Available online at www.sciencedirect.com

ScienceDirect

Procedia CIRP 39 (2016) 191 – 196

www.elsevier.com/locate/procedia

TFC 2015 – TRIZ FUTURE 2015

# Creativity, Learning Techniques and TRIZ

Tiziana Bertoncelli*, Oliver Mayer, Mark Lynass

*GE Global Research, Fresinger Landstrasse 50, 85748 Garching bei München, Germany*

* Corresponding author. Tel.: +49-(0)89-55283-443; fax: +49-(0)89-55283-180. *E-mail address:* tiziana.bertoncelli@ge.com

**Abstract**

Creativity and innovation are acquiring a foremost importance in the scientific and engineering world. TRIZ offers a systematic approach for problem solving, still it requires creativity abilities when translating the recommendations offered by inventive principles and standard inventive solutions into the specific domain of the problem. Goal of this paper is to show that creativity can be enhanced if the learning process is better understood and how strongly learning and creativity training are linked. The technologist who wants to be a lifelong learner and a creative professional inventor can profit from different techniques that cognitive psychology proved to be effective for learning, like metaphor, story and visualization, focused and diffuse modes of thinking, interleaving and how to overcome Einstellung. Their commonalities and relationships with problem solving approaches will be explained. Different learning techniques can be mapped to already well known TRIZ tools, giving them a neuroscientific foundation. Often TRIZ practitioners in a corporate environment are called to facilitate TRIZ sessions with very little time allocated. Being effective in a short time is crucial to enhance trust and leverage application. Several sessions at GE Global Research Munich offered a chance to compare different approaches and observe how to boost the idea sparking process, even in situations where the facilitator is not a subject matter expert or the inventive team has little or no background in TRIZ.

Peer-review under responsibility of Scientific committee of Triz Future Conference
*Keywords:* TRIZ, Creativity, Learning, Brainstorming

## 1. Creativity, Learning and Problem Solving

Creativity and innovation are words that have been acquiring a foremost importance in the scientific and engineering world. How to be creative? Or rather: how to learn to be creative? The historical account of the genius working alone at his new concept is a belief that fascinated people and spread the understanding that either you are creative by birth, or no way to be blessed by such an exceptional talent. But creativity can be learnt and trained [1] [2]. The recent field of creativity research [3], linked to neuroscience studies, refuses this model so rooted in the western culture and aims to find a scientific explanation of the inventive process to reproduce it when needed so that anybody could improve the own ability to generate innovative solutions. It is widely recognized that creativity is no longer an individual spark and that its driving power is outgrowing the area of art and entertainment and gaining stronger and stronger relevance in the business environment. New technologies like internet are shaping it anew: inventors work in geographically distributed large groups, especially in the scientific community. This makes the sociocultural aspect more and more relevant, and makes creativity an interdisciplinary subject requiring multiple levels of analysis [3]. New technology nowadays is brought forward in big complex organizations, and social networks are giving it a more collective dimension [4-5].

Consistently, there are a lot of techniques and problem solving methods taught both in major universities and companies aimed to foster idea generation and enhance creativity; their goal is to bring people out of the usual well know working pattern when asked to resolve a specific task to create something new. Creativity was recognized as a discipline that could be taught and learnt by cognitive psychologists in the fifties. Not much later, in the seventies, corporate creativity consulting started along with a number of training programs. TRIZ, one of them, offers a systematic approach for problem solving, thus still requires creativity abilities when translating the recommendations offered by the


Peer-review under responsibility of Scientific committee of Triz Future Conference
doi:10.1016/j.procir.2016.01.187

inventive principles and the standard inventive solutions into the specific domain of the problem. Goal of this paper is to show that the ability of solving technical problems can be enhanced if the learning process is better understood and to highlight how strongly learning and creativity training are linked. If we recognize how our brain behaves when we are trying to study new things and develop new concepts, we can achieve a better awareness of how we learnt when we were students, how we can flex our learning style in our career when needed and eventually profit from this knowledge when facing problems requiring creativity by means of applying learning techniques to creativity sessions. If we learn again how to learn, we become more creative at the same time.

In [1] it is stated that learning is a creative activity, with strong connection between artistic and scientific innovation processes. If we reverse it and see innovation and research as learning processes per se, we can look at different techniques that cognitive psychology proved to be effective for learning from the point of view of the technologist who wants to be a lifelong learner and a creative professional inventor. In this context, the most relevant learning topics are: the so-called Einstellung, linked to Psychological inertia in TRIZ at first by Belsky [6]; metaphor, story and visualization, interleaving and focused and diffuse modes of thinking. They are very powerful mechanisms, and being familiar with them can help overcoming psychological inertia. Commonalities and relationships of these concepts with problem solving approaches will be explained. The different learning techniques can be mapped to already well known TRIZ tools giving them in this way a neuroscientific foundation. On the other hand the TRIZ practitioner can profit a lot from the research about learning, both recognizing known techniques with a better neuroscience-based understanding of the different tools and new suggestions on how to use TRIZ in a more productive way. Often TRIZ trained people working in a corporate environment are called by colleagues to offer TRIZ facilitating session for which a very small amount of time is allocated. Being effective in a short time in this context is crucial to prove TRIZ skeptics that the method works and can be very helpful to enhance trust in the methodology and leverage application. Different TRIZ session held at GE Global Research Munich offered a chance to compare the effectiveness of different approaches, observing how applying already small changes and tips can boost the idea triggering process, even in situations where the facilitator is not a subject matter expert or the inventive team has little or no background in TRIZ.

In the next paragraphs learning tools extensively described in [1][2] will be mapped to well-known TRIZ tools and concepts, whose neuro-scientific aspects will be deepened. Subsequently it will be shown how these tips can be incorporated during the practice of TRIZ according to the experience at GE Global Research Munich.

## 2. Einstellung and creativity- Engineers and chess players

Einstellung is German word with a lot of nuances in meaning: the more relevant to the topic are „stopping“, „stance“, „mental attitude“. In Neurosciences it is the name of the phenomenon that occurs to people where special and very strong memory structures and neural patterns have been formed over the years, often consolidated by decades of experience, allowing rapid search in the long-term memory for information and actions [7-8]. The same happens in learning, when consolidation of a concept impairs refinement and further learning. It often happens to very experienced professionals, talented people with an impressive working memory and most often to very knowledgeable engineers. When creativity is needed, this most valuable expertise can be actually counterproductive and constitutes a barrier which keeps such people into their well-established working routines and comfort zones. As a result, a new more creative idea has little chance to blossom or can be even rejected. This phenomenon is very well known in the theories of problem solving as the biggest obstacle to innovation and in the TRIZ theory is referred to as „psychological inertia“. Experiments on chess players [9] show that a pattern of thought, once triggered, can prevent other ideas to be activated and pursued: attention is directed towards sources of information confirming these first concepts and alternatives are ignored. This often causes many cognitive biases, mostly relevant in the fields of problem solving and reasoning, perceptual errors and memory failures. This occurs in everyday thought and in problem solving session; failures due to Einstellung can be seen as the side effect of extensive consolidated knowledge and efficient cognitive abilities relying on experience. Experts can provide solutions quickly, providing a big advantage, nevertheless they are often restricted to the domain-specific knowledge and hardly ever entirely novel.

How to overcome Einstellung and cross the fence towards new more creative fields? Problem solving tools give you a lot of tips, patterns or solution models, and they are the primary tools to overcome Einstellung by definition. But also learning sciences can help with some advice. The first is working in groups, now the habit in big corporations. Both during the problem formulation stage (which more often than not is a learning step), and the solving process it is ideal to sit together with other people, learning from the explaining point of view and different focuses: all the questions will be a great chance to trigger new points of view. This was already stated as the goal of brainstorming in the early days of innovation methods. Multicultural groups enhance the diversity of possible interpretation since everyone brings in the own learning history and different backgrounds; connect to work together and welcoming all the nuances everybody can bring in are the best ways to overcome the Einstellung. Major companies are engaged in forming and maintaining a very diverse and multicultural work force precisely because in this way teams can be much more creative and productive (and make a much more fun workplace). A very effective way is trying to transfer of ideas and concepts from one area to another: people from different background may have seen solutions to an analogous problem in another field.

This holds also for TRIZ tools like Function Oriented Search & Physical System Integration, Feature Transfer: their application could be enhanced when in the team there are mixed domains of expertise. In Feature Transfer once the functions have been identified, finding the alternative system can be quicker, since function oriented search is based on generalized functions that allow to searching for solutions of the same generalized problems. Other tips form the learning sciences [1] include exercises that help defocusing from the specific problem, like blinking, not consciously working on the problem in timely manner and all the activities that help alternate focused and diffused thinking, as more deeply explained in paragraph 4.

## 3. Metaphor, story and visualization – Be an Author

Metaphor, story and visualization are excellent memory techniques: when trying to memorize something, building up a metaphor, or an entire process as a fiction story, can help anchoring the concepts in the memory in a much stronger way, as well as visualizing a physical entity by analogy to a more familiar or better known one can help understanding its physical model. Also visualizing a process plotting a story for it, makes it easier for the brain (a very strong visualizer) to recall it connecting the different phases with the characters [1]. This has proven to be so helpful in creative process, that there is already consolidated research on this topic. A famous approach is Synectics, a problem solving method whereby brainstorming is led through metaphors and analogies where the creative person is the object of the ongoing process. To overcome the difficulties that can arise from exaggerate identification, in the frame of the TRIZ Theory there is the technique called "small smart people" [10]; this approach turns the problem solver into an author, who rethinks the problem where objects and field consist actually of a large bunch of miniature smart people capable of anything, i.e. thinking and working so that they give your problem life and intelligence.

Visualization, metaphor and analogy are also the basis of one of the most powerful TRIZ tool, Substance- Field Models combined with the search for alternate fields (MaThChEM) to perform the identified functions. Su-Field modeling gives an immediate and intuitive visualization of the problem which simplifies also its comprehension during TRIZ sessions, as explained more extensively in paragraph 5. This leverages its effectiveness, since TRIZ users are in this way quickly brought to think in an abstract way: the search for alternate solutions is guided by analogy.

Does it work? A paper by Gick and Holyoak [11] shows how analogy pervades thought and knowledge of solutions for prior stories helps by problem solving of relevant analogs, with also examples of learning. Biological-inspired design is also very well known. In Engineering Design and Artificial Intelligence domain of research analogy is seen a key point of innovation and creativity and is a basis for modeling design processing. Analogical design is defined as the process of transferring elements of the solution of one design problem to the solution for a second design problem. Goel [12] has introduced a method to define a measure for design by analogy. Design by Analogy is what in TRIZ theory is known as Feature Transfer. So the same intuition is declined into similar concepts across apparently different disciplines and all those approaches confirm that both while learning and designing we can profit from analogical thinking and its most creative applications, like metaphor, story and visualization.

## 4. Focused and diffuse modes of thinking and Interleaving

Taking advantage of focused and diffuse modes of thinking is the least practiced way to attack problems in the working time and its powerful effect is not yet consciously taken advantage of. Focused and diffuse mode understanding suggests that taking brakes, exercising, allowing rest pauses, not only does not damage learning and doing creative work, but can strongly help to improve those processes.

From neuroscience perspective, focused and diffuse modes identify two different and mutually exclusive ways in which the brain processes information: during focused mode the learner or inventor or problem solver is consciously learning and using his working memory to store and retrieve information; a powerful process activated when deep concentration on a very specific activity is involved, which inhibits access to more remote regions of the brain. MRI shows how the brain area involved, the default mode network, is well defined in the prefrontal cortex and highly active. The diffuse mode occurs when the person is not concentrated and involves the global brain network and results difficult to be localized anatomically. This mode allows a big picture way to approach a problem in a defocused and attention-relaxed state and also permits to connect concepts apparently far apart, not accessible in the focused mode [1]. Those brain modes are equally important in the learning process, especially for new and complex concepts, since shifting between them allows the brain to grow and consolidate the neural patterns needed to build up the newly born knowledge. In our context it means that the mental structure where the new knowledge is consolidated is built better if both modes are allowed alternatively and the necessary time is allocated for the neural structures to form. This distinction is already to be recognized in the vertical and lateral thinking concepts formulated by De Bono in the 70s [1] and given a biological foundation in recent studies, where the dual process theory [13] refers to them also as associative and analytic. In the same paper by Gabora and Ranjan [13] it is explained in detail how memory is encoded and how it relates to new idea generation. When in diffuse mode, the set of potential associations is larger while the brain processes the big picture since at neuronal level more structures responsible of memory called microfeatures are activated. Memory is encoded in a distributed manner across groups of neurons and in such a way to enable crosstalk, so multiple representations merge together and associations beyond already known concepts are allowed. In other words, a more associative or divergent form of thought can be activated when in need of a creative association. In corporate environments, where being "creative on demand" is often requested, this can be influenced with a proper time management of sessions.

In [14] analyzed brain functional connectivity at rest has been studied and it is shown how it enhances the connection between the main nodes for focused mode. This demonstrates that the „resting mode" is needed to allow building up those connections that in turn strengthen the next focused mode session. The parallel with innovation and creativity is given by the same paper: a creativity test for divergent thinking was used and functional connectivity at rest strongly and positively correlates with it. So for both learning and problem solving, interleaving of focused and diffuse mode phases is very helpful and necessary, and during breaks the brain unconsciously works to make your knowledge and creative process stronger and more effective. From the practical point of view, it underlines the importance of rest, breaks, interleaving activities and gives a scientific foundation to insights happening outside of the working routine when attention is defocused. Indeed, awareness of focused and diffused modes of thinking can help manage a better learning and creative work routine and allows a more efficient practice for innovation professionals while designing creative sessions: these concepts were tested on one specific TRIZ project described as Case 4 in the next paragraph.

## 5. Examples of TRIZ sessions at GE Global Research Munich

At GE Global Research Munich there is a team of trained TRIZ experts. Team members are often called to facilitate short brainstorming meetings also for projects out the specific technical domain of expertise with the specific goal to find novel solutions. The correct and effective design of TRIZ session, especially with tight time constraints, is crucial for success and also for TRIZ acceptance throughout the organization. Thus different cases are analyzed where several TRIZ tools were applied so that observations could be inferred.

Five cases involving different inventive teams are reported in Table 1, for which the request for a TRIZ session came directly from different project leaders, whose expectations were to find quickly new out of the box ideas for their current projects. The requesters were familiar with TRIZ concepts since most of them took part at TRIZ Level 1 courses delivered at GE Global Research and wished for a more effective time management and tool choice while using TRIZ. TRIZ literacy among the participants was very diverse, facilitators being most of the times MATRIZ Level 3 certified and the others ranging from Level 2 to no knowledge at all. Usually only one session was allocated, from 2 to 4 hours. Different approaches were used, left to the judgment of the TRIZ expert. In all cases the time slot was too short to go through the problem identification stage, so the project content was briefly explained off-line by the project leader to the TRIZ expert in one hour session. Different problem identification tools from the TRIZ knowledge base where used, chosen on the basis of this preliminary information and the TRIZ practitioner's individual experience So in most of the cases the inventive team could skip the problem identification stage, receiving the analysis as a result of a pre-work in form of PowerPoint presentation. In Case 1 the project leader wanted to review the analysis with the team shifting the focus on Function Analysis for Processes and this left too little time for the problem solving phase. In Case 2 and 4 standard Inventive Solutions were given to the team in form of graphics of solution models so that each member, regardless of the TRIZ background, could immediately take advantage of the tools. In Case 4 project-related examples of contradictions and the related recommended Inventive Principles were given for the same reason. The assignments or problems to solve were in each case very different: i.e. in Case 1 the assignment required to rethink the overall architecture of a system, Case 3 was a strategy planning task. In all other cases focus was on specific products or parts of solutions from multiple GE's businesses.

Looking at Table 1 we can see that seldom project leaders are ready to invest longer than a half a day for TRIZ sessions for already running projects. In these situations, involving an entire team in developing Functional Analysis from scratch is a rather time consuming choice. In fact, observing Case 1 in Table 1, we can see that the problem identification stage has impaired the allocated time for the inventive stage, resulting in a rather low number of proposed solutions. The comparison with Case 4, for which the same amount of time was allocated, is striking, with more than three times generated concepts. The major differences were in the meeting agenda: in Case 4 the pre-work allowed all the participants to start almost immediately with the idea generation process, and the four hours were split into two sessions. TRIZ fundamentals were explained with analogies and examples form the projects itself, making the session also a hands-on training chance. This aspect proved to be really powerful from the educational point of view: examples directly derived from the domain of expertise conveyed a sense of confidence on the methodology which, was perceived as more problem-focused and effective. In Cases 2 to 5 the meeting started with a short pre-session called "Idea Parking Lot", during which the team members were asked to list upfront the first ideas spontaneously coming to their minds: those ideas were in this way documented before starting the actual TRIZ activity. The intention and the effects were twofold: at first documenting the ideas gave the team a sense of confidence that the domain expertise was captured and safe, relieving in this way the psychological inertia; on the other hand this exercise forced the people to activate quickly an intense focused mode, to be relaxed during the following TRIZ session, allowing a more relaxed mental state where the diffuse mode could emerge. Those sessions also proved to be the most fruitful.

Table 1.TRIZ session features for five different projects.

| Project | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
|---|---|---|---|---|---|
| Prework | yes | yes | yes | yes | yes |
| Prework hours | 2 | 1 | 2 | 2 | 1 |
| TRIZ Prework Tools | FA Product, FA Process, SuF | SuF | MultiS, EC | Table 2 | FA Product, SuF, EC |
| Sessions | 1 | 1 | 1 | 2 | 1 |
| S1 Hours | 4 | 3 | 2+2 | 2 | 1 |
| S2 Hours | - | - | - | 2 | - |
| Tools | FA Process, Trim, EC, PC | SuF | MultiS | Table 2 | SuF |
| TRIZ Intro? | Yes, FA Process w/ team | Yes, Infographics | MultiS Template | Table 2 | Yes, Infographics |
| IPL* | No | Yes | Implicit | Yes | Yes |
| Concepts | 11 | 21 | 24 | 68 | 27 |

*IPL: Idea Parking Lot

In Case 4, Su-Field models were received very quickly and prepared the team for the second session, where results from the Functional analysis were shown already in form of Engineering and Physical Contradictions, with immediate access to the Inventive Principles. Familiarity with the problem given by the first session and a day break in between gave time to bring in fresh ideas developed over the pause.

The effectiveness of a pre-work allowing a session in the form of hands-on training proved to be effective also in other sessions, as shown by Case 2, case 3 and Case 5, with a significant number of generated ideas. It proved to be useful also to document the usage of the different TRIZ tools for future session planning, and results are reported in Table 2 and Table 3. The question which TRIZ tool should be used in which situation almost always arises during trainings and sessions and has been addressed in literature by Petrov [15].

Table 2.TRIZ session and generated concepts in detail for Project 2.

| Case 2 | Unique Session |
|---|---|
| Idea Parking Lot | 6 |
| Su-Field 1.2.1 | 2 |
| Su-Field 1.2.4 | 9 |
| Segmentation | 1 |
| Su-Field Class 4&5 | 3 |

This experience confirms that with limited time, Su-Field models are of immediate understanding thanks to visualization and analogy, bringing people very quickly to the idea generation stage. When time allocated by the project leader allows the Functional Analysis, with Engineering and Physical Contradiction already available from the case under study, the identification of new contradictions is far quicker; moreover, the quicker access to the inventive principles selected according to the Altshuller's matrix proves to be most effective approach as far as the number of generated ideas is concerned.

Table 3.TRIZ session and generated concepts in detail for Project 4.

| Case 4 | Session 1 | Session 2 | After |
|---|---|---|---|
| Idea Parking Lot | 8* | - | - |
| Su-Field 1.2.1 | 11 | - | - |
| Su-Field 1.2.4 | 10 | - | - |
| Su-Field 1.1.3 & 1.1.4 | 6 | - | - |
| Contradictions (EC/PC) | - | 27 | - |
| Trimming | - | 2 | - |
| Total concepts/session | 35 | 29 | 4 |

*Recognizable TRIZ Tools during IPL: Trimming, Function Oriented Search

## 6. Conclusions

The human ability of being creative and generate innovative solutions is deeply linked to the memory structure and learning capability. This is confirmed by the continuously growing creativity research field and the emerging interest in learning science.

On the other hand, from the industry point of view, creativity is becoming one the biggest drives in business innovation and different tools and techniques have been widely studied and practiced in the major companies over the last decades. Several Innovation tools developed over the years already map very well on learning techniques, as shown in Table 4.

Table 4.TRIZ & Innovation Tools and Learning Techniques Mapping

| Learning/ Creativity Research | Innovation methods/ TRIZ |
|---|---|
| Einstellung | **Psychological Inertia*** |
| Analogy, Metaphor | Biological-Inspired Design, Design by analogy, Synectics, **Small Smart People, Su-Field** |
| Transfer Idea/Concept from one area to the other | **Feature Transfer**, **Function Oriented Search**, **Physical System Integration** |
| Story, Visualization, Mental Play | Design Thinking, Synectics, **Small Smart People, Su-Field** |

| | |
|---|---|
| Interleaving | Split Multiple Sessions |
| Focus & Diffused Methods of thinking | Split Multiple Sessions |
| Working into Groups | Form Diverse Teams, Brainstorming |

*in bold TRIZ Concepts and Tools

This suggests taking advantage of the outcomes of learning and creativity research to enhance effectiveness of problem solving tools. In addition, from this analysis of TRIZ application in different short brainstorming meetings we can derive some recommendations specific for short sessions, based on the experience where half a day or less was allocated to solve a given problem:

- Skip the problem identification stage with the team and prepare it as a pre-work with crisp infographics with project related examples, so that by metaphor and analogy the team members without TRIZ literacy can use the TRIZ tools immediately
- Organize a pre-session during which the team can have a first glance at the pre-work analysis and familiarize with the method; plan the inventive session for a following day, activating in this a way a preliminary interleaving of focused/ diffuse modes of thinking
- For very short meetings the Su-Field Model proved to be the most effective approach because of a smoother learning curve due to the immediate visualization and analogy mechanisms, while contradictions have proven to be the most powerful idea generation tools in terms of number of generated concepts
- Use the idea parking lot as brain cleaning exercise and first brainstorming phase, to force a first stage in focused mode and then allow a more relaxed creative mental state, without sense of loss of the technology knowledge base and experience
- Split the allocated time into multiple shorter sessions a couple of days apart, so that the creative process can take advantage of the brain default mode during breaks
- Gather Experts of different backgrounds in order to have a diverse and more creative team, to allow for analogies and metaphor thinking

**Acknowledgements**

The authors would like to acknowledge the contribution of colleagues involved in the TRIZ sessions for valuable discussions and feedback.  A special thank you to Dr. B. Oakley and the MOOC “Learning How To Learn” participants for inspiration and encouragement.

**References**

[1] Oakley, B.; A Mind for Numbers, How to Excel at Math and Science, Penguin Group, 2014
[2] Learning How To Learn, Coursera MOOC, Course Material
[3] Keith Sawyer, R.; Explaining Creativity, the Science of Human Innovation, Oxford University Press, 2012
[4] Lopez Flores, Negny, Belaud, Le Lann.; Collective Intelligence to solve creative problems in conceptual design phase. In A. Aoussat, D. Cavallucci, M. Trela & J. Duflou (Eds.), Proceedings of TRIZ Future Conference 2013 (pp. 223-232). Paris, France: Arts Et Metiers ParisTech.
[5] Brewer, Domb, Miller, Mann; Crowdsourced and crowdfunded business models viewed as completed (technical) systems. Proceedings of TRIZ Future Conference 2013 (pp. 529-538). Paris, France, 29-31 October 2013
[6] Belski, Belski; Application of TRIZ in Improving the Creativity of Engineering Experts. Proceedings of TRIZ Future Conference 2013 (pp. 67-72). Paris, France, 29-31 October 2013
[7] http://www.triz-journal.com/psychological-inertia/
[8] http://www.triz-journal.com/digging-way-psychological-inertia-hole/
[9] Bilalic, McLeod, Gobet; The Mechanism of the Einstellung (Set) Effect: A Pervasive Source of Cognitive Bias, Current Directions in Psychological Science, 19(2), 111-115
[10] http://www.ideationtriz.com/TRIZ_tutorial_6.htm
[11] Gyck, Holyoak; Schema Induction and Analogical Transfer, Cognitive Psychology 15, 1-38 (1983)
[12] Goel, A.K.;, Design, Analogy and Creativity, IEEE Expert, Vol. 12, Issue 3
[13]Gabora, Ranjan; How insight emerges in a distributed, content-addressable memory. In A. Bristol, O. Vartanian, & J. Kaufman (Eds.) The Neuroscience of Creativity. New York: Oxford University Press
[14]Takeuchi, Taki, Hashizume, Sassa, nagase, Nouchi, Kawashima; The association between resting functional connectivity and creativity. Cereb Cortex. 2012 Dec;22(12):2921-9. doi: 10.1093/cercor/bhr371. Epub 2012 Jan 10- http://www.ncbi.nlm.nih.gov/pubmed/22235031
[15] Petrov,V; Algorithm for Selecting TRIZ tools. “TRIZfest-2014: Theories and Applications”, The 10th MATRIZ Conference Proceedings, pagg. 26-34