STRUCTURE OF TALENTED THINKING

G.S. Altshuller, 1979.

From "Creativity as an Exact Science", Moscow, 1979 (in Russian).

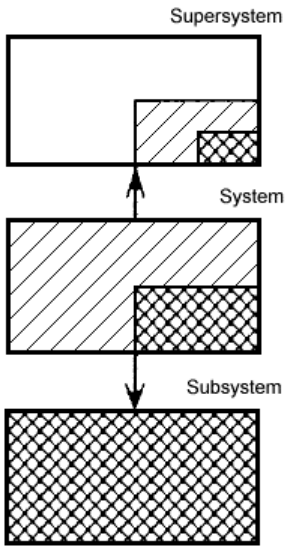
What is it - talented thinking?

Let us have a look at the problem.

A motor boat sets up a new, seemingly absolute, speed record. The boat has an ideal shape and the most powerful engines. How to break the record and to rise the speed, say, 100-200 km/h more?

An inventor immediately imagines a traditional boat. His mind creates a mental screen on which a clear picture is drawn. Now, the imagination starts to modify the picture. An ordinary inventor slowly browses possible alternative designs. The alternatives generated (even dozens of them) just slightly differ from the original picture. "To make the boat longer? To improve the boat's shape? To install a more powerful engine?…"

A brave inventor quickly scans alternatives: new and new pictures are being born on his mental screen. Alternative number 67: "What will happen if we cover the boat with something like a fur of a cheetah? It is not a coincidence that the cheetah runs faster than other animals" (Soviet Patent 464716 was issued to the inventor G.N. Soutiagin. It states that "in order to reduce the friction, the surface is covered with an artificial fur, fiber fabrics, etc.")

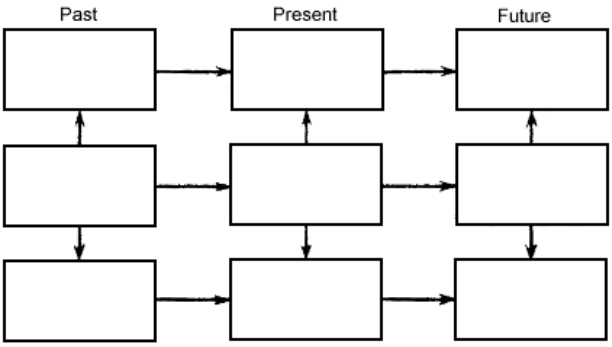


Technical systems never exist independently from the rest of the world. Each of them belongs to a bigger system (so called "supersystem") and, therefore, can be regarded as a part of the supersystem. It interacts with other parts of the supersystem. But every system also consists of other parts – subsystems. A principal feature of the talented thinking is the capability to "travel" between systems, supersystems and subsystems. Therefore, the human mind has to be able to work with all three screens (picture 7).

In other words, when looking at a tree, one has to see a forest (supersystem) and parts of the tree (branches, leaves, etc. - subsystems). However, it is not enough. At each screen, it is necessary to see its own line of evolution. What does this mean - "to see the line of evolution?" For example, one of the subsystems of the boat is a hull. The higher speed of the boat, the higher is the water resistance. As a consequence, the hull tends to get more narrowed, to occupy less space. An ideal hull - no hull at all. Another subsystem of the boat, the engine, evolves in opposite direction. It tends to gain more power and, as a consequence, becomes more bulky. Finally, it will occupy every part of the hull and we will have to place its parts outside the hull if we want more speed. A struggle between these two contrary trends defines the direction of the boat's evolution: the hull gets narrower whereas the sizes of the engine grow thus filling in every piece of space inside the boat's hull.

There is a real hurricane in the mind of the inventor: collisions of contrary trends; different conflicts arise, a struggle of contraries intensifies… And sometimes, the original picture is replaced with a so-called "anti-picture". Instead of the boat, imagination creates an "anti-boat". The traditional boat sails on the water, but the anti-boat should not sail. Therefore, the anti-boat is a boat that does not need to be kept in the water. And what happens? It sinks. This is an absurd, from the traditional point of view.

But what if to think further? The overall density of a boat is less than 1, this is why the boat does not sink. A lot of empty space inside the boat results in a large volume of the boat but it also results in the growth of the water resistance during a sea ride. A hydrodynamic foil can lift the boat and keep it above the water, but there is still the resistance of the air.



The anti-boat should not necessary to be in the water. As a consequence, it can be filled in with steel engines to its full extent. As clear, more power will produce more speed. But such a great boat with so much steel will immediately sink. On the other hand, during the ride it can be kept above the water by the lifting force produced by the hydrodynamic foil. During stops, it is possible to use floats - inflatable balloons, for instance. According to the law of Archimede, the boat will be perfectly safe on a parking lot. After the boat reaches the required speed, the balloons can be deflated and hidden inside the boat.

Therefore, the idea of the anti-boat does not seem to be crazy any more. Now the traditional design looks a bit odd - why to have a large hull which has the only function - to prevent the boat from sinking?

In 1991, the Vilson's chamber was invented and soon had become one of the main instruments of physics. Charged particles that move in a supersaturated vapor become "visible" by forming tracks consisting of tiny liquid droplets. Numerous improvements of the chamber were proposed since. However, during half a century, nobody was able to come up with an idea of an "anti-chamber", in which the track would be formed by the gas bubbles in liquid. In 1960, D Glesser won a Nobel Prize for his invention.[1]

Now back to the screens of talented thinking. Three levels, nine screens, images and anti-images - and this is still a very limited picture. A real talented thinking is able to see many levels above the system and many levels beneath the system. It is not enough to see the forest around the tree, it is necessary to see much more -- the biosphere. Not only a leaf, but also cells of the leaf. Many screens can be added before the system (recent past, far past), many – after (near future, far future). Images on the screens get larger or smaller, slow down or accelerate…

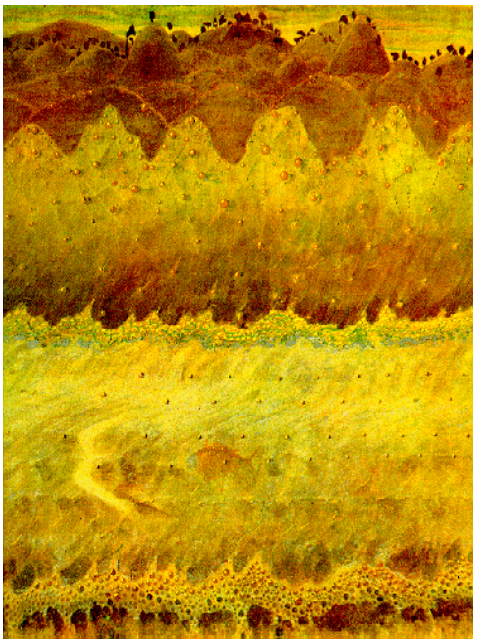
Difficult? Yes, difficult. Our world is very complex. And if we want to cognize and change it, our mind has to view the world in a correct way. The complex, dynamic and dialectically evolving world has to be

[1] The concept of "anti-system" is quite popular in TRIZ. One of TRIZ inventive principles is "the other way round: instead of necessary action to perform the opposite action". A good illustration of the principle is recently invented in the USA "beach book" - white characters are printed on black background.

presented by a relevant model in our mind. Which also has to be complex, dynamic and dialectically evolving.

A mirror displaying the image of the world has to be complex and many-sided. Similarly the artworks of Ciurlionis [2].

It seems like no other artist ever possessed such "systemic view" of the world. Paintings of Ciurlionis are not limited to showing "a system" - they also depict subsystems and supersystems. "Sonata of the sea (allegro)" consists of three different scales. Seaside hills are shown from the bird's eye view. The waves are shown differently: like a person standing on a seaside might have seen them. We can see play of lights and shadows on the sea floor, silhouette of a fish. And at the same time - one more scale: we even see large water droplets and bubbles.



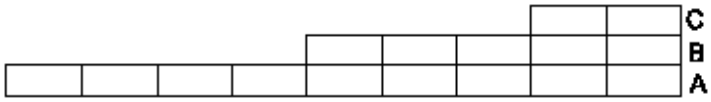
The reader might ask: are we also talking about genius thinking? Yes, that is true. And even geniuses do not posses such mentality every day. In reality, a moment of viewing a full multi-screen diagram indicates a triumph of a genius – and this happens rather rarely in the lifetime of any great thinker or an artist.

The full diagram represents IFR (Ideal Final Result), and ARIZ helps to shorten the path leading to the IFR. It is not difficult to notice that ARIZ provides a linear projection of the full diagram and defines what is necessary to draw components of the diagram.

In the beginning of learning TRIZ, separate operations, which are components of the full diagram, are studied. Then, the most difficult phase is necessary - integration of the separate operations into a new system of thinking. At this phase, it is necessary to try to solve very difficult problems along with traditional inventive problems.

In particular, the question "what is a sense of life?" was used in experiments.

If there is a new group of students who just started education, the students use the trial and error approach: various alternatives are suggested but every answer focuses on a given system (the life of a human being) and only at a current moment of time.



An experienced TRIZ group works in a different way. First, students try to correct the question: the life has to be regarded on three levels (a cell, an organism, society). On each level the past, the present and the future have to be looked at. However, the cell is older then the organism and the organism is older than the society. Therefore, it is obvious that the diagram has to be replaced with a new one.

[2] Ciurlionis, M. K. (1875-1911) – Lithuanian painter and composer.

Evolution of single cells has slowed down since the nature invented organism (level B). Correction number two: evolution of biological organisms has slowed down since the society was “invented”. Therefore, the evolution is not a single line: the evolution has to be considered at many levels.

The diagram can be added with more wide levels - “lives” of molecules, atoms, elementary particles. Too heavy atoms are unstable - and the level of atoms stops near 100th sample, and further evolution goes on by combining atoms into molecules. The next level of molecules takes over: new complex molecules are formed, such as polymers and proteins. However, formation of proteins ends the evolution of the molecules. Now the cells continue the evolution. The cells form their own level where a number of consequently evolving samples can be observed. For instance, very large cells of seaweeds. Finally, the nature creates an organism.

First, cells combine into more complex structures and, finally, – into an organism. Before creation of a human being, the nature made attempts to evolve simpler organisms – such as bees and ants by creating supersystems of the bees and the ants. It seems like these supersystems were unsuccessful because of a single but important criterion: the supersystems did not provide acceleration of the evolution. Vice versa, the evolution rate has approached zero. Only after the nature has “invented” the human being, the evolution entered the next level.

Why does this happen? Why do we have these levels? An answer is obvious. Each next level is less dependent of the environment. Elementary particles (when interacting with environment) live during extremely short time intervals. Non-organic and simple organic formations live longer but they have no protection against external factors – heating, cooling, or chemical reactions. Proteins and cells are higher forms of the matter and therefore they have a higher degree of protection. An organism is even higher form. The cells in our bodies renew every seven years, but the whole body lives much longer. The last known level of the evolution - a society - is more stable and has a higher degree of protection against environmental factors than a single human being.

The evolution diagram can be extended above, too. The evolution of the society will continue until a new level appears where the society will play a role similar to the role of a single cell in the organism.

Recently, much attention has been paid to the search for extraterrestrial civilizations. Why do not they send us a signal? Why do not we notice tracks of their activities?

A super-civilization has to be more developed, smarter, more energy-consuming. As follows from our diagram, the super-civilization has to occupy the level above the level of the society. By analogy, do we think that a single cell will be searched by an organism to establish a contact? Doubtfully.

Many efforts were invested to search for signals of extraterrestrial civilizations. As seen from the diagram, every new level creates conditions for a transition to another level much faster that the previous level. Following logic, each new level will form faster and faster. The conclusion is, that the super-civilization might appear to be even further from our society that our society from an elementary particle!

We even have not started yet to search for an answer to the question of what a sense of life is, but learned a lot of new and interesting during completing the diagram of the evolution.

I would like to outline that building evolution diagrams is a fragment of the training in the creative imagination improvement. The total training program consists of 15 sessions. Other examples are shown in the book “A.B. Selutski, G.I. Slugin: Inspiration By Order), Petrazavodsk, Karelia, 1977, pp. 138-166 (in Russian).

The training results in a better understanding of origins of the evolution of artificial systems. When a system has no more resources to evolve, it becomes a part of a higher-order system -- a supersystem. Once it happens, the evolution of the original system slows down while the evolution of the super-system sets off and accelerates.

Take ship building, for example. The ships driven by oars became obsolete after a sail had been invented. The ships with both sails and oars had a long history. Then the ships got rid of the oars. Then a steam engine was invented and the ships with sails were equipped with the steam engines. Later, the sails became obsolete. And so forth…..