1958. Then has written and has published the first fantastic story. He has quickly reached(achieved) the big popularity. For example, in 1965 of him printed more, than any of other writers in the USSR.

But for G.S.Altshuller the fantasy was not only the literature, but also serious scientific work. He wrote the fantasy and simultaneously was engaged in studying of fantastic ideas of other writers. Together with wife V.N.Zhuravlyova (also the known fantastic writer) he writes the big scientific articles about technical forecasts of different authors.

Studying G.S.Altshuller's fantasy has prepared the big list of ideas and has decided to systematize them. And to break on classes and groups how it was accepted in invention.

The Systematized list of ideas has received the name «*the Register of science-fiction ideas*».

The «*Register*» is not only the list, the list. It is the systematized fund of the most different ideas from the science-fiction literature.

In the «*Register*» science-fiction ideas are divided into eleven classes:

1. Space;
2. Earth;
3. The person;
4. A society;

5. Cybernetics;
6. Other-planets reasonable essences;
7. Fantastic animals and plants;
8. Time and space;
9. Fantastic initial situations;
10. Scientific and technical ideas;
11. Ecology.

All classes are in addition broken on subclasses, groups and subgroups.

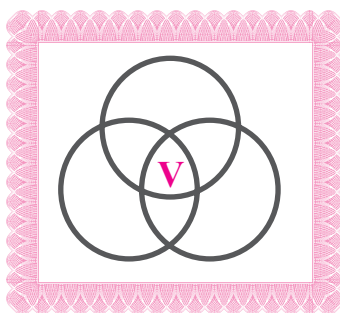
The «**Register**» was created first of all for classification and studying of ideas of science fiction. Therefore here there is no such, for example, popular sub-genre in fantastic literature, as the fantasy, the fairy tale fantasy, an the erotic fantasy.

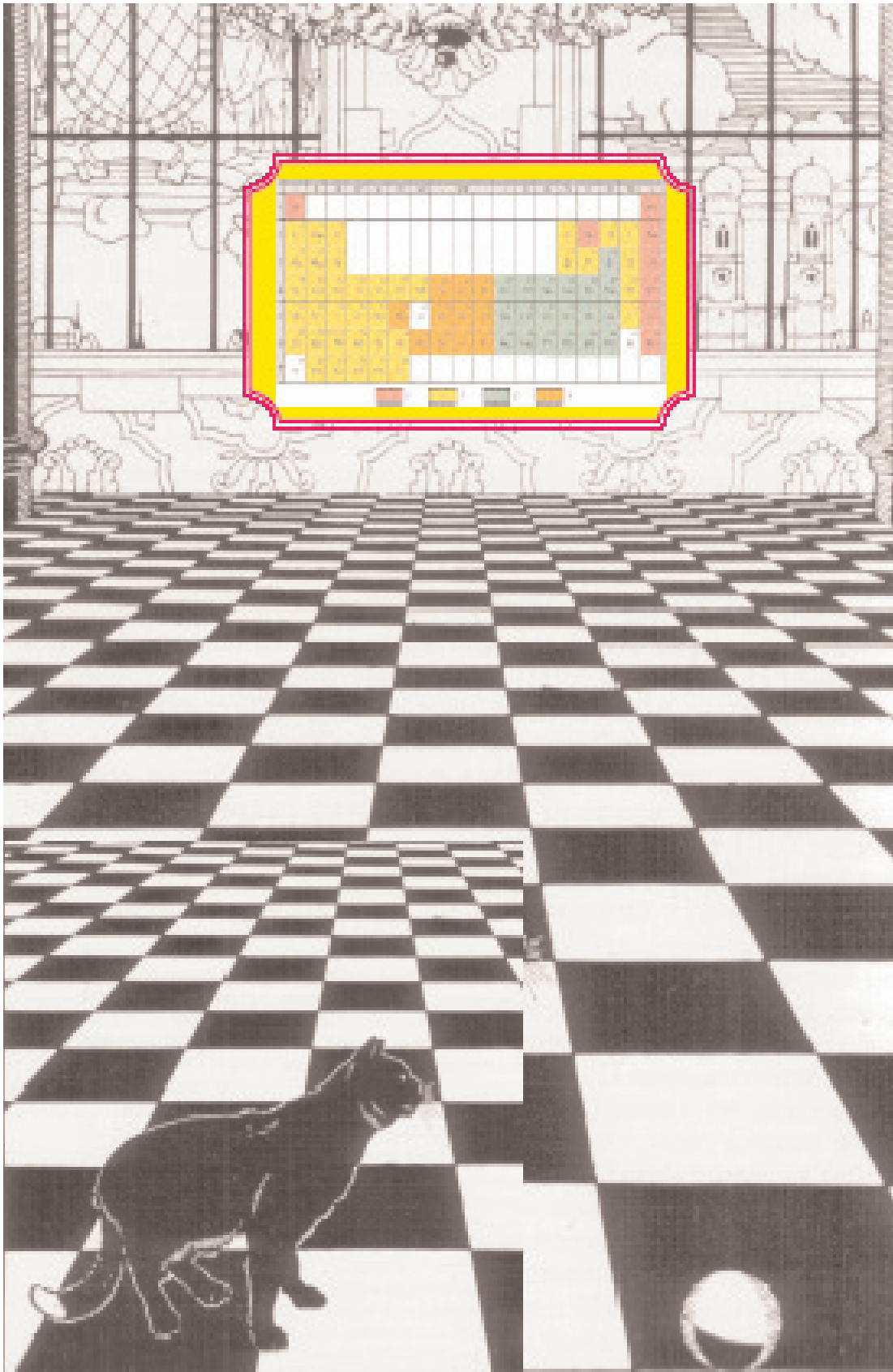
Active work for the «**Register**» has borrowed more than ten years.

The first version was prepared for the publication in 1974 under the name «the Register of fantastic ideas and situations».

The «Register» replenished with ideas till 1980, various groups of TRIZ experts participated in this work.

G.S.Altshuller always hoped, that researches in the field of science fiction will be continued. These researches in his opinion should allow to formulate the general laws of development of intellectual systems.

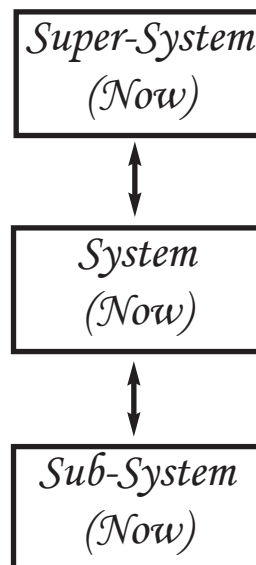




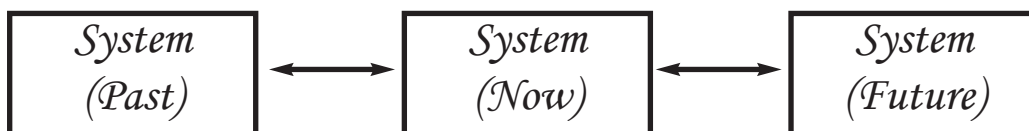
The Multiscreen Scheme

In the table of classical tools TRIZ the **Multiscreen scheme** takes the important place – it directly ensures the functioning of ARIZ and SLCP.

Each system consists of some elements - and each system can be an element of more general structure.

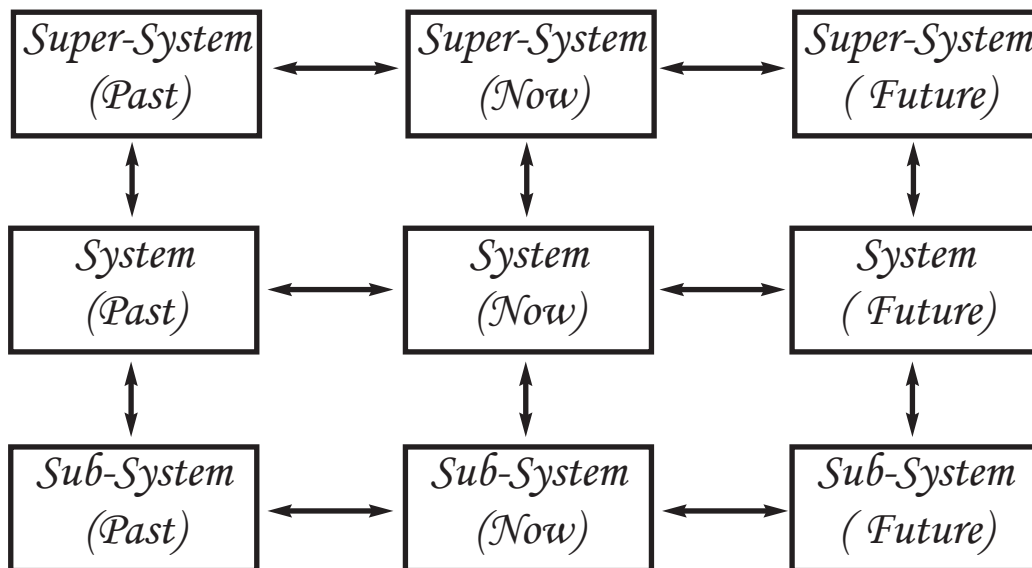


Besides each system is examined now, and also in the past and in the future.



Thus, according to the *Multiscreen scheme* each system is examined in a complex: at different hierarchical levels and in different times.

In the minimal case to such scheme corresponds 9 screens.



The similar scheme is built also for anti-system (system with opposite characteristics). It increases the minimal picture up to 18 screens.

Even the most simple analysis under the minimal scheme allows to receive many new interesting results. But for complex systems are not limited to the minimal scheme – construction conduct «upwards» and «downwards» on the many levels of hierarchy, and also in the past and the future on many steps.

Training in drawing up of multiscreen schemes should be carried out constantly, on the most different systems.

Ideal strategy of creative

Serious creative work, as a rule, is carried out at three levels.

At the very first level are solved concrete technical (including technological) tasks.

When the quantity of the solved of tasks becomes very big (at high quality of solutions) – work passes to the second level. Now it is necessary to formulate and solve tasks general technic and general scientific.

Development of general technic and general scientific tasks results in an output far beyond initial system. Now there are the social, universal problems connected to development of former tasks and solutions of these tasks.

Ideal creative strategy consists in a correct combination of work at all three levels. Carrying out the solution of any specific target, it is necessary to see the nearest and perspective consequences of this solution. If necessary in time it is necessary to be able to pass from one level of work to another even if it looks difficult or in general impracticable process.

The Special rate devoted to *ideal creative strategy*, was developed simultaneously with *Strategy of Live for the Creative Person*. This rate is necessary for most productive use TRIZ.



В. Г. Шенников на микрофотографии в Ташкенте. Фото-
графирование В. Г. Шенникова.



«TRIZ teams»

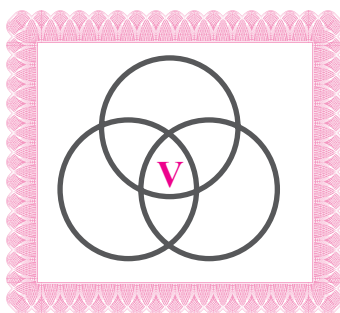
Work with application of TRIZ – is qualitatively new kind of creative activity. And results of such work also unusual.

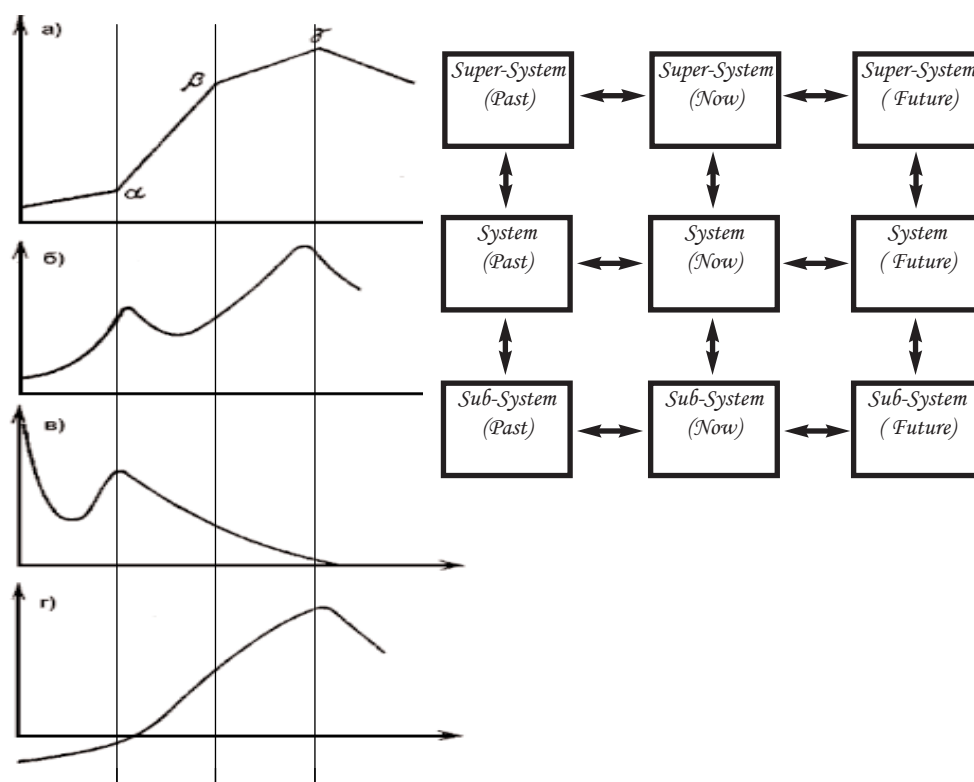
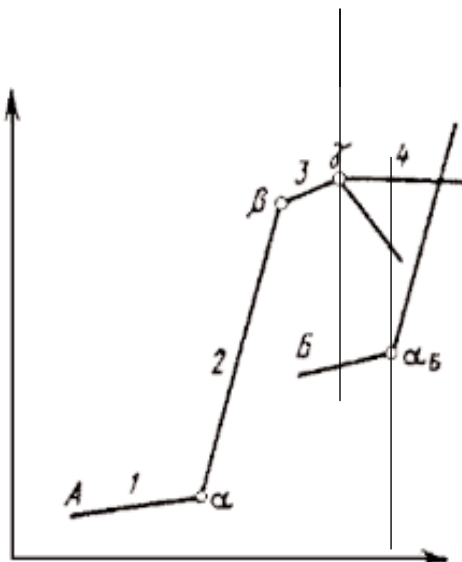
Many researchers mark, that active and exact use TRIZ during long time allows to create the strong, qualified teams. Such teams cope with practical problems much fastly and more successfully. Participants such «TRIZ-teams» realize ideal creative strategy much more often.

On the other hand – only «TRIZ-teams», and it is even better – interaction of such teams allows to develop a science to receive new results for perfection of TRIZ.

Formation and saving serviceability of «TRIZ-teams», certainly, demands significant efforts from its participants. But there is no other way to receive from TRIZ really serious, significant result.

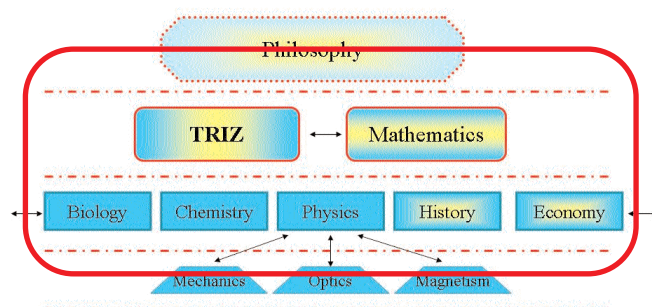
«TRIZ-teams» – is the major instrument of a science.



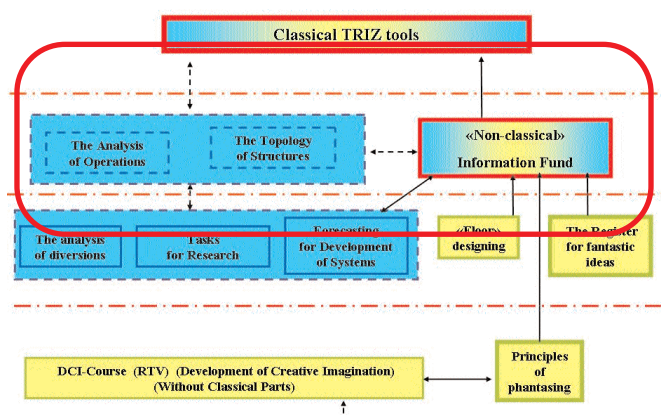


Further development of TRIZ

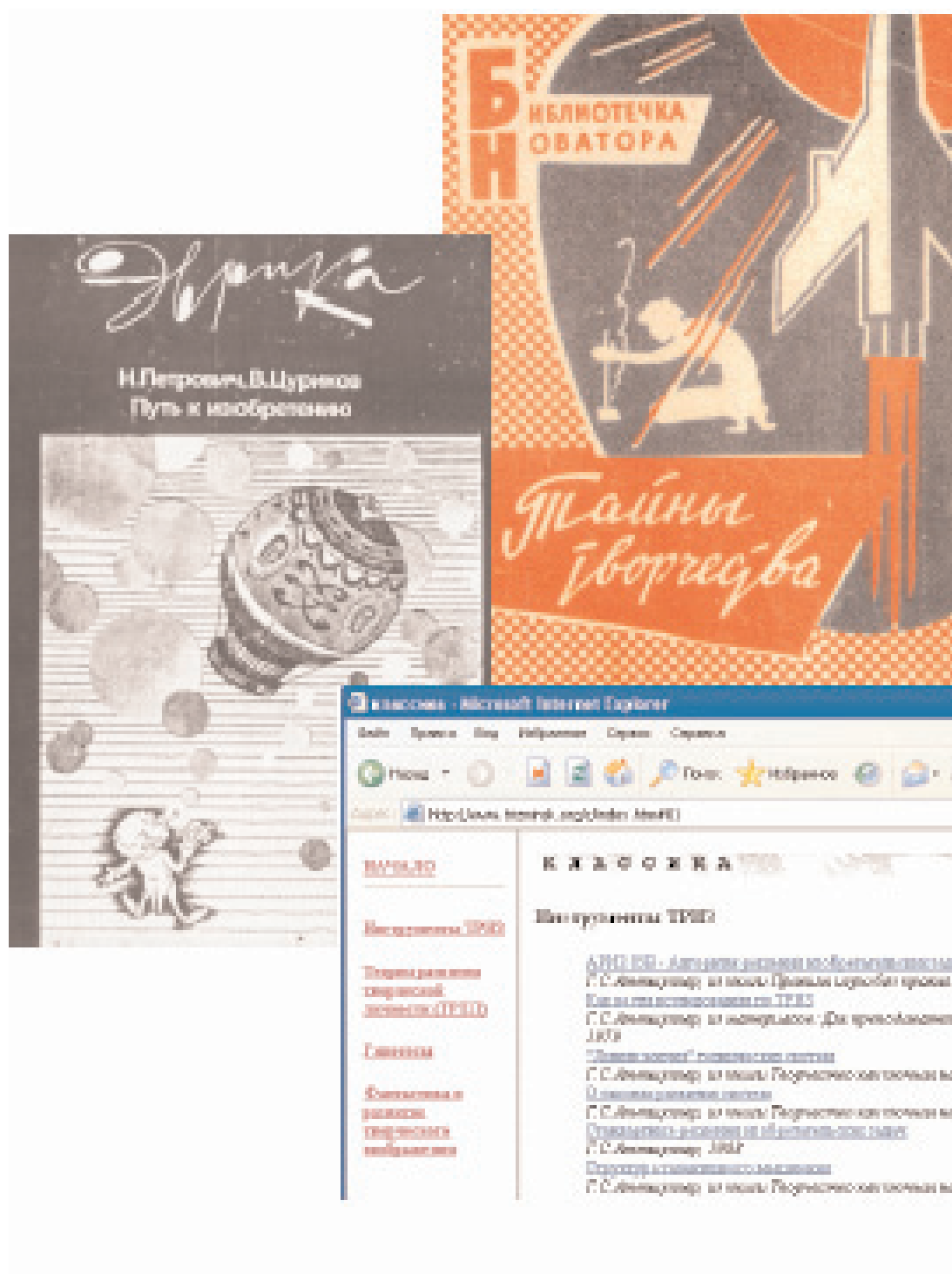
Development of TRIZ occurs in the usual way for a science. There are two interconnected directions of development. On the one hand any science aspires to cooperate with «environment» – other sciences as much as possible.



The Second direction – perfection of internal mechanisms, development of old tools and creation new.



The necessary condition of such perfection is presence and the minimal serviceability «*TRIZ-teams*».



History of TRIZ development

The beginning of researches in TRIZ concerns to 40-th years of 20-th century. About this time first information fund TRIZ is formed.

1956 – the first publication about TRIZ in magazine, the first publications on a fantasy, a formulation of concepts of ideality of systems, contradictions in development of systems, the first ARIZ.

1957 – the first educational and practical TRIZ seminars.

1961 – the first book about TRIZ, formation of «G.S.Altshullera's school».

1969 – the beginning of work on special funds (physical effects).

1971 – creation of the Azerbaijan institute of inventions creativity (Baku).

1973 – the beginning of works by vepol models.

1975 – a formulation of system of laws of development of technical systems, the beginning of work by standards, the beginning of formation of system of schools («TRIZ movement»).

1979 – the book «Creativity as the exact science», the beginning of work of Public laboratory of the theory of invention, the beginning of a plenty of regular seminars and publications by TRIZ.

1981 – the beginning of work by SLCP.

1985 – are prepared ARIZ-85V and System of standards-77.

1990 – sharp reductions of regular seminars and quantities of working schools (the reason not dependent from TRIZ, «external» – economic and social), braking of development of «TRIZ movements».

1996 – occurrence TRIZ in the Internet.

1998 – G.S.Altshullera's last circular.

2003 – the beginning of formation of new TRIZ schools in the different countries.



The Literature

For qualitative studying and application of TRIZ it is necessary to use the full original text of basic instruments of TRIZ. Analyses of tasks and comments in this textbook were carried out only on the basis of such texts.

Full texts of basic tools TRIZ in the original look in such editions (other sources are not recommended):

ALGORITHM for SOLUTION of INVENTIONS TASKS
ARIZ-85V. G.S.Altshuller. **Rules of game without rules / ARIZ – the victory means.** – Petrozavodsk: Karelia, 1989. with. 9-50.

STANDARD SOLUTIONS for INVENTIONS TASKS
(76 standards). G.S.Altshuller. **A string in a labyrinth / the Small immense worlds.** – Petrozavodsk: Karelia, 1988. with. 168-230.

STRATEGY for LIVE for the CREATIVE PERSON
(SLCP). G.S.Altshuller, I.M.Vjortkin. **How to become the heretic / How to become the heretic.** – Petrozavodsk: Karelia, 1991. with. 9-184.

Theoretical questions of TRIZ are shown in such books:

G.S.Altshuller. **Creativity as the exact science.** – Moscow: the Soviet radio, 1979.

G.S.Altshuller. **To find idea.** – Novosibirsk: the Science, the Siberian branch, 1991.

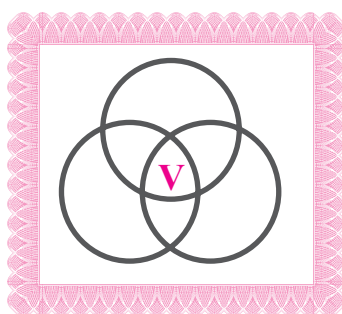
G.S.Altshuller. **Algorithm of the invention.** The edition 2 corrected and added – Moscow: the Moscow worker, 1973.

For initial acquaintance with ТРИЗ the book is recommended:

G.Altov. **And here the inventor has appeared.** – Moscow: the Children's literature, 1984.

It is necessary to take into account, that at the moment of preparation of this book there is no satisfactory translation of books of G.S.Altshullera from Russian. All seen translations contained the important, basic mistakes.

In the Internet also there are no full and exact texts of books of G.S.Altshullera and descriptions of separate instruments of TRIZ.



Education Plan

Criteria of quality educational preparations are formulated by G.S.Altshuller (for example, in the book «To find idea», p. 176):

1 level. General time of occupations – till 40. Written works are not present. The purpose of training – acquaintance with principles of the theory, attraction to the further study. For occupations it is necessary 60-70 pages of teaching materials on each student.

2 level. General time of occupations – 60-80 (half-year at occupations once a week or a fortnight seminar with a separation from work). Written works – domestic tasks. The purpose of training – profound acquaintance with principles; partial development of working instruments of TRIZ. Materials – 120 pages.

3 level. General time of occupations – 120-140 (year at occupations once a week or a monthly seminar with a separation from work). Written works – domestic tasks, examination. The purpose of training – development of basic working instruments of TRIZ and the solution with their help of one industrial task (with the subsequent registration of the patent application); development of some skills of creative thinking. Materials – up to 200 pages.

4 level. General time of occupations – 220-280 (two years of occupations once a week or two monthly seminars with a separation from work). Written works – domestic tasks, control and course works, final work upon termination of a rate, degree work upon termination of the second rate. The purpose of training – development modern TRIZ and the solution of several industrial tasks (with registration of applications for patents); development of skills of creative thinking; preparation of teachers and developers of TRIZ. Materials – 400 and more pages.

Quality of practical application of TRIZ is easily checked on control to questions of ARIZ (the step 7.2).

Criteria of quality of research work in the TRIZ are formulated by G.S.Altshullerom. These are six control questions:

1. Whether the methodology offered in is based the book on any information fund? If there is no information fund to speak there is nothing.

2. If on patent fund, whether that levels of the solution are revealed?

3. Whether «instrumented» given recommendations? What for all this? How it to use?

4. Whether recommendations practically are checked up? Whether such check is possible? Such recommendations are sometimes given to check up which efficiency is impossible. Such recommendations are senseless.

5. Whether there correspond conclusions and the recommendations given in the book to what has already settled?

We admit, that the person on good patent fund proves, that there is no law of increase of ideality, and there is any other law. There should be a conformity with already known. Infringements are extremely interesting. It or the indication on existence of something new, or the indication on hack-work.

6. Typical attributes of the bad publication: quasi-science, «out-mind», abundance of a unnecessary terminology, super-mathemating (any formule are resulted, it is not known for what in which not integrate, will not receive) for demonstration of learning of the author. Superfluous citing «classics», at the slightest pretext (in one clever book are not quoted in succession classics). Bulky proofs of positions not requiring for the proof.

Education Tasks

As any exact science, TRIZ is difficult enough. For master the main thing – classics of TRIZ, it is necessary a minimum two years of regular jobs under the direction of the skilled teacher. It is necessary to read many books, articles, other additional materials. But the most important – needs to be solved, carefully to disassemble many educational tasks.

The minimal norm – one task by ARIZ-85V per one week (not including two-three weekly tasks and exercises on application of other instruments of TRIZ). Each this analysis should be checked up by the teacher, mistakes are eliminated, remarks are taken into discounted – in new record of the text of analysis of a task. Thus, for two years the base from hundred independently disassembled educational tasks should collect.

The structure of domestic tasks also necessarily includes copies of cards from constantly filled up personal card file (not less than three cards into one week), an estimation on a scale «Phantasy» of science-fiction products (a minimum of one per one week) and the table of the constant account of personal time.

Presence and the constant control, check of such tasks by the teacher – the certificate of quality for educational process. Accordingly, their absence speaks about opposite...

But it's – educational process only. The complete set of work in the TRIZ consists of three elements:

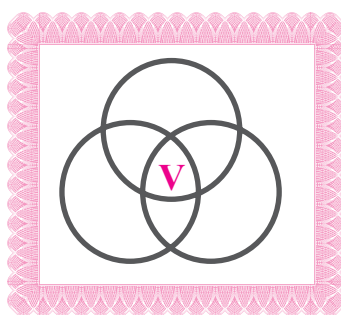
- Training and studying of TRIZ;
- Applications, uses of TRIZ;
- Researches in the TRIZ.

Such complex is characteristic for serious work in any science, but in the TRIZ insufficiency any of elements has especially clearly an effect for decrease of the general results.

Certainly, not for all tasks it is necessary TRIZ, there are many specialized problems which are solved other means. In such cases it is necessary to use these means and to not create at all visibility of application TRIZ. Especially – it is inadmissible «to mask as TRIZ» inventions solutions , but received without TRIZ, other means.

By the way, presence of such solutions – quite normal phenomenon for the creative worker in any area. Eventually, Thomas Edison has received more than thousand patents for excellent solutions – and in one of them did not use TRIZ. Was not in its time of such science...

Unfortunately, even by qualitative educational preparation the good form in TRIZ can be lost for one year – one and a half if not to carry out the most necessary «creative training». Elements such training the same, as at qualitative study: regular updating of a personal card file; reading (and an estimation) science fiction; the constant account of personal time. But the most important – careful analysis educational, and then and practical tasks in steps ARIZ-85V.



Terms which are used in TRIZ

In it is **additional**^{*)} – section the general-system terms used in TRIZ are shown. Special TRIZ terms are shown in a full training course.

Attention: **not all terms shown in section, are classical for TRIZ.** They are shown to give representation about possible *system of TRIZ terms*.

The explanatory of each term is given in such sense in what this term is used in TRIZ in general and in ARIZ in particular. In some cases the same term is used in TRIZ in various senses – these a situation each time are explained separately. Use of different terms for identical concepts also is separately explained.

All explanatories of terms – whenever possible short, help. Detailed, full explanations together with necessary examples are shown in a full training course. Latin conformity are shown for simplification of translation.

Object (objectum).

Any part of space, and also change of a part of space in time (process) can be object. Generally coordinates of space and time can have any nature (*natura*).

^{*)} *This section is not obligatory for elementary education, but acquaintance to it facilitates understanding of TRIZ.*

Property (proprietas).

Some action made by object and causing changes in other objects or in the given object refers to as Property.

Interaction (interactio).

Process of change of properties of objects as a result of action of objects against each other refers to as interaction. Various interactions between the same objects are possible.

The Combination (combinatio).

The Certain accommodation of objects in space not resulting (bringing) to interaction refers to as a combination. Various combinations of the same objects are possible.

System (systema).

Some objects refer to as system in that case when their interaction or a combination has some property which is not to properties of one of these objects. The objects forming system, refer to as elements of this system.

Complex system (compositus systema).

The System refers to complex if it has (shows) some various properties which are not reduced to one of properties of this system. In turn properties of one or several systems can be elements of new system (can form new system).

The Environment (externa).

Objects and the interactions which are not included in the given system, refer to as an environment concerning the given system. Elements of an environment can form some other systems. In some cases elements of an environment can be placed inside system or inside its separate elements without interaction. Elements of an environment also can cooperate with elements of the given system or with all system (thus it is formed one or several new systems).

Process of reception the information on system.

Any action allowing the external observer to define property of system, its elements, and also properties of these elements, refers to as process of reception of the information on this system. For reception of one «standard unit» of change of the information action which twice reduces uncertainty of a condition of system for the external observer is accepted.

The External observer (externus observator).

The Object (a part of an environment), having an opportunity to influence system for reception of the information on this system, refers to as the active external observer. The object (a part of an environment) not having an opportunity to influence system for reception of the information on this system, but receiving such information, refers to as the passive external observer. The external observer can be any object of an environment having necessary properties.

Operation (operatio).

Any change in the system, caused by the active external observer, refers to as operation.

Properties of system.

For the external observer of property of system can be obvious and unevident. In the second case elements of system can look like vaguely long time group of objects independent from each other (can be an environment the friend for the friend). However properties of system are objective, i.e. these properties exist irrespective of the external observer. At the same time, process of active supervision can make changes to system (in its elements and properties). Character and size of these changes depend on objective properties of the system and process of supervision.

Elements of system (elementum ...).

Each element of system in turn can be system. On the other hand - each system can be an element of other system. Elements of system can change under influence of internal and external influences change the

interaction and a combination. Such changes can result in change of properties of system.

Model of system (schema ...).

Each system it is possible to describe as model in which elements are conditional «substances», and influences – conditional «fields». Such models refer vepol. Thus conditional «substances» can be any objects (including real fields or processes), and conditional «fields» – any processes. Models of simple systems can coincide with systems practically. For construction of model of complex system, as a rule, are limited to its one property and those elements which provide this property.

Levels of systems (gradus ...).

Each system a priori is considered system of a base level (a level «zero»). In this case its(her) elements have a under – system level (a level «a minus unit»), and systems into which it enters as an element, have an above – system level (a level «plus unit»). Each system can have unlimited quantity(amount) of positive and negative levels. Changes at one level of system can result in changes at other levels (positive and negative). Character and size of these changes depend on objective properties of various levels of system, and also from objective properties of interaction of these levels.

Layers (floors) of a level of system (stratum ...).

At one level of system its(her) elements can be divided and be united, forming new groups, but not creating thus of qualitatively new property – there is only a quantitative change of property existing. Such groups refer to as layers (floors) of the given level of system. At each level of system there can be some layers (floors).

Development of systems (evolutio ...).

Under action of external and internal influences of system vary. Changes of systems (their elements and properties at different levels) occur naturally. Each observably(notice) law of change of systems represents model of some process which is carried out under certain conditions. These laws operate simultaneously, influence against each other and in turn form system.

Objectivity of laws of development of systems.

Laws of development of systems depend on objective properties of systems and do not depend on the external observer. For the external observer these laws can be obvious and unevident. Process of supervision and controlled change of properties and elements of system can not change laws of development of systems. Therefore the result of development of system due to controlled change depends first of all on objective natural development of this system. Constantly it is necessary for active external observer to collect the information on systems to reveal laws of development (to do their obvious) for systematic purposeful development of systems.

Ideal system (perfectus ...).

If properties of system are obvious to the external observer, and elements of this system for it are unevident (are not-observably), such system refers to ideal. Ideality can depend on properties of the external observer (subjective ideality), but also can be real, objective feature of the system. In the second case property (properties) of system at a base level is realized by elements of sublevels (negative levels) that allows to reduce quantity of elements of system of a base level. The size of ideality of system is directly proportional to quantity of properties of system and in inverse proportion to quantity(amount) of elements of a base level.

Interaction of systems.

Systems of one level can have the general(common) elements. In that case ideality of each of these systems can raise. At the same time additional interactions between elements of systems can cause additional conflicts. In other cases (if the general(common) elements are not present) systems are the friend for the friend an environment.

Conflicts and contradictions (conflictus, controversia).

Interaction of elements of system creates various properties of this system. Thus active change of one of properties is accompanied by passive changes of other properties. Such phenomenon refers to as the conflict. Conflicts are objective (are independent of the external observer) and are defined(determined) by properties of elements and the interactions causing this conflict. In development of system both parties of the conflict can change quantitatively (without occurrence of new property) and is qualitative (with occurrence of new property). At qualitative changes conflicting elements or their interactions always have opposite properties. Such phenomenon refers to as the contradiction.

Development of systems - process of elimination of contradictions.

Development of system is qualitative change of this system (its properties and elements). Such change occurs by elimination (removal) of the objective contradictions arising in this system.

Natural, social and technical systems (natura, civilis, technicus).

All systems, arising and consisting of natural (natural) elements a priori refer to as natural way natural (natural). Natural systems for the development use ready external objects. Systems which for the development will transform external objects (systems), refer to as proto-social systems. These systems can have biological (albuminous) or not biological (not albuminous) structure. As a rule, such systems are capable to reproduction (creation self-like systems). The systems creating new (distinct from) the systems intended for transformation of external objects, refer to as social systems. Social systems contain social or proto-social elements. The systems created by social systems for transformation of external objects, refer to as technical systems.

The Subjective factor (subjectum factor).

The Overactive external observer can influence elements of various systems for the directed change of properties of these systems (in view of the general information on systems as laws and models, and also the concrete information on the given system). Such overactive observer refers to «the subjective factor». For realization of the directed influences the subjective factor uses technical systems. The subjective factor is social system.

The Solution of a task, approximation (approximare).

Complex process of subjective influence on objective development of systems of a different nature and a various level refers to as Approximation. The basic result of such process is objective reception (creation) of system with subjectively given properties. As a rule, reception of such system occurs by gradual approach – approximation to some ideal system having only given property (properties). At transition from initial system to ideal a lot of objective contradictions comes to light and eliminated. Process of approximation is complex system of operations. Usually, this process in TRIZ refers to as the decision of a task.

Quality of result and process of approximation (qualitas).

Quality of result of approximation is defined by size of ideality of the received system, and also in direct ratio to a maximum level of the changed above - system (concerning a base level). Quality of process of approximation also depends on a maximum level of the changed subsystem and in direct ratio to the module of this level.

Tools of approximation (instrumentum ...).

Elements (subsystems) of process of approximation refer to as tools of approximation. Technological the tools focused mainly on systems which is exposed to change refer to. Organizational the tools focused mainly on the subjective factor refer to. Process of reception of the information is the separate tool group having both technological, and organizational properties. All tools are divided(shared) also on «classical» and «non-classical». Classical tools which at correct application practically always give a sufficient degree of quality refer to. The numerical size of a sufficient degree of quality can be various for different systems, and also

for one system in different time. Generally separate tools can pass from one group in another.

Resources (supellex).

All conditional «substances» and «fields» which can be used for creation of system with the given property, refer to as resources. As a rule, the degree of availability of resources is inversely proportional to the module of a level of resources concerning a base level of created system. There can be other special conditions also influencing a degree of availability of resources.

Conditions of a problem(task) (conditio).

The List of necessary and existing elements of process refers to as conditions of a problem(task). In most cases initial conditions are not sufficient for reception of the decision (existing elements insufficiently, necessary all are known not). Conditions of a problem(task) form system which will transform to minimally necessary model.

Types of models of problems(tasks) (typus ...).

There Are three basic such as models of the problems(tasks) decided(solved) during approximation:

1. Construction of the system having given property, at presence of the certain resources (in an ideal - reception of the given property without construction of new system).
2. Definition of the resources necessary for construction of system with given property (in an ideal – reception of the given property without use of resources).
3. Definition of properties of systems which can be constructed from existing resources (in an ideal – a maximum quantity of new properties for the given quantity(amount) of resources).

Kinds of problems(tasks) (species ...).

The Trivial problem(task) – concrete conditions, concrete operations for the given conditions and concrete result earlier were known. For the decision it is necessary to execute concrete operations precisely.

The Standard problem(task) – the model of the conditions, typical operations for the given models of conditions and model of result earlier

were known. For the decision it is necessary to transform typical operations in concrete (for the given concrete conditions) with the help of known tools.

All other problems(tasks) - non-standard. For the decision it is necessary to create new operations with the help of known or new tools.

Standarding and a non-standarding of tasks can be objective and subjective.

System of tasks.

For development of complex system it is necessary to solve many problems which also can form system. At this system there can be various kinds and types of tasks.

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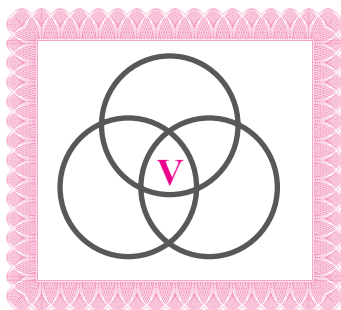
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Altshuller

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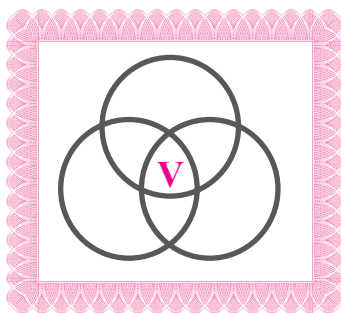
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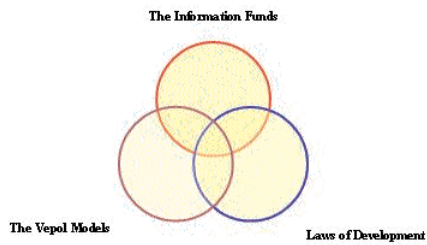
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Genrich Saulovich Altshuller

The basic dates of life.

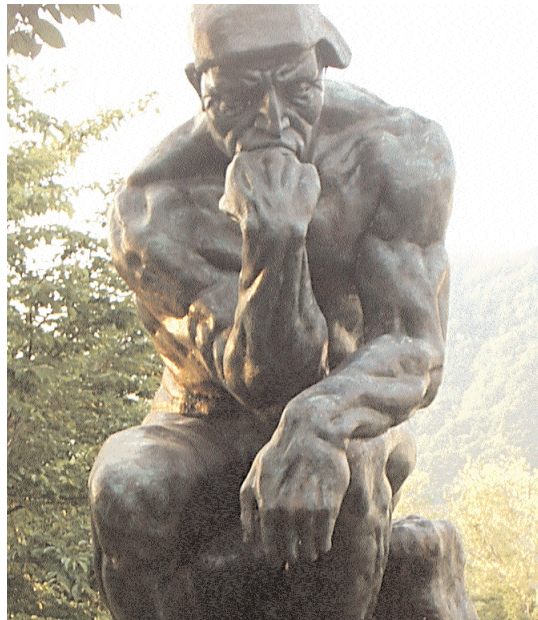
- 15.10.1926 – the first day of his life, Tashkent (Uzbekistan).
1931 – together with parents comes to Baku (Azerbaijan).
1943 – after the ending of professional school it is called up for military service, serves in inspection on invention of the Caspian flotilla.
1943 – creates the first invention (with co-authors).
1945 – after the ending of the Second world war continues service in a military flotilla, occurrence of the first ideas about creation TRIZ.
1950 – becomes the younger officer of a military flotilla, it is arrested and condemned on false accusation.
1954 – the prisoner is released as unduly. Comes back in Baku.
1956 – the first publication by TRIZ in magazine, the first publications on a fantasy.
1957 – the first educational and practical seminars on TRIZ, G.S.Altshuller's marriage with V.N.Zhuravlyova.
1961 – the first book about TRIZ.
1971 – creation of the Azerbaijan institute of inventions creativity (Baku).
1979 – creation of Public laboratory of the theory of invention, the beginning of regular seminars and publications by TRIZ.
1990 – the moving to Petrozavodsk (Russia) in connection with war in Azerbaijan.
24.09.1998 – Petrozavodsk (Russia), last day his lifes.





**TRIZ is exact science.
G.S.Altshuller.**

**ARIZ is the tool for thinking,
but not instead of thinking.
G.S.Altshuller.**



Examples of TRIZ-solutions

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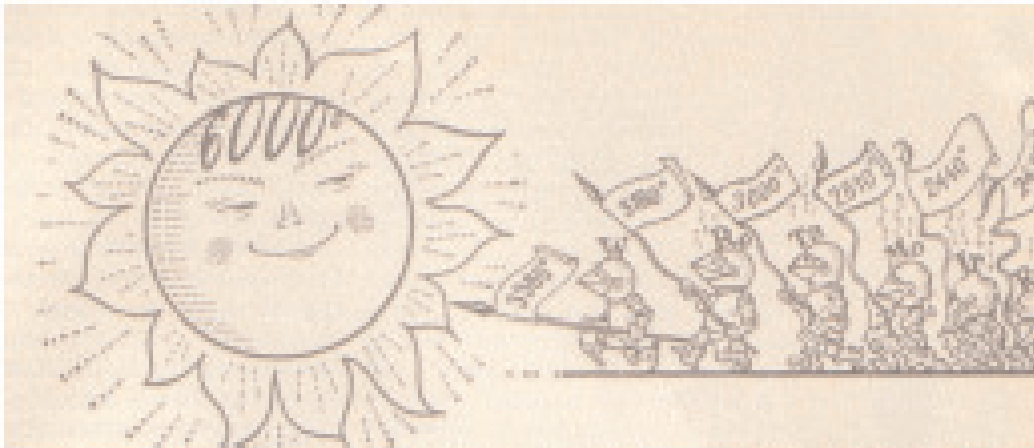
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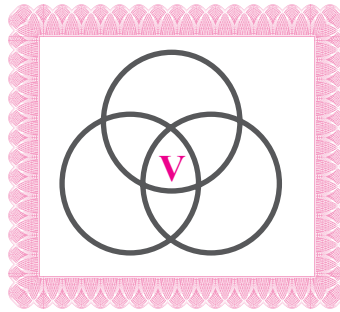
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TRIZ

History of the Instruments





It is a little about the future

*«It Is useful to study all new that way,
Which way to inventions will open.»
(G.W. von Leibnic in G.S.Altshuller's statement).*

In translation from latin language «engineer» is «inventor». But actually to create inventions, to create something new it is necessary everyone.

Any knowledge – both at schools, and at universities – are given that each person could solve set of problems(tasks) which arise in life. TRIZ just also it is intended for the decision of such tasks. But TRIZ does not substitute other knowledge. TRIZ only helps to use already acquired knowledge and, probably better, it is more rational to organize new knowledge.

Each person from birth has certain abilities. TRIZ helps to develop and correctly to use these abilities.

The solution of tasks is serious creative activity and demands knowledge, the experience, the advanced imagination, sometimes – a courageous guess.



Our world is combined. It's any part itself consists of many parts. When the task is formulated in a general view, completely not clear what from parts should be changed. The analysis on ARIZ helps to allocate the necessary part of system or the necessary stage of process. The analysis shows, where there is a reason of a problem and as it is necessary for removing. Applying the analysis oby ARIZ it is possible to formulate the words reasonings on steps. Important only thus that the scheme of the analysis was kept. At the decision of tasks by ARIZ it is necessary to adhere to the offered order and a sequence of steps.

TRIZ is under construction not only on laws of development of engineering and generalization of experience of inventors. TRIZ takes into account also mental features of the person. The thinking of inventing person has prominent feature: reflecting above the decision of a task, the person imagines system which should be improved, and mentally changes it.

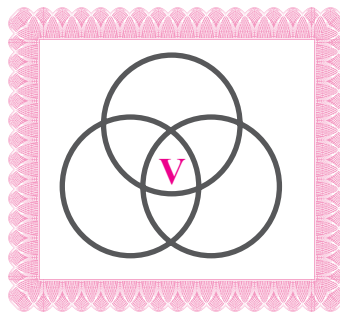
Thus, before the solution of a task it is necessary to make the forecast of development of the given system under the multiscreen circuit and under laws of development of technical systems. It is necessary to collect the information on the given system and to draw the diagram of development of this system. If the system has resources for development it is possible to appear to the decision of a task. And if the system has exhausted resources of the development it is necessary to consider its development in super-system as a part an arch of system.

During the solution of a task is useless to think only abstractly, «in general», rejecting concrete conditions. Always it is desirable to make a start from some existing design, from real the working model.

Insufficiently skilled решатель tasks can take as such initial model already known old design. In this case to it is improvement of an old design will promote in the solution exactly so, as far as possible. The idea of the inventor is held down by opportunities of an old design.



Absolutely other business – to take for a basis for cogitative experiments yet not existing, ideal design. Then the task is reduced to not so to recede from the ideal decision. And the main thing – from all possible directions to define that direction, where it is possible to create the most perspective solution.



In this book all sections necessary for initial studying of TRIZ, only are designated. Further each section goes deep and extends.

The Special attention needs to be turned on such sections:

1. **Practicum** – analysis of problems(tasks) with use ARIZ-85V.
2. **Comments** for the basic classical tools.

Comments to Strategy for Life of the creative person.

Comments to System of Standards-77.

Comments to principles of imagination (including – 50 principles of Altshuller for elimination of technical contradictions).

3. **Comments** to a rate of science fiction.

The Comment to the Register of fantastic ideas.

The Comment to a scale «Phantasy».

The Comment to the base literature on a fantasy.



4. **Scientific effects** from point of TRIZ view.

The Comment to physical effects.

The Comment to chemical effects.

The Comment to mathematical effects.

The Comment to biological effects.

The Comment to social effects.

5. **Comments** to "nonclassical" uses of TRIZ.

Comments to «nonclassical» instruments of TRIZ.

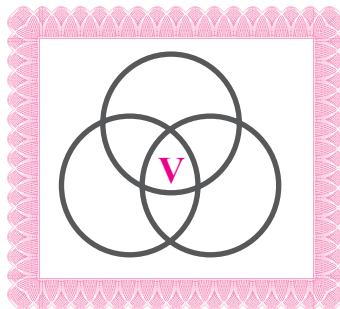
Comments to a rate «Development of creative imagination».

The Comment on application ТРИЗ for social systems.

6. History of TRIZ.

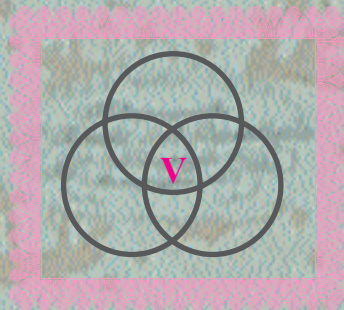
Scientific biography of Altshuller.

Development of TRIZ from point of TRIZ view.



TRIZ

History of the Instruments





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History of the Instruments

*History of the
Instruments*

TRIZ Master's Book