Human and Technical System

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The original Russian text consists of two parts, which are combined here.

Part 1: `http://www.gnrtr.ru/Generator.html?pi=201&cp=3`
Part 2: `http://www.gnrtr.ru/Generator.html?pi=200&cp=3`

Is a human a part of a Technical System or not?

... the last words of the book of the prophet Lustrog read:
≪all true believers break eggs from whichever end is more convenient≫.
Jonathan Swift ≪Gulliver's Travels≫

Introduction

The Theory of Inventive Problem Solving (TRIZ), developed by the talented engineer, inventor and ingenious thinker G.S. Altshuller, is widely known and, undoubtedly, the most effective tool for solving engineering problems at present time. A large number of materials have been published in Russian and English languages, in which the essence of the theory is quite fully revealed for an initial acquaintance with her. The best Russian-language resource is the Minsk website center OTSM-TRIZ[1], the best English-speaking is the American TRIZ Journal[2]. Having studied TRIZ from books and articles, you can easily teach others – the material is so rich and fascinating that interest in the classes will be ensured.

However, for a deeper understanding of TRIZ, one has to think through the material, first of all, of the concepts and terms of TRIZ. This is required, since most of the TRIZ material is presented for further reflection, and not set up for simple memorization.

During my work for SAMSUNG as a TRIZ consultant, I had anew and seriously to rethink everything that I knew about TRIZ before. When solving technical tasks, bypassing patents of competing companies and developing a development forecast of technical systems, it was very important to understand the deep content of each TRIZ term in order to use its tools with maximum efficiency.

One of the basic concepts in TRIZ and one of the most important links to all, without exception, of its tools is the concept of a ≪Technical System≫. This term is introduced in

[1] `http://www.trizminsk.org`
[2] `http://www.triz-journal.com`

classical TRIZ without definition, as a derivative of the concept of a ≪System≫. But with closer examination, it becomes clear that this concept ≪Technical System≫ requires further specification. This statement is supported, for example, by semantic aspects. The concept of ≪Technical System≫ is translated from Russian into English in two ways: ≪Technical System≫ and ≪Engineering System≫. Using any search engine on the Internet, it is easy to convince yourself that these concepts are practically equal for TRIZ specialists. Or take, for example, the glossary of Victor Fey[3], in which there is simply no explanation of either one or the other concepts.

In this article, I tried to describe my understanding of the term ≪Technical System≫, gradually developed after the solution of a specific problem, which challenged me to find out the full composition of a minimum operational technical system.

An attempt to analyze the concept ≪Technical System≫

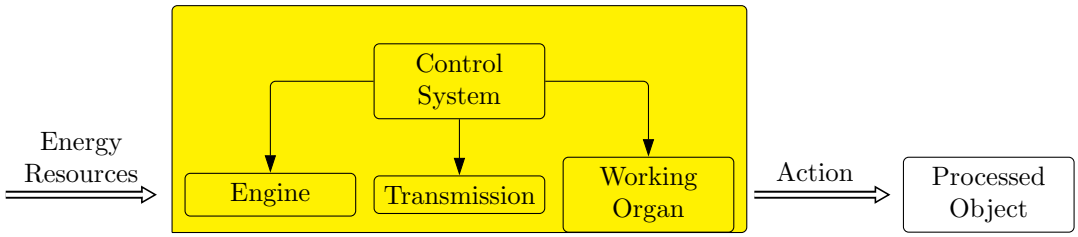
First, let's consider what a general system is. There are many different definitions of a system. The most dashing, abstract, therefore absolutely exhaustive, but with little use for practical purposes was given by B.R. Gaines [1]: ≪**The system is what we define as a system**≫. In practice, the most often used definition of a system is due to A. Bogdanov [2]: ≪**A system is a set of interconnected elements with a common (systemic) property that is not reducible to the properties of these elements**≫.

What is a ≪Technical System≫?

Unfortunately, G. Altshuller did not dierectly define the concept of a ≪Technical System≫. It is clear from the context that this is some kind of system related to technology, to technical objects. As indirect definition of a Technical System (TS) can serve the three laws formulated by him, or rather, three conditions that should be satisfied for its existence [3]:

1. The law of completeness of the parts of a system.
2. The law of ≪energy conductivity≫ of the system.
3. The law of harmonization of the rhythms of the parts of the system.

According to the law of completeness of the parts of a system, each TS includes at least four parts: engine, transmission, working body and control system.



Minimal structure of a technical system capable to work according to G. Altshuller.

That is, there is some kind of system, a machine consisting of technical objects, subsystems that can perform the required function. It includes a working body, transmission and engine.

[3] http://www.triz-journal.com/archives/2001/03/a/index.htm

Everything governing the action of this machine is placed in the ≪control system≫ or a not well understood ≪cybernetic part≫ [4].

The important thing here is the understanding that the TS is created to perform some function. Probably, this should be understood in such a way that a minimally TS capable to work can perform this function at any time, without additional supplementation. Ways to the definition of a Technical System are given in the book ≪Search for New Ideas≫ [5], where the definition of a ≪Developing Technical System≫ is given. This question is touched by V. Korolev in his interesting studies [6,7]. Some critical remarks are devoted to this topic also in the materials of N. Matvienko [8]. The definition of the concept of a ≪Technical System≫ in relation to TRIZ is given by Yu. Salamatov in [9]:

> **A Technical System is a set of orderly interacting elements, which has properties that can not reduced to properties of individual elements and intended to perform certain useful functions.**

Indeed, a human has some kind of needs, for the satisfaction of which it is necessary to perform some function. Hence you need somehow to organize a system, performing this function – the Technical System – and satisfy the need.

What is confusing in the above definition of a Technical System? The word ≪intended≫ is not quite clear. Probably, it's not someone's wishes that are important here, but the objective ability to perform the required function.

> *For example, what is a metal cylinder for with an axial hole with variable diameter and threaded at one end?*
>
> *It is almost impossible to answer such a question. The discussion is immediately switching to the level of the question ≪where it could be applied?≫.*

But is it possible, using this definition, to say: Until now this is not yet a Technical System, and from now on – it is? It is written like this: ≪... the TS appears, as soon as the technical object acquires the ability to perform the Main Useful Function without a human.≫ And then it is claimed that one of the trends in the development of the TS is the removal of the human from its parts. This means that at some stage of TS development, a human is part of it. Or not? Unclear ...

> *We probably won't understand anything if we don't find an answer to the question: is the human part of a Technical System or not?*

Having interviewed several TRIZ experts, I received a fairly wide range of answers: from a firm ≪No≫, backed up by references to big experts, to a timid ≪yes, probably≫.

The most original of the answers: when the car moves evenly and straight – the human is not part of this technical system, but once a car begins to turn, then the human immediately becomes a necessary and useful part of it.

What's in our literature? Salamatov [9, Section 4.3] gives an example that a man with a hoe is not a TS. Moreover, the hoe itself is not a Technical System. But a bow is a TS.

But what is the difference between a hoe and a bow? The bow has an energy accumulator – string and flexible rod, in a good hoe, too, when swinging, the handle bends and when

moving down increases the force of the blow. It bends a little, but it's about the principle. The bow work in two movements: first it is cocked, then released, with the hoe – too. Why then such an injustice?

Let's try to figure it out.

A sharpened wooden stick is a Technical System? Does not look like it. And an automatic pen? This is probably a TS, and a quite complex one. And what about a printer? Undoubtedly TS.

And a pencil? Who knows ... It seems like neither this nor that. Maybe call it ≪simple Technical System≫? Lead or silver writing stick? Question ... Already not a splinter of wood, after all – a precious metal, but it is still far from the pen.

A modern capillary pen, a pencil, a sharpened stick and the writing unit of a printer – what do they have in common? Some useful function that they, in principle, could perform: ≪leave a mark on the surface≫.

≪Lanky Timoshka is running along a narrow path. His traces is your labor≫. Do you remember? This is a pencil. And also a stick, lead or silver stylus, pen, felt-tip pen, printer, printing press. What a set! And the row is logical ...

However, here again a question arises.

If all these objects can perform the same function, then they all are Technical Systems. And there is no need to divide them into complex and primitive ones. If objects implement the same functions, then they have not only the same purpose, but also the level of hierarchy should be the same.

Or vice versa – these are all not TS. Well, what a Technical System – a sharpened stick? Where is its engine or transmission? But then it turns out that the printer is also not a TS.

Let's be formal.

Any Technical System must perform some useful function. Can the sharpened stick fulfill its function? No. And the printer?

Let's do a simple experiment. Place the pen on the table. Or, for simplicity, on the paper. Let's just wait until it begins to perform its main useful function. Does not. And it will not perform until a human, the operator, takes it in his hand, does attach it to a sheet of paper, and ≪... the verses will flow freely≫.

And the printer? Will he start typing until the user gives a command to the computer, and this one in its turn, does forward it to the printer? That is, without pressing a button, a voice or, in perspective, a mental command, the action will not happen.

Thus, the following is obtained. A pen, a hoe, a printer, a bicycle are not TS. More precisely, not complete TS. They are simply ≪systems of technical objects≫. Without a human, an operator, they cannot work, i.e. cannot fulfill their function. Of course, in principle – can, but in reality ... In the same way, four wheels, a body and a hood can't nothing transport ... Even a fully equipped brand new car, refueled lonely, with key in the ignition lock, is not a Technical System, but simply a ≪system of technical objects≫. If the operator will sit down on his place, in common language, the driver, takes rushes behind the wheel, and immediately the car becomes a Technical System. And all others technical objects and systems become complete TS and operate only and exclusively together with a human, the operator.

The operator can sit inside the ≪system of technical objects≫. Can stand near it, farther or closer. Can even program the action of the Technical System, turn it on and leave. But in any case – the operator must participate in the TS management.

And no reason to oppose the spaceship and the hoe. Both the first and the second – this is a greater or lesser part of a certain TS, which for normal execution of the main useful function must be supplemented with one or more operators.

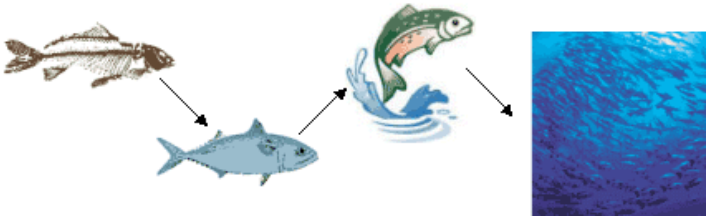
Let us recall the law of completeness of the parts of a system, formulated by G.S. Altshuller. A TS arises when all four parts are present (Fig. 1), and each of them should be minimally capable to work. If at least one part is missing, then this is not a Technical System. It is also not a TS if one of the four parts is not working. It turns out that the Technical System is something that should be completely ready for immediate fulfillment of its main useful function without additional completing. Like a ship that is ready to cast off. Everything is filled up, charged up and the entire crew on their places.

And without human, the control system is not only not ≪minimally capable to work≫, but not capable to work in principle, since it is not staffed. The law of completeness of the parts of the system is not fulfilled. And the law of energy conductivity is not fulfilled. There is a signal going into the control system, and – stop. There is no reverse flow of energy.

And what about those ≪Technical Systems≫ that successfully perform their useful function, but do not contain technical objects at all? For example, the electrician changing a light bulb ...

It seems that there is such a special level of the hierarchy at which a collection of objects, elements turns into an actual Technical System. This is the level of a car with a driver, a video camera with operator, a pen with a writer, an automated production in a water complex with operators who start and maintain it, etc. This is the level at which the system is formed: a set of natural and technical objects, a human operator and his actions, who is performing some kind of a directly useful for humans function.

It is interesting to see how the hierarchy of biological objects and systems is built. Molecules, cells, elements, parts of organisms – this are the levels of subsystems. A ≪Subsystem≫ is a separate part of a body, for example, the skeleton of an elephant, the sting of a mosquito or a feather of a titmouse. The sum of such subsystems, even their complete set, an organism entirely assembled from them, cannot perform useful functions. You need to add something else to this ≪set≫, breathe in a ≪spark of God≫ to get a living, functioning organism.



Living organisms, individuals, can be combined into a supersystem. A ≪supersystem≫ is more or a less an organized collection of animals or plants, such as a bee family. But such a sharp qualitative leap does not occur here.

By analogy with biological systems, the concept of a ≪Technical System≫ can be considered as a special level of the hierarchy, at which the system gets the opportunity to act independently,

i.e. at the level of a living organism.

In other words, the ≪Technical System≫ in technology corresponds to the level of a living organism in nature. In a patent application, this is called "machine in operation". That is, ≪the system of technical objects≫ plus a human operator. For example, a carburetor is not a TS, but simply a system, a set of technical objects. But the human (operator), knocking with the carburetor on a nut is a TS with a useful function: to peel nuts from the shell. So a man with a hoe is a TS, but a tractor with a plow is not. Paradox ...

> *≪Human≫ – what is this applied to a Technical System? What is here difficult for understanding?*

The confusion is probably caused by the very wording of the question. It is psychologically difficult to put a human and a shoe brake on the same level.

There is no doubt that human, as part of the technosphere, has the most direct relation to any TS and can be in relation to it in the following role situations:

In the supersystem:

1. As user.
2. As developer.
3. As manufacturer of the technical objects of the system.
4. As person providing maintenance, repair and disposal of equipment system objects.

In the system:

1. As operator, the main element of the control system.
2. As source of energy.
3. As engine.
4. As transmission.
5. As working body.
6. As the processed object.

In the environment:

1. As element of the environment.

The user is undoubtedly the main person. It is he who pays for the creation of the TS, at his will, developers and manufacturers get down to business. He pays for the operator's labor, maintenance, repair and disposal of technical objects of the system.

The second group of persons ensures the functioning of the TS during work, feels its impact on itself.

The third group indirectly helps or hinders this process, or simply observes gives behind it and is exposed to the side effects that occur during operation.

A person can fulfill several roles at the same time. For example, the driver owning the car or a person using an inhaler. Or a bicyclist. He is an element of almost all bicycle subsystems, except for the working body (seat) and transmission (wheels and bike frame).

Still, it turns out that a human is an obligatory part of the Technical System.

It seems what does it matter. After all, how it comes down to it, to the solution of real engineering tasks, then human quickly leaves the problem zone and has to work at the level of subsystems. Yes, but only in those places where the coordination and passage of energy is carried out between subsystems not connected in any way with the operator. But if we come closer to the control system the problem of human interaction with technical objects grows up in full size.

Take a car, for example. The car acquired its current appearance by the end of the 1970s, when airbags and a reliable automatic transmission were invented. Most of the improvements since then are aimed only to improve management, safety, ease of maintenance and repair, i.e., on the interaction of a human, the main part of the TS, with its other parts.

The truck of the 1940-50s had a steering wheel with a diameter of 80 cm. The driver must be very strong to drive such a car. And in aviation ... the giant airplane of the 1930s ≪Maxim Gorky≫. To perform a maneuver, at the contol stick the first and second pilot had to pull together. Sometimes they called the navigator for help and the rest of the crew. Nowadays the operator with the help of amplifiers can control much more loaded mechanisms. It seems the problem has been solved. But no, again often the human is forgotten ... The fact is that amplifiers do not always allow the operator to fully feel the behavior of the controlled mechanism. This sometimes leads to accidents.

For example, the problem of the safety of driving a car or the more ≪monotonous≫ locomotive management. It is very important that the operator is always in an alert, workable state. This problem is also solved in the supersystem – causes we fall asleep while driving are removed, medical control is carried out, the responsibility of the driver-operator is increased. But increasingly it is solved directly in the Technical System. Right in the cabin. If the driver does not turn off the warning light in time, the engine is stopped and the train slows down. Or in a car: you won't go until you fasten your seatbelt. That is, there is a normal feedback in the same way as between all other elements of the TS.

Perhaps one of the reasons why this direction of improving technical systems began actively to develop actively in recent years is a lack of understanding of the place of human in their structure. Rather, not that not understanding, but ... In general, the developer finds himself in a difficult psychological situation. As human the developer of something new rightfully feels like a creator. He cannot fully feel that a human can also be an operator, engine or working body, a part of the mechanism, the machine, the Technical System. It's good yet if it's a widely used TS that closely interacts with a human, for example, a car. Here a person can be a developer, an operator and a user at the same time.

As with a computer. It is difficult to work with most computer programs even today, when the developers understood the simple truth, that with the program will work a human operator who cares about the result, not the construction of the device. Today such concepts as ≪user friendly interface≫ were introduced. But earlier ... Why walk far, remember ≪Lexicon≫.

And other TS, standing, at first glance, far from the human ... Their name is legion. Here often the thought does not even occur that human is a part of the Technical System. But when developing any of them, it is necessary to analyze the interaction of the elements composing the system and taking into account the capabilities of the human body and mind. Sometimes it is not done.

Even worse, often many of the known natural factors are not taken into account, affecting the well-being of humans, the clarity of their movements and the speed of reaction. A newly discovered psychological factors, for example, the ≪Cassandra effect≫ [10]?

It rises Chernobyl as terrible mushroom, airliners fall and ships collide.

But what else, besides the operator, is needed to get a ready-to-operate Technical System?

The complete composition of a minimally capable to work Technical System

There is a set of technical objects combined into a system, there is a human operator. Is this enough for the Technical System to perform a useful function and to satisfy user's need, or do you need something else?

Let us recall the well-known TRIZ example given in the book by G. Ivanov [11]. We are talking about the Russian scientist Kapitsa, who visited the Simmens and Schuckert plant on production of generators. The owners of the plant showed him the generator, which did not want to work and offered 1000 marks for correction. Kapitsa quickly realized that the central bearing was skewed and jammed, took a hammer and hit the bearing housing – the generator started working. The confused customers asked for an invoice for the work performed. Kapitsa wrote: ≪*1 blow with a hammer – 1 mark, for knowing where to hit – 999 marks*≫.

And here is another example from Fenimore Cooper [12].

The heroes of the story run away from the chase, the Indians drove them into thickets of tall dry grass and set it on fire. The fire goes like a wall, what to do? The old hunter was not taken aback and set fire to grass near where they stood. The wall of fire went towards the one who overtook them fiery shaft, burning fuel for it. The fire went out, those who fled escaped.

What is a Technical System in the one and the other case?

In the first example. The user's need is to start the generator. Useful function – align the bearing. Operator – Kapitsa, system of technical objects – hammer. It turns out that the Technical System is Kapitsa with a hammer.

In the second example. The user's need is to stop the fire. Useful function – destroy the grass (fuel for the coming fire). The operator is an old hunter, the system of technical objects – flint and steel.

Technical System – a hunter with flint and tinder.

What's coming out? A minor action of a human operator using a primitive technical means gave such a tremendous result both in the first and second case! Is that all? Is it really a complete set of technical systems, action which allowed in the first case to start a huge generator, and in the second – to stop a wall of fire?

No, it's not.

The most important thing is that which was completely overlooked in the previous reasoning – informational component.

Indeed, you can uselessly hammer on the generator from morning to night. But Kapitsa knocked not at random, but in a strictly defined manner. And in this case, the informational

support of his actions consisted of two parts: ≪the ability to knock with a hammer≫ and the knowledge, understanding of ≪where to hit≫.

In the same way, setting fire to the grass could be completely useless, and most of the variants could end in disaster for the one who set it on fire.

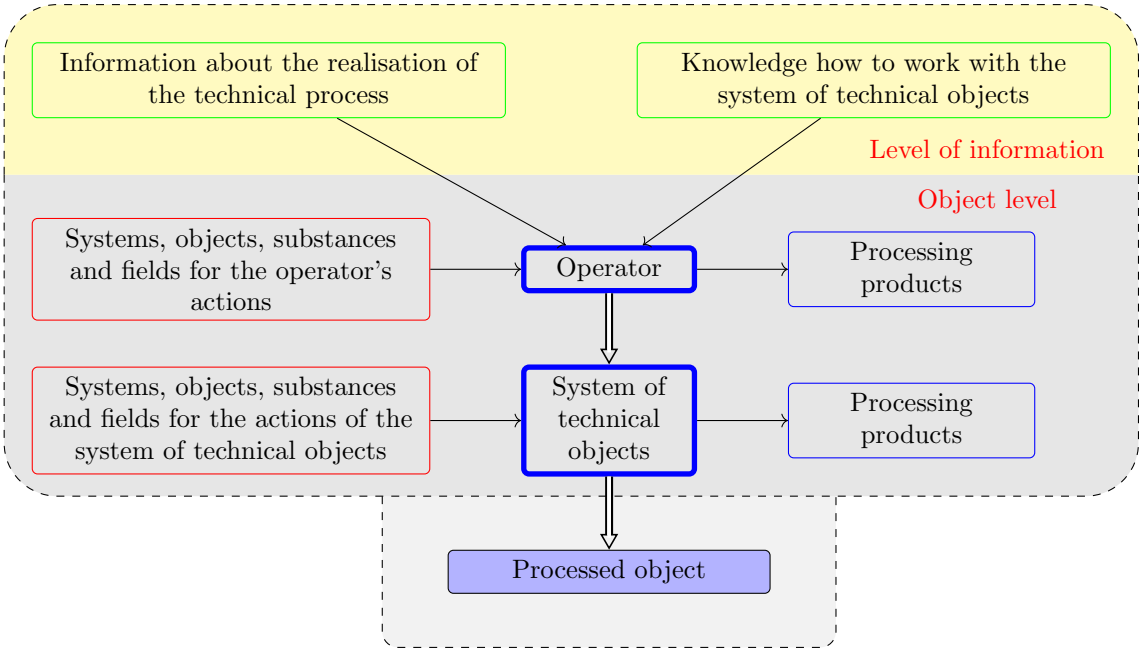
If we further analyze the second example, it becomes obvious that the burning dry grass makes sense when the hunter not only knows that the wind can drive the fire towards the approaching fire, but if the wind blowing in the right side is present.

Therefore, it is very important to know ≪how to do it?≫, how to perform a useful function, using for this technical objects and available substance-field resources that also become part of the TS during its operation.

To complete a full minimum capable to work TS, it is necessary to take into account the following informational and material components:

1. The technological process of performing the useful function.
2. Material technical and natural objects and systems of different levels of hierarchy.
3. One or more operators who own a set of control techniques of the material objects and systems.
4. Substances and fields necessary for the operation of the material objects and systems, and the products of their processing.
5. Substances and fields necessary for the functioning of the operator, and the products of their processing.
6. The processed object (in some cases).

Full composition of a Technical System:



It is in this composition that the TS gets the opportunity to work everywhere, in any place and full autonomy. Even in zero gravity and airless space.

This approach – complete a TS with everything necessary to carry out its useful features – does not override the traditional one, but is quite convenient. Collect everything you need to perform the function into one system and transform it, mentally separating it from the supersystems. It is easier to do any job if you prepare in advance all the necessary materials, tools and drawings, arrange it in the most convenient way not to rummage later on around the "workshop" (supersystem), remembering what else is required to provide ensuring the capability of our TS to work.

That is, the Technical System is the supersystem for the System of technical (material) objects.

This understanding of the TS has something in common with its description given by N. Matvienko [8]: ≪**Every Technical System is a set of material, energetic and information elements (in other words, real parts and details, energy resources for their functioning and a set of prescriptions, instructions, commands, signals that determine the sequence and type of interactions of material elements with surrounding systems and with each other)**≫.

This approach puts the human operator at the center, in the basis of the Technical System.

At the same time, a "Technical System", organized by a human, may include the use of object like technical or natural elements – for example, acupuncture or transportation of goods, as well as avoiding them altogether – the speech of a lawyer in the court or a dance. This sometimes changes little. As example of this statement may serve a lawyer speaking to the audience with or without a microphone.

But, if you really look at it, then a human is a multifunctional Technical System, too. Human nature is twofold – he has the ability to think, to model his actions, to make decisions. And act using his body to do some work. It is here where the informational and material components of a human unite into a single entity.

The human operator includes all the main parts of a TS and, subject to information and material support, can perform some functions, in accordance with the possibilities of his body. When these possibilities are exhausted, one can add to the body material objects, combine them into systems and expand the capabilities of the human. The normal process of enfolding a Technical System begins. A rock, stick, shovel, excavator ... Human is getting stronger, he can fulfill a more and more increasing amount of work.

And what about folding? After all, it seems that it is already impossible to fold a human. Yes, when talking about folding objects. But here the folding is on the information level.

For example, it's time to water the garden. One can take a water can, adapt a water tube, set up a whole irrigation machine. Or you can just look at the sky and, if it is raining soon, you don't have to do anything. That is, folding occurs at the level of functions, technological operations. Finally, at the level of systems and process design. TRIZ itself is a logical continuation of this direction. After all, the concepts of ≪Ideality≫, ≪Ideal Final Result≫ are basic concepts of this methodology.

This was noticed a long time ago, and a rare fairy tale avoids a part where something is going on by itself, a person achieved what he wanted without any expenses. The power of thought, so to say, breaks mountains. Move in time and space. A ≪technical task≫ on human development in this direction are prescribed by science fiction writers and storytellers. And there are reasons to think that this direction will be mastered. Levitation, moving objects

with glances, communication over long distances without any technical means and much more – all this can be accessible to humans.

Yes, this is interesting, but what does all of the above give for transforming, improving Technical Systems in real practice?

A dramatic increase in the amount of resources that can be acquired for change when transforming the system.

In the traditional approach the following resources can be used:

1. The system itself.
2. Its subsystems.
3. Connections between subsystems.
4. Links between each subsystem and system.

With the proposed approach, the number of possible resources for use increases dramatically. Here are just a few of them:

1. The Technical System itself.
2. The Technological process.
3. Technological operations.
4. The System of technical objects.
5. Subsystems of the system of technical objects.
6. The operator as a thinking system.
7. The body of the operator, as a material biological system.
8. Sense organs of the operator.
9. The system of skills of the operator.
10. Individual skills of the operator.
11. Systems, objects, substances and fields consumed by a system of technical objects.
12. Systems, objects, substances and fields consumed by the operator.
13. Relations between the Technical System and the technological process.
14. Relationships between technological operations and the technological process.
15. Relationships between technological operations.
16. Relations between the Technical System and technological operations.
17. Interaction of substances and fields consumed by the Technical System with a system of technical objects.
18. Interaction of substances and fields consumed by the Technical System with the operator.
19. Connections between subsystems of the system of technical objects.
20. Connections between each subsystem of the System of Material Objects and the system of technical objects.
21. Relationships between the subsystems of the system of technical objects and the technological process.

... And many other combinations of elements of the Technical System ...

It's time to give some examples.

1. Classic airplane. A classic airplane of the beginning of the twentieth century consists of two wings that were attached to the fuselage with the help of numerous struts and cable

guides. To make such a plane well flew (this was especially important for air fighters), the stretched cables must be properly tensioned. Since the cables under tension are further stretching they often had to be adjusted using a simple screw mechanism. They applied a special ruler, and the cable was pulled with a dynamometer. About the degree of tensions they judged by the deviation of the cable from a straight line. This process was very laborious and slow.

How to be? How to speed up the process of adjusting the stretching?

Basically, a new system had to be invented to adjust the stretch marks. If those who solved this problem would only start from the System of Material Objects, used to perform this function, it would be extremely difficult to solve it. If remember and take into account that there is an operator in the system, then the number of possible conversions increases significantly. So, you can solve the problem using the organs of sense of the operator.

Indeed, why not use hearing, or rather people with perfect pitch? Piano tuners were invited to adjust the stretch marks, the adjustment process was accelerated many times.

Interestingly, since there were not enough piano tuners, the next solution was found, which demonstrates the repeatedly described TRIZ tendency ≪displacement of human from the TS≫. Stretch adjustment was handed over to the mechanics again, but instead of a bulky ruler and dynamometer it was suggested to use a suitably configured tuning fork.

2. Oil lamp. It's hard to imagine what a titanic job was done by inventors who tried to make an oil lamp shine well. All the problem was poor oil flow to the wick tip. To improve the supply numerous spring based devices were created to build up pressure in the oil reservoir. Pumps for forced oil supply were also used. That is, work went within the framework of the ≪system of technical objects≫ – they tried to improve the machine. And when examined the full composition of the TS, it became clear that the issue was not in the lamp device, but in the combustible material. When instead of oil that was poorly absorbed by the wick oil liquid kerosene was used, all problems disappeared.

3. Computer. Suppose you want to use your computer in the dark. If we transform the System of Material Objects, then ideas about glowing keys, light bulbs and more come to the thought. If you think about the Technical System, then the answer is obvious – the operator must be able to type in the dark, remember the location of the keys by heart.

What can be said in conclusion? Now in TRIZ and other innovative methods the concept of a ≪Technical System≫ is completely confused mixing up constantly a system that **performs** some function, and a ≪System of technical (material) objects≫, that is **designed** to perform some function. Interfering as little as possible into the dispute between "sharp-edged" and "blunt-edged" (see the epigraph), I tried to understand this matter.

Without calling the reader to agree with me, I will be glad if this attempt of analysis turns out to be useful to him to some extent.

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