THINKING SKILLS FOR INNOVATION

Valeri V. Souchkov

www.xtriz.com

In the past, we could invent something once and enjoy benefits till the rest of our lives. Time has changed. Today we need to continuously stay innovative and maintain leadership - which means we need to possess “power” thinking skills to be able to constantly come up with new winning ideas. But what are the differences between “regular” and “power” thinking skills? Due to nature of my work, I have had a unique chance to meet many great people: outstanding thinkers, inventors and innovators from different areas: technology, business, arts. Below I would like to summarize these differences, based on many years of observations.

1. Multi-Screen Thinking vs. *Spot Thinking*

In most cases, when we attempt to solve a problem, we tend to focus on a very narrow spot where the problem takes place. As a result we limit ourselves to considering only those components that immediately form the problem. However looking at the problem from the viewpoint of its relationships with a rest of a system where the problem has arisen helps identifying much broader scope of opportunities, better understand the roots of the problem, and identify different strategies of solving a problem. Thus we should see the problem as a part of a bigger system and also recognize how our solution will impact the future of a system and its environment. When we want to innovatively improve a certain system – technical, business, etc., - it also makes sense too look to the past to find out what changes the system experienced and what were drivers of these changes. Seeing a problem or a system under a different angle also helps to recognize different types of solutions and evolution directions. (“Multi-Screen Diagram of Thinking” is one of the key TRIZ components, also known as “System operator”, or “9 Windows”.)

2. Abstract Thinking vs. *Specific Thinking*

Specific thinking forces us to stay at the level of details within a scope of known to us solutions and concepts and try to adapt them to our problem. As a result, we either stuck or come up with small

incremental improvements. Abstract thinking helps to migrate problem solving to a new level and fight mental inertia which is brought by mental images formed by specific information and details. It also helps to recognize analogies in totally different areas. Say the word “wall” and we usually imagine a wall of a house made of bricks or stones. But the wall can be also a waterfall, a steam flow, a light lock… By saying the word “company” we immediately start imagining an office filled with people and desks while a company can be virtual, with home-based employees, etc. Abstraction furthermore helps to recognize links among seemingly unrelated objects and events and come up with totally different ideas and concepts.

3. Breakthrough Thinking vs. *Trade-off Thinking*

TRIZ states that emergence of contradictions is a major driving force of evolution of technological systems, and resolving contradictions by their elimination instead of trading-off helps achieve a major qualitative jump in evolution of a system. For instance, a speed of a chariot will be always limited by speed of a horse, no matter how much effort we put to redesigning a chariot, how great ly we feed horses, or how many horses we have. To reach a higher speed, we need to replace a horse with something that makes the chariot move much faster. Apparently this is valid for many other types of man-made systems. For instance, during evolution, business, social, and political systems experience numerous contradictions as well. However when we face contradictions, our mind tends to soften conflicting demands and search for a compromise instead of targeting at breakthrough solutions that would completely eliminate contradictions. Thus contradictions remain unsolved - but unsolved contradictions tend to deepen over the time. Early recognition of contradictions and resolving them is one of the most important features of “power” thinking.

4. Intensification Thinking vs. *Sheltered Thinking*

We are often afraid to think outside of existing concepts and ideas. But all breakthroughs happen only when we overcome barriers set up by our mental inertia. To break these barriers, it helps to intensify given tasks, conditions, or requirements. Often we need to intensify them to such a degree that they seem to be “impossible”. For instance, we want to develop a new concept of a mobile phone. How small it can be? We can start thinking about usual length of the mobile phone – around 10 cm. So shall it be 6 cm? Too little! Imagine that the phone’s length should be 1 cm, or, better, 1 mm. It is clear that a concept of the mobile phone should become totally different. Or we want to have a screen on a mobile phone which completely fills our field of sight. It is also clear that we should think about totally different screen: probably, a projected screen, or screen mounted in glasses, etc. By pushing existing limits far beyond we increase our chances to come up with radically new solutions.

5. Non-linear Thinking vs. *Linear Thinking*

It is known that about 80-90% of long-term forecasts made by even very renowned futurists appear to be wrong. A common mistake which is often made is focusing on extrapolating existing trends without recognition of radical changes which are not possible to predict. The same with problem solving: staying within a frame of known concepts and relationships it is not possible to recognize non-linear connections. Non-linear thinking also helps to bring together things that are not related today but can be linked in the future and produce a great impact on technology and society, such as was, for instance, development of a personal computer.

6. Diversity Thinking vs. *Uniformity Thinking*

Breakthrough innovations are almost always based on outside knowledge. Thus it was not surprising that I noticed that one common thing among great inventors and thinkers I was lucky to meet has been their "hunger for knowledge". And what is important, all these people do not limit themselves to a single specific area of interest: as a rule, they consume a lot of information from totally different areas. A library of Voltaire who lived in the 18th century counted 6.814 books, more than 2.000 of which had his handwritten remarks. A library of Thomas Edison consisted of 10.000 books. A friend of mine, who invented a disruptive technology for chemical industry, has also a library of 10.000 of scientific and technical books, and he read most of them. Diversity helps to both see solutions in other areas and create unique experience which helps to recognize patterns between seemingly totally unrelated things.

7. Structured Thinking vs. *Random Thinking*

We often think that to solve a "big" problem in a creative way we must "unlearn and unstructure" as much is possible. True, because it helps us to fight mental inertia. But as noted by G. Altshuller, unlearning and unstructuring work well when we solve problems of low degree of difficulty that do not require numerous trials to find a solution. Once in a lifetime we can be lucky. But when we constantly facing problems of high degree of complexity, we must structure the problem solving process. We must have a roadmap how to navigate from a problem to its solution, reuse previous experience, and patterns of strong solutions. Does it kill creativity? Not at all. In ancient Rome, the mathematical operation of division was considered to be an art and was based on heuristic rules. Today this operation is fully automated and nobody seem to suffer from that. Bringing structure to support creative processes does not mean replacing creativity with formal procedures: creative imagination remains of great importance to find a final solution. But we can drastically save time and efforts by structuring the process and thus avoiding unnecessary errors which often cost billions of euros and dozens of years. Most important is that a structured and well-defined process is repetitive.

8. Ideality Thinking vs. *Consumption Thinking*

Once I was involved to helping a customer who had a problem with a robot which was not properly adapted to do a job, and as a result there was persistent loss of a product. The customer contacted the robot's manufacturer who proposed to upgrade the robot within several months by adding new electronics and precision mechanics, but such solution would cost the customer around Euro 500k. A bit too expensive, but there seemed to be little choice. However by formulating an "Ideal Final Result" concept we were able to solve the problem within one hour and our solution was implemented next day: we only used resources which were available directly in the customer's manufacturing process. Result: no product loss any more. Ideality is an extremely powerful concept which forces us to recognize already available resources to achieve what we want. Such resources are everywhere – and smart thinkers might achieve extraordinary results by recognizing and using them.

9. "Ultimate Goal" Thinking vs. *Shallow Thinking*

Goals are everything. Goals predetermine our results, our intentions, and our strategies. If we set up a wrong goal, we are going to fail; if we set up a weak goal, we will get weak results. I remember that several years ago I read a cover article in Time magazine, where the author was exploring a progress in cancer research. His conclusion was that most of research in the US was focusing on decreasing tumor sizes rather than on completely eradicating the tumors… But does reducing the tumors mean their elimination? Not necessary at all. In TRIZ, G. Altshuller introduced a concept of an "Ultimate Goal": let us set up goals which do not seem to be achievable today: for instance to reach the stars, to eliminate hunger,.. Probably, we will not achieve them even during our lifetime, but the progress made would be considerably greater than defining weak goals in the very beginning.

10. Evolutionary Thinking vs. *Trials and Errors Thinking*

Before TRIZ, the vast majority of innovations were made by trials and errors. TRIZ uncovered laws and trends of men-made systems evolution, and knowledge of these trends is essential to define what to create next without blind guesses. For instance, we know that a specific system in the beginning of its evolution might tend to increase the degree of dynamics by breaking to parts and introducing flexible links between the parts; but when the system moves over a certain point of its evolution, a number of parts and the overall degree of the system's dynamics tends to decrease.

11. Long-term Thinking vs. *Short-term Thinking*

Quick fixes or investments to the future? Ok, in some cases quick fixes are necessary and justifiable, but when our thinking is only limited to quick fixes we might be drowned in them. One day it might become clear that quick fixes do not work any longer but we do not have neither enough time nor physical resources to avoid a disaster. Thus quick fixes might be ok only if they are balanced by proper investments to long-term goals.

12. Wild Thinking vs. *Down to Earth Thinking*

This is where a role of creative imagination becomes crucial. In his book "The Psychology of Creativity" published in 1896, French psychologist Theodule Ribot mentioned that we reach a peak of our creative imagination in the age of 12-14, and then it gradually drops. When we are young, we play games in which we invent new fantastic characters, explore space, etc. and thus we boost and develop our creative imagination skills: in these games, no one demands us to stay within the borders of "reason". Thus we push borders and relax our mental constraints. When we grow older, we sink in the world of reason and even might be punished for "crazy" thinking. But there is no other way: moving "out of the box" demands crushing mental barriers. Luckily, creative imagination is not magic; everyone possesses it and can further develop it.

And finally - I strongly believe that most important contribution of G. Altshuller and TRIZ was not a toolbox introduced to support creative phases of innovation, but that it was revealed how "power" thinking can be learned and developed.