

Fundamentals of Classical TRIZ

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We live in a rapidly changing world. The speed of changes and the appearance of novelties are growing abruptly. It is not easy to orientate oneself in this world. Knowledge quickly gets out of date and new knowledge appears. The situation in the world and in the regions of the countries around us is also changing, as well as economic conditions. Cultures are integrating. Today, it is not enough, as it was previously, to master one specialty, learn typical professional solutions and use them all through one's life...

INTRODUCTION

TRIZ has been evoking many discussions since the moment it appeared in 1946-1949. First, it arose as an invention-creating METHOD. At that time, creating such a method was believed to be impossible. At that time, the ability to invent was considered a gift of nature. You either can invent if you are dowered with such a gift, or cannot invent if no such gift is given to you. Nevertheless, in 1949 the method was created and tested on very complicated problems. The solutions obtained through the use of that method won a grand-prix at an inventors' competition. In addition, the method was also tested on other problems and yielded steady results. The authors of the method wrote a letter to Stalin reporting about the achieved results. Instead of encouragement, the authors – Genrikh Altshuller and Raphael Shapiro – were arrested and sentenced to 25 years of GULAG. Genrikh Altshuller served the term of imprisonment in the Arctic Circle, working in Vorkuta pits, while Raphael Shapiro was sent to the south of Central Asia, near Karaganda.

Shortly after Stalin's death, the method authors got their liberty. Raphael Shapiro withdrew from the development and research while Genrikh Altshuller continued his work on the method and began spreading it among engineers. The method was being gradually improved and turned into a clear enough ALGORITHM which, with the course of time, was given the name of the Algorithm of Inventive Problem Solving (ARIZ).

By that time, the public opinion about the invention METHOD had started to change for the better. The method proved its effectiveness. It began to be studied and used by different people who, just at the author, obtained excellent results. Skeptics changed their opinion and began to admit that a method of inventing the new could exist but speaking of ALGORITHM was too strong!

Nevertheless, ARIZ continued to develop and training courses for those wishing to master ARIZ began to be organized more and more often. That promoted a more active ARIZ development. The participants of ARIZ workshops kept in touch with the author, sent him difficult-to-solve problems. Altshuller applied ARIZ to problems analyzed by his followers, revealed the weak points in the algorithm and created new ARIZ versions. As a result, there appeared two figures in the ARIZ name, which denoted the year of issue of a given version: ARIZ-64, ARIZ-74, ARIZ-77, etc.

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Workshops were becoming more and more popular and new ARIZ versions were being produced more and more often, sometimes several versions a year. As a result, letters denoting the version number, were introduced into ARIZ names in addition to figures. For example, in 1982, there were created several versions: ARIZ-82 A, ARIZ-82 B, ARIZ-82 C, ARIZ-82 D.

Each new version had been checked on test problems before Altshuller started its distribution. The collection of test problems was permanently growing; it included the problems which were impossible to solve using previous ARIZ versions.

There began to emerge schools of inventors, where ARIZ was taught not only by the Algorithm author, but also by people who had received training by G.S. Altshuller. By the mid-80s, there existed about 300 invention schools where training was organized on different levels and with different frequency.

As time went on, the hypotheses, proposed by G.S. Altshuller and Raphael Shapiro in their very first article, dedicated to the foundations of the invention method creation written shortly after the liberation from GULAG and published in 1956, found confirmation. Over 30 years were spent to verify the ideas described in the article, during which time there were obtained new ideas as well as theoretical foundations underlying ARIZ. All those achievements were integrated into a single theory and tools for use in the everyday engineers' practice. In the mid-70s, the theory acquired the name of the Theory of Inventive Problem Solving (TRIZ).

By that time, the public opinion had already accepted the idea of the possibility to create an invention ALGORITHM, but had begun to deny the possibility to create an articulate invention theory. It is necessary to say that in the late 80s and early 90s, the possibility of creating an Invention Theory was beginning to be recognized but TRIZ was denied to be a theory... G.S. Altshuller's and I.M. Vertkin's research into the history of innovation implementation by people who changed the world proved that the delay in recognizing innovations is characteristic of all the cases regarding the introduction of weighty level innovations: Aviation, Railway, Spaceflights and many others had to travel the same way to recognition. Today, the recognition of TRIZ as a well-knit and practically effective system is prevented by many factors, the main of them being the lack of reliable information from primary sources created by G.S. Altshuller himself.

Popularity is being gained by simplified and abridged versions of the simplest tools of Classical TRIZ. At workshops, neither the theoretical foundations of Altshuller's Theory nor its most important and basic tool – ARIZ – are considered. The information about Classical TRIZ is diluted with numerous "improved" versions of the "modern TRIZ". Many of these TRIZ versions are far from what could be called an applied invention theory. Judgements about TRIZ are very often based on these compilations rather than on primary sources. It is interesting that as early as 1985, at the first presentation of the research into the history of innovation implementation by creative people of the past and the present, Altshuller himself predicted that the events would take this course after his death. That research proved that there exist steady regularities of events which accompany the introduction of new ideas, whether it be within the limits of a separate company or organization or on the Humanity scale...

Meanwhile, a new stage of TRIZ development and dissemination started in the mid-80s. The TRIZ development logically resulted in new ideas. For example, it became clear that further development of TRIZ required creation of a strong foundation underlying three new theories.

The first theory should deal with the evolution of those systems the improvement of which is the job of creative people, different kinds of inventors. G.S. Altshuller called it the Theory of Technical

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System Evolution (Russian acronym - TRTS). Because of the historical circumstances, he narrowed the name of this theory and only restricted himself to technical systems. Different people (Boris Zlotin, Alla Zusman, Igor Vikentiev, Vyacheslav Yefremov, Igor Kondakov, Yury Salamatov, Igor Vertkin, Natalya and Alexander Narbut and many others) were engaged in TRTS development. Their works formed the basis of the recent versions of the Classical TRIZ tools.

Systems are developed by people – inventors, creators, so it was necessary to understand where people, who changed the world, came from, how they managed to introduce their ideas despite the resistance of their contemporaries. G.S. Altshuller and I.M. Vertkin scrutinized the biographies of about 1000 such people, whose names became history of humanity. It emerged that the biographies of most different people who lived in different historical periods of the human history and in different regions of the world have certain similar features. Many of them faced similar problems while working on their inventions and ideas and while implementing them. It is important to note that similar problems occurred not only in the life of engineers, but also in the life of painters, doctors, researchers, businessmen (for example, the Federal Express history). The analysis results were presented in the form of a business game “External Circumstances versus Creative Person”. It is a kind of problem collection which describes typical problems arising in the life of Creative People irrespective of their occupation, time and place of residence. This research work formed the basis of the second theory which needs further development. The authors called it the Theory of Creative Personality Development (Russian acronym - TRTL).

The evolution of Classical TRIZ proved that its theory and practical tools are applicable not only to technical systems. Such a hypothesis arose at the early TRIZ creation stages. However, the practical confirmation of this hypothesis required several decades of application of TRIZ tools and theory by different people engaged in research activities in various fields such as physics, botany, chemistry, various production and financial applications, business applications and different kinds of social problems of different scale, advertising and many others.

Many of Altshuller’s followers started applying TRIZ to various problems including those arising in their private life. Many but not all of them. There arose a question why some people could and others could not apply TRIZ to various situations. Not only engineers but also representatives of other professions such as advertising specialists, businessmen, and research workers were beginning to attend TRIZ schools. Banks, exchanges, government organizations were beginning to resort to the services of specialists. There arose another question connected with the first one: how to teach all those people to effectively use the Classical TRIZ tools in their fields of activity? While searching for answers to those questions, new ideas came into Altshuller’s head, which formed the basis of the theory named the General Theory of Powerful Thinking (OTSM). He started to develop those ideas in the mid-70s. In the mid-80s, Nikolai Khomenko was involved in the OTSM development.

By the mid-80s, much more people had accepted the idea of creating an Invention Theory. Besides, both the idea of developing a General Theory of Powerful Thinking (OTSM), as well as the Theory of Creative Personality Development (TRTL) faced a strong resistance even in the environment of TRIZ specialists.

The OTSM evolution caused further development of Altshuller’s basic ideas and gave an impetus to the creation of a comparatively articulated theory of powerful thinking. This theory formed a basis for the appearance of tools for dealing with complicated interdisciplinary problems containing tens and hundreds of sub-problems from various areas of knowledge. Examples of problems with such an

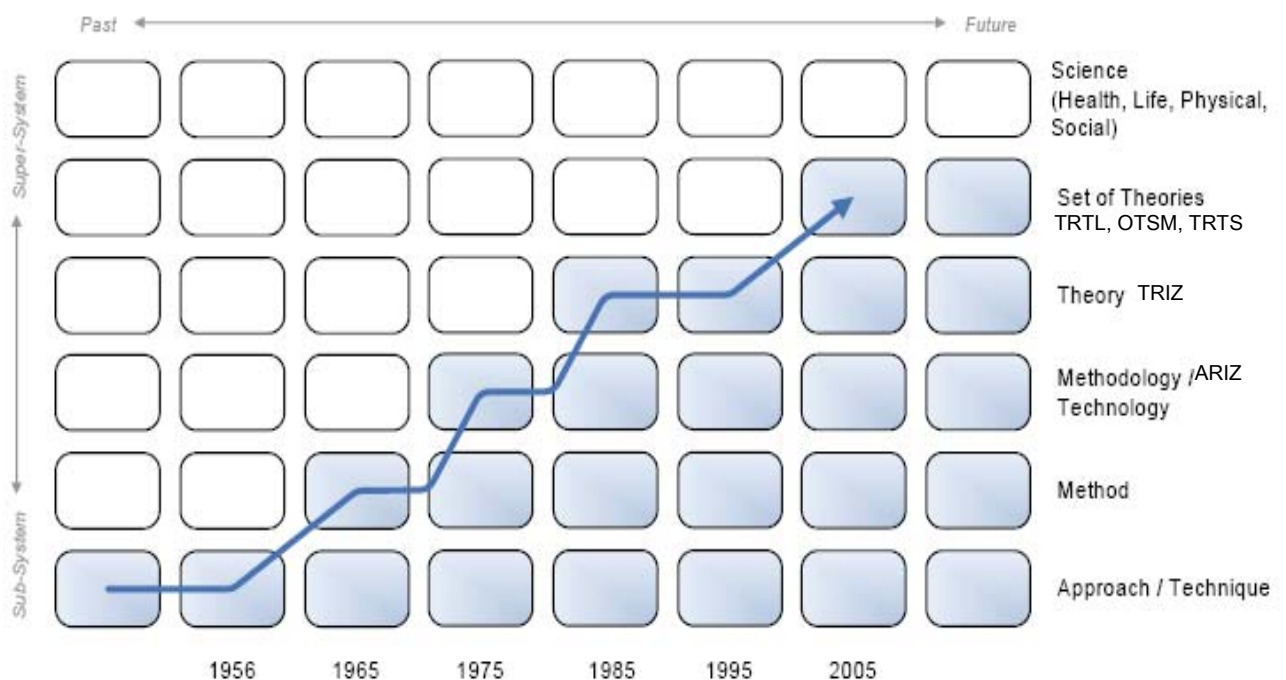
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amount of complexity are: manage the sustainable development of a region with hundreds of thousands or even millions inhabitants; setting up a company or business based on permanent and effective creation and introduction of innovation ideas; the creation of research centers capable of changing pioneer heretical ideas into an ecologically safe and profitable business for society.

OTSM provides users with tools for dealing with various kinds of knowledge. It helps them effectively assimilate knowledge from different areas, including new areas of human activity. That is why a group of researchers from the former Soviet Union selected OTSM as a basis for building new pedagogical tools capable of improving the educational system effectiveness in teaching adults and children to deal with problems. For example, one of such tools was Alexander Sokol's approach to simultaneous teaching of foreign languages and OTSM-TRIZ basics. This approach, called Thinking Approach, is founded on the idea that Language is one of the tools used for solving vital problems of a man and to master and make the best use of this tool, it would be advantageous to know at least the basic approaches to problem solving in general.

Let us look back again at the history of the Classical TRIZ and see what transformations it underwent during its evolution (see Fig. 1).

First, there appeared a METHOD comprising a small number of steps. Then supplementary methods started to appear. In the due course, those supplementary methods began to integrate into a system – an ALGORITHM which increased their application effectiveness – ARIZ. ARIZ evolution revealed some fundamental applied theoretical statements which were presented in the form of an applied scientific THEORY – TRIZ. The theory evolution proved the necessity of developing several other theories which must serve as a basis for a new TRIZ.



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Fig. 1. Evolution of Classical TRIZ.

Altshuller thought that the system of theories needed a new, more suitable name but no new name has appeared so far. Therefore, the formed system of theories is still called Classical TRIZ, which causes some misunderstanding while talking to people interested in TRIZ but unacquainted with its history. As Classical TRIZ acquired popularity in the world, its various modifications began to appear. They are generally strongly simplified and abridged. A reverse process is likely to start - moving away from the already achieved objectives back to special methods and algorithms.

Some of the Classical TRIZ evolution branches produced interesting approaches. For example, an interesting approach and a useful method, named Directed Evolution, was created in I-TRIZ. The main authors of this approach are Boris Zlotin and Alla Zusman. Analyzing this and other branches of Classical TRIZ are not within our scope.

Classical TRIZ has repeatedly proved its effectiveness. TRIZ and its tools have been used for solving various problems starting with relatively simple ones (technical) and finishing with all sorts of complicated social problems.

People who come to know TRIZ sooner or later start wondering why it all works so effectively. We will try to answer this question in the next sections. For better understanding how and why TRIZ works, it is necessary to go thoroughly into different aspects of Classical TRIZ. Nevertheless, even the most perfunctory knowledge of TRIZ and its theoretical foundations allow people of different professions to cope with many problems they encounter in their professional and private life. This is just what makes Classical TRIZ and OTSM attractive to people engaged in the sphere of education.

Research has been conducted and OTSM-TRIZ elements have been used in pedagogy and education for over 25 years so far. There have been created individual special methods as well as complex systems used in education and pedagogy. Using those methods, we are ready, right now, to start developing creative and thinking abilities in children aged 2 or 3 and guarantee a positive result. Most of the pedagogical OTSM-TRIZ tools are represented by games and various kinds of creative activity. Children who began to assimilate creative thinking methods based on OTSM-TRIZ are already grown and have children of their own. It is interesting that they themselves are beginning to work with their children using new, modern methods or create their own methods if the need arises.

This fact is worth noting. High-quality, in-depth comprehension of OTSM-TRIZ not only improves the application efficiency of the existing tools for dealing with complicated nonstandard problems, but also allows promptly creating needed tools if those available do not cope with a problem.

The current OTSM-TRIZ is in fact a construction set composed of various tools which are united into a required system according to respective rules. These rules constitute the theoretical foundations of OTSM-TRIZ to be mastered for a better understanding and for solving problems arising in the educational system. That is why we are starting with the theoretical foundations. You should not be afraid of the word “theoretical” because the theoretical foundations of Classical TRIZ and OTSM are in effect applied tools of a higher generalization level. That is why they work where the existing standard tools of professionals and experts of all kinds cease to work.

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We live in a rapidly changing world. The speed of changes and the appearance of the new are growing abruptly. It is not easy to orientate oneself in this world. Knowledge quickly gets out of date and new knowledge appears. The situation in the world and in the regions of the countries around us is also changing, as well as economic conditions. Cultures are integrating. Today, it is not enough, as it was previously, to master one specialty, learn typical professional solutions and use them all through one's life... New knowledge and new tools for work with this knowledge appear even within one specialty. It is difficult to foresee how the world is going to look like in several decades. Somebody can say that this problem is solved by life long learning. To better outline the problem, let us use one of the Classical TRIZ tools – aggravating the problem situation to an absurd extreme. This method allows basic roots to be identified within a problem, leaving for a time the remaining particulars for subsequent analysis.

Let us imagine that we have created the best, the most advanced training course and began teaching a group of students. Some days later, the students successfully defend their graduate papers and get diplomas. But when they leave their educational institution, it becomes clear that the most advanced skills and knowledge they got while studying became hopelessly outdated during the training period. The real life changed during that time and required new skills and knowledge.

The situation is really challenging and many educators are really at a dead end! What should they teach to students in this rapidly changing world if knowledge becomes obsolete by the end of a training course?

“The Third Millennium”, G.S. Altshuller's unfinished novel, describes a fictitious school where not narrow specialists are trained but universals capable of deriving knowledge necessary for resolving vital situations ...

Problems are also changing. Typical professional solutions are becoming useless. What is to be done?

We think that G.S. Altshuller's ideas exposed in his fantastic novel are worth our attention. We have to teach our children living in the world of which we ourselves know very little. Today we cannot provide our children with standard tools for solving problems which are unknown to us. What we can do is teaching them to create tools for effectively solving those future, unknown problems. This is proved by the applied experience of Classical TRIZ and OTSM. Probably, it is not enough. Neither Classical TRIZ nor OTSM can replace special knowledge in various subject areas. However, we think that the skill of dealing with knowledge about problem situations is one of the fundamental subjects of the educational system of the future... And we must start creating this future right now.