Integration of Method of Systemic Constellations into Moderated Educational and Problem Solving Workshops with TRIZ for Technical and Non-Technical Tasks

Pavel Livotov
European TRIZ Association, ETRIA e.V. Hanover, Germany

Abstract

This paper is introducing a new approach for system and contradiction analysis while moderating educational or problem solving workshops using TRIZ methodology. The technique is based on the method of Systemic Constellations and addressing the needs of TRIZ moderators, regarding identification and in-depth analysis of concealed contradictions both in technical systems and organisations.

Keywords

TRIZ Workshop, Systemic Constellations, Problem Analysis, Contradiction Identification, Idea Evaluation

1 INTRODUCTION

As well known, the description of initial problem situation with TRIZ includes system analysis with definition of positive and negative functions and properties of significant system components, continued by contradiction analysis. Contradiction analysis results in the identification of positive and negative interactions between system components and environment. An experienced moderator has to describe and classify both the explicit information about a system from the workshop team as well as to help the workshop participants to recognise implicit, hidden interactions within a system. This task includes a choice of the core contradiction(s) and may face serious difficulties within a team. In addition to characteristic psychological inertia and typical wish of workshop participants to skip system analysis for idea generation, teams are often unable to find a consensus in understanding of origins of contradictions and key processes within a system. This fact often results in decrease of motivation in further idea generation phase or in a “solving a wrong problem” phenomenon.

In such situations a psychological approach of systemic constellations can be very helpful. This method was originally proposed by German psychologist Bert Hellinger for finding solutions in family, organisational or cultural systems under difficult systemic conditions. Constellation work in TRIZ workshops can be introduced as an additional technique for in-depth identification of contradictions as well as method for enhancing creative inspiration in the ideation phase.

2 METHODICAL APPROACH

2.1 Method of Systemic Constellations

Systemic Constellations are an approach to resolving personal, professional and organisational issues, offering a way of mapping a present reality, working at the source of the hidden dynamics and moving to resolution.

The understanding of systems and systemic thinking is not new. After all it was Aristotle who said “The whole is greater than the sum of its parts”. But looking at the whole system can simply create a bigger and more complex picture. The words “system” comes from the Greek and literally means “stand together”. The word “constellation” comes from the Latin and means “a collection of objects which together form a pattern.” It’s from these meanings that this approach derives its name and methodology.

In the typical procedure of Systemic Constellations a group of participants (10-20 persons) is led by a trained facilitator. One participant (issue holder) presents a personal issue or organizational problem. The others either serve as representatives for system’s elements or actively contribute by observing.

In the first step the facilitator asks for information about the issue looking for origin of the problem in the past that may have systemic resonance. Next, the facilitator asks the issue holder to select group members to represent a system parts, moving them into place. Once the representatives are in position, they stand without moving or talking and try to tune into the resonance of the system field.

The facilitator observes and may inquire of each representative, “How are you feeling?” The representatives may be without emotions or they report strong emotions or physical effects. The reports are subjective and contain some aspect of personal projection. However, the intermixing of subjective personal projections with field resonance does not contaminate the process as a whole. The facilitator works slowly with this system pattern helping the hidden systemic dynamic to come into clear view.

So, a systemic constellation is a ‘living map’ made up of people representing the essential elements and influences around a personal or organisational issue. They are placed in relation to each other, standing together, forming a pattern. This pattern is recognisable to the issue holder as an external image of an internal sense of the situation. At the same time this pattern can be interpreted and explored by a trained systemic facilitator to find hidden resources and paths to resolution, postulating that everyone and everything has a ‘right place’ in the family or organisational system.

2.2 Constellation Work in TRIZ Workshops

In a systemic constellations work in a TRIZ workshop moderator may choose representatives out of a group of workshop participants to stand for different system components, substances or fields, positive or negative effects, persons or organisations, and for other aspects that are important in the dynamics of the conflict situation the team is dealing with. Moderator places these representatives somewhere in the room, so that he gets a three-dimensional picture of the constellation of analysed situation. The distances and positions between the representatives and their feelings give important information about present situation, and can offer potential

systemic solutions for future. For example, constellation may bring to light places where important elements or interactions were excluded, and reveal factors empowering or blocking the way towards constructive solutions. In terms of the TRIZ substance-field analysis the systemic constellations method delivers additional informational resources ("informational" field), which can be efficiently utilized at any step of the problem solving process.

2.3 Application for Contradiction Analysis and Idea Evaluation

One of the important TRIZ applications for problem solving and systematic innovation in the industry is the complete search for innovative solutions in technical systems (TS) [4]. This ARIZ-based method, as shown in the Fig. 1, starts with the analysis of initial problem situation and in particular with identification of all conflicting pairs – i.e. potential conflicts between the components of the TS. In the following steps technical contradictions, ideal final result and physical contradictions on the macro and micro level can be formulated for each conflicting pair. Due to this approach a complete search tree with 15…30 technical and physical contradictions could be created and resolved with TRIZ inventive and separation principles that usually results in more than 100 ideas [5], [6].

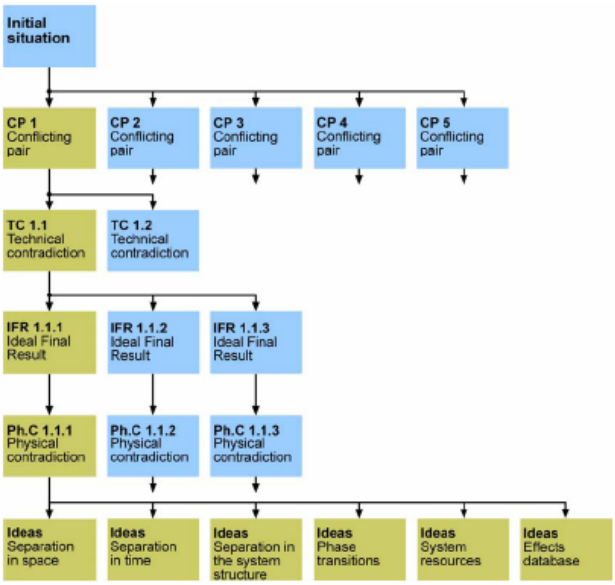

Fig. 1: Search for solutions with inventive algorithm ARIZ.

Systemic Constellation can be applied at following steps of the problem solving process:

a. Analysis of the initial conflict situation and choice of the crucial conflicting pair(s): here the representatives have to stand for different system components.
b. In-depth analysis and refining of formulated technical contradictions: representatives stand for system components which build the conflicting pair as well as for positive and negative interactions within a contradiction.
c. Idea evaluation and choice of the best solution concepts: representatives stand for existing and new system components within a new technical system, where a contradiction or problem seems to be solved.

2.4 Application for Failure Identification

Amongst the most important applications of the method for Anticipatory Failure Identification, AFI for short, are

- The analysis of previous breakdowns which have happened for no apparent reason
- The prediction of hidden sources of potential breakdown scenarios or damage.

The approach of AFI is different to the existing quality control methods such as FMEA, HAZOP and others. Instead of defensively asking "Might this function or part fail?" one asks offensively "What actions will definitely cause a function not to be delivered or a system to fail?" Failures are "produced" this way in a subversive manner. The approach identifies the existing faults and predicts potential system or process failure mechanisms. The AFI-method is "inventive" in all aspects: target; available resources for creating a failure; use of effects (physical and others) for that; recognition of inherent conflicts and finding solutions for them using certain tools.

The application of the AFI method results as a rule in 3…5 different failure scenarios, which should be confirmed or rejected experimentally. Exactly before this time consuming and expensive experimental phase the constellation work can deliver additional information, a "missing link" for decision making and choice of the possible failure roots.

2.5 Solving Non-Technical Problems

The systemic-phenomenological approach delivers often surprising and un-expected insights while analysing and solving non-technical or organisational problems [2], [3]. The rational analysis provides the whole picture of the problem, which often turns out to be too complex for decision making. Systemic constellations can help to simplify and clarify the situation and to make obvious what has to happen next.

Individuals who are not involved in the problem situation are used to represent people or parts of the company and a moderator has to feedback from the representatives to reveal hidden dynamics and point to possible solution path.

3 CASE STUDY

A case study demonstrates application of systemic constellations in a moderated TRIZ problem solving workshop. It describes a problem solving process for a new type of the optical image projection system, using a transparent miniature liquid crystal display (LCD) as an image carrier for projection on the screen.

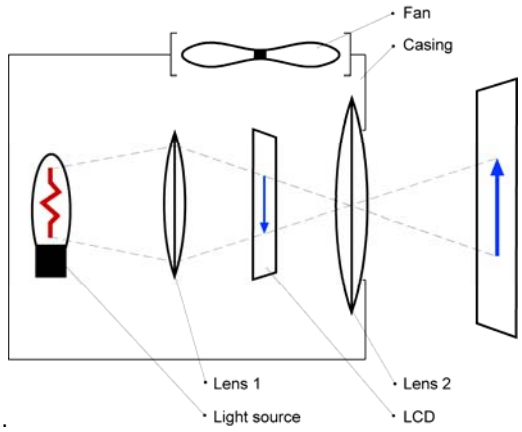

Fig. 2: Case study "Image Projection System"

Problem analysis results in following technical conflicts between system components:

1. Light source - LCD image carrier: The light source illuminates the LCD image carrier but heats up the image carrier, limiting its service life.
2. Optical system - LCD image carrier: The optical system allows the projection of the image on the LCD onto a distant surface, but it stores heat and leads to a build up of heat around the image carrier.
3. Light source – Casing: In compact casings, a build up of heat results from the heat emitted by the light source.
4. Fan - LCD Image carrier: Increasing the performance of the fan also increases the suction of dust particles into the casing, which quickly leads to soiling of the image carrier.

In the systemic constellation of this problem situation six workshop participants were selected to represent different system components: light source, LCD image carrier, optical system (2 persons for lens 1 and 2), fan and casing. They were placed at first in accordance to the simplified technical scheme of projection system (Fig. 3a). A participant, who was standing for LCD image carrier, reported about his feelings: he felt himself uncomfortable staying too close to the lens 2. After the distance between representatives “LCD” and “Lens 2” was enlarged, the LCD-representative notified that “Lens 2” was hindering his direct view toward the light source. After the “Lens 2” was moved by side the “LCD” asked “Light Source” not to look at him directly (Fig. 3b). The final position of the representatives as shown in Fig, 3b underline the unexpected importance of the technical conflict N2. This position was later identified as one of the possible solutions with the light source illuminating the LCD indirectly with the help of the multi-layered mirror, which was able to filter out harmful UV and IR elements within the light spectrum.

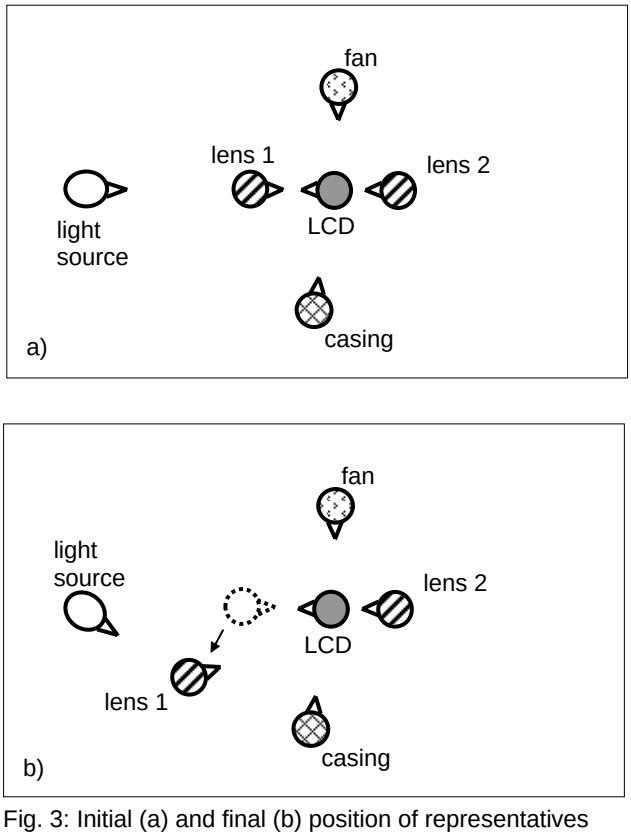

Fig. 3: Initial (a) and final (b) position of representatives

4 SUMMARY

The application of systemic constellations can help to identify system conflicts faster and precisely while solving technical or non-technical problems. The basis for all systemic constellations work whether in technical or non-technical, e.g. organisational context is an empirical (based on observation) and phenomenological (based on direct experience of the current situation).

To the other promising application of systemic constellations in moderating TRIZ workshops belongs anticipatory risk analysis of solutions and innovation concepts. Constellation work helps to identify and transfer unspoken feelings of participants into clear reasons for possible system failures.

Systemic constellations can be also successfully used in the lead user workshops for identification of concealed customer needs and benefits as important information for definition of innovation tasks.

However a careful analysis of further case studies should be performed to explore and evaluate objectively all application possibilities of constellation work for technical problem solving.

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CONTACT

Pavel Livotov, Dr.-Ing.,

TriS Europe GmbH

Eichendorffstr. 9 - 30175 Hannover - Germany

E-mail: p.livotov@tris-europe.com

Phone: +49 (511) 81120040 - FAX: +49 (511) 81120045