

TRIZ and Creativity

TRIZ, the Theory of Inventive Problem Solving, has emerged from the work of Genrich Altshuller, who first worked as a Patent Officer in Moscow. Altshuller, reflecting the more common Russian/Soviet approach to science, was interested in developing a theory of inventiveness. By searching through patents he was able to determine the theoretical patterns that inventive solutions contained and build a comprehensive approach for others to follow. If they understood the theory.

TRIZ begins with a request for a statement about the Primary Functionality of the thing you wish to invent.

E.g. you may begin with the statement: I wish to invent a lightweight device for transporting me short distances – emerging from this may be a skateboard or a bicycle!

TRIZ would then seek to explore many *secondary functions* of the device, like being illuminated and carrying objects.

The TRIZ process invites exploration along several avenues, one of which is the invitation to look at all the *resources* available. Anything can be a resource as long as it is possible for the thing to have some potential way of changing the device and its functionality. So for the bicycle, the air and the ground and the person are resources, but so is the sun and the rain or even other cars!

Using the TRIZ process in a formal way the user would be encouraged to explore in a systematic way, a way which reflects how other devices have been invented and solutions found. For example, it is clear in TRIZ that devices tend to evolve in predictable ways. Solid devices turn to use of liquids then gases and finally fields of electromagnetism. Solid devices get segmented, have voids put in them, and go from uniform shapes to complex forms.

Occasionally, if the way ahead is not clear, the problem owner would be asked to *exaggerate* the wish – drive the imaginative process by exploring how to do something 1000 times faster or smaller.

In TRIZ one exploration of solutions invites the inventor to look at Contradictions in the system. Often *people know how* to do something but the *more they do it that way* the more *a negative effect builds up* or the *positive effect begins to diminish*. So the problem owner is asked to capture these contradictions. If they are not sure what the contradictions are then again the inventor is asked to *exaggerate* them. They usually stand out clearly. If you wonder what would happen if your engine ran 10% faster you might say “not sure”. If I asked you to imagine it goes 10,000 times faster you would have images of all kinds of events, most not happy ones. This gives you the list of contradictions to solve!

Again, TRIZ offers a structured approach in that the inventor is asked to state contradictions from one of 39 options. These options are part of a Table of Contradictions developed by TRIZ theorists. A typical contradiction would be, for example, Speed versus reliability. By looking at the table the inventor can see that where this contradiction has occurred in other inventions it has been solved using one of 40 Principles. The TRIZ 40 Principles for solving Contradictions are a formal part of the TRIZ process. TRIZ has other standard process, such as 76 Standard Solutions to which the inventor can simply refer to see if it offers a way forward.

“Excursions” drive the creative process – using metaphor and analogy to rethink what a solution might be like. TRIZ uses the concept of Ideal System or device (or Ideal Final Result – IFR), where all the functionality exists but without the device!

TRIZ would then invite you to look at the core physical issues and be inventive. It is important to be very playful at this stage as the only risk is in the idea. If you miss something at this stage you will end up with a hard business cost. Altshuller, in his book “The Innovation Algorithm” suggests reading science fiction books!

It is to be expected that TRIZ, which has solutions bounded by the laws of physics should have a structured approach as the invention process develops. (though we need to be very very careful that the boundaries are real and not imagined or simply lacking in ways around the problem).

It is interesting to note that TRIZ experts are now exploring how TRIZ can be used on more open problems, like Management Systems or Marketing or simply behavioural psychology. Taking the 40 Principles it is possible to tweak them slightly so that they have a more generic application.

For example, the Feature “Weight of Moving Object” could be interpreted as “Weight of Psychological Barrier”. If this has a contradiction to speed of action, which seems likely in both cases, then the TRIZ Principles numbered 2, 13, 28 and 38 can be applied.

Number 2 is the Principle of “Extraction”. For a heavy object this means you move only the part you need to move, for a psychological barrier this would suggest finding ways of getting fast change without moving the barrier.

Number 13 is “Inversion”. Implement the opposite action. For a heavy object it is the “take Mohammed to the Mountain” as you can’t “take the mountain to Mohammed.” You might similarly increase the psychological barrier until it breaks under its own weight!

You might like to try the same for Number 28, replacement of a mechanical system, with an acoustic/gaseous system (you are invited to be creative here) or Number 38 Use Strong Oxidizers (hint – think not about oxygen but the strength of a catalytic action – can you insert a catalyst for change to shift the barrier?)

Many of the Trends in TRIZ also offer ideas for developing solutions in non-technological fields. The technological trend to move from solid devices to fields and forces is similar to the shift from solid companies to virtual companies – companies which exist in their virtual collaboration rather than hard-wired contracts.

Similarly the trend from uniform action to complex action reflects how companies are fine tuning and making variable their responses to rapid change.

Creativity versus Science?

One of the common comments from engineers and scientists when trying to explain the TRIZ process is that you cannot be creative with the laws of physics. They exist and that is that. They like the formalisation of solutions that TRIZ offers but are uncertain when you try to suggest that TRIZ can be creative in use.

TRIZ is used to overcome psychological blocks. The framing of a problem may be limited by these blocks or may simply be wrong! The use of analogy and metaphor is a powerful way of reconceptualising a situation and seeing it differently.

It is useful to see the inventive process as an approach which explores the interaction between the machinery of the thinking process and the machinery of the laws of physics. We learn about the physical world through our senses and our brains build up a picture of how things work. This picture is enhanced by education but that enhancement may in itself be faulty. The presentation of our world via education is often created for efficiency and speed rather than accuracy. And the presentation of the physical world is also often a creation based on the history of science than current more accurate models. As children get older the models of science work through, stage by stage, the development of science through the ages. In doing so we find children get disillusioned as they are told again and again to forget what they have learnt before as this new way of thinking is superior.

Teachers may feel that children will like being told that now they are more grown up they can learn something better. In reality, the child is probably wondering how many more lies will be told before the truth is out!

TRIZ offers ways of presenting discovery of the laws of the physical world through creative thinking and experiment. Children could see their knowledge building up through their own thoughtful inquiries. We could give them a set of processes to do this. They would then be inventors all their lives, not only for the physical world but also in all other aspects of their life.

TRIZ and Synectics – a comparison

| Synectics | TRIZ |
|-------------------|-----------------------------|
| Headline | Primary Functionality |
| Ideal Wish | Ideal final result |
| Additional wishes | Secondary functionality map |

| | |
|-----------------------------------|---|
| Explore How to... many times | Look at all Resources, Trends |
| Value positives and state needs | Find contradictions |
| Exaggerate needs/conditions | Exaggerate conditions/requirements |
| Use metaphor/analogy | Use 40 Principles or 76 Standard solutions |
| Be playful and loop around freely | Use process iteratively, read around subject area |