A Study on Pointers to Effects for Non-technical Problem Solving

Hongyul Yoon
TRIZ Center, South Korea

Abstract

Most of TRIZ thinking tools can help us to solve non-technical problems. However, the efficiency and effectiveness of TRIZ for solving those problems seem much lower than used for technical problem solving. Absence of pointers to effects for non-technical problem solving should be one of the main causes of that. Non-technical problem solving requires some effects that are different from those based on physical science and engineering technology. In order to develop some pointers to effects for non-technical problem solving, the structures and meaning of 'function model' and 'effect' were discussed. Based on the discussion, some pointers to effects were proposed for non-technical problem solving.

Keywords

TRIZ, Pointers to Effects, Non-Technical Problem, OTSM, Function Model, ENV

1 INTRODUCTION

Recently, not only technical problem solving but also non-technical problem solving has been successfully achieved with the thinking tools of TRIZ. In this paper, 'non-technical problem' means some problems which cannot be solved through application of physical, chemical, geometrical, and biological knowledge or technological knowledge based on physical science. The author has been running some on-site training courses to generate new market ideas or new technology ideas through TRIZ tools based on OTSM[1]. The participants told the thinking ways of TRIZ and OTSM helped themselves to systematize their own thinking processes beyond their expectation. That favorable response seemed to come mainly from the use of abstract problem models and solution idea models of TRIZ and OTSM. OTSM leads us effectively to transform a complex and non-typical problem situation into a set of simple and typical problem models. Almost all of the abstract models for thinking offered by TRIZ and OTSM guide us very well to solve non-technical problems as they do for technical problem solving.

However, the author found the efficiency and effectiveness of TRIZ tools are much lower in non-technical problem solving than in technical problem solving. Some people showed difficulty in coming up with ideas after getting the clear understanding of the solution models offered by TRIZ. Others took more time to get effective ideas compared to those who tried to solve technical problems.

The causes of those points required deeper examination. One of the causes was checked through the following discussion.

Based on OTSM viewpoint, the process of inventive problem solving could boil down to two main stages[2];

(1) problem model transformation from a complex and non-typical situation into a set of simple and typical problem models
(2) application of typical abstract solution models of the human being including those of TRIZ

In technical problem solving, to get solution ideas from typical solution models of TRIZ, we need knowledge of materials, several types of energy, and influences of energy transmission. Even if we get the simple and typical problem and solution models in OTSM viewpoint, we cannot get a solution idea without scientific knowledge related to the model. It could be a good explanation of the fact to examine the application of inventive standards to idea generation for technical problem solving.

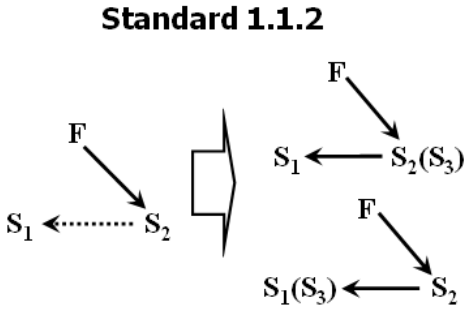

Figure 1: A simple and typical model case

In Figure 1, the solution model recommends us introduction of a new substance into the tool or the object. We can imagine what will happen if a certain additive is introduced 'according to our scientific knowledge'. If someone has no knowledge even a bit on the physical nature of the world, he or she would be hardly able to propose a solution idea with some confidence. As the methodology helping with problem solving, TRIZ offers the way to overcome the shortage of scientific and engineering knowledge. The scientific knowledge itself doesn't belong to the realm of TRIZ. TRIZ gives us the efficient way to adopt the scientific knowledge. The way is called as 'pointers to effects'[3]. An effect is a 'TRIZ-version' equivalent of a certain scientific law, principle, or engineering knowledge.

The pointers to effects help solvers in technical problem field. Even though the solver has little scientific knowledge, the pointers to effects of TRIZ give him or her helpful clues and directions on the required knowledge. The pointers to effects of TRIZ activate the abstract solution models like inventive standards in a solver's mind. Main ideas of pointers to effects often lead solvers more comprehensive understanding of familiar scientific knowledge.

Likewise, those who try to apply TRIZ to non-technical problem solving need some kind of pointers to effects. They might not have enough knowledge required to activate the abstract solution models provided by TRIZ. Sometimes, they depend on very wrong subjective thoughts against objective knowledge to result in some irritating ideas against their wishes. For those reasons, many TRIZ learners for non-technical problem solving have required 'Pointers to Effects' for them. This paper was prepared to fulfil the request.

2 PRAGMATIC REQUIREMENTS OF POINTERS TO EFFECTS IN NONTECHNICAL PROBLEM SOLVING

The pointers to effects in classical TRIZ are formulated as the matching of a certain technical function and some physical, chemical and geometrical effects adopted to deliver the function in which an effect could be translated into a pair of 'input action' and 'output action' (or the resultant change) of an object(a resource)[4][5]. That is depicted as shown in Figure 2.

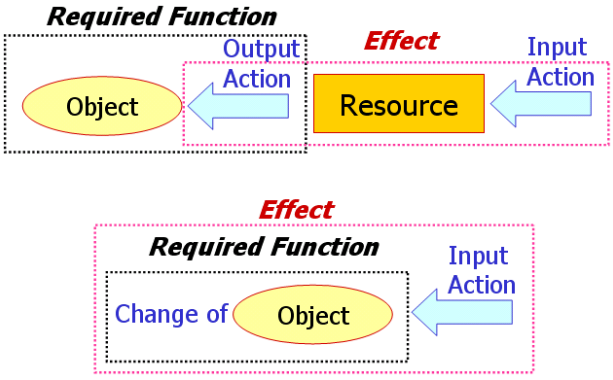

Figure 2: General structure of 'a pointer to effects'

The similar structure could be kept for the pointers to effects for non-technical problem solving.

Before developing those kinds of pointers for non-technical fields, a question seems to lie in front of us;

What are the requirements for the pointers to effects to provide efficient use?

This question looks too big to be answered completely in this first stage paper. The author will try to discuss it in only two aspects.

First, we will examine how to formulate 'function model' for efficient use of the pointers to effects.

Second, we will discuss what kinds of effects are needed for non-technical problem solving.

2.1 'Function model' as a problem model

The pointers to effects are not always helpful to problem solving.

Actually, 'A function' as a problem model must be formulated correctly in order to use the points of effects efficiently. The usefulness of the pointers to effects is from the matching of a function and some effects but depends on the correct formulation of the problem.

Generally, 'a problem' could be defined as 'a situation in which the current state of the target object is different from its' state of what I want'. In this case, 'a solution' is defined as 'how to eliminate the difference between two states of the target object' or 'to change the current state of the target object to the desired state of it'.

The above descriptions can be translated into ENV modelling of OTSM.

'A problem' ; there is a difference between the current value and the required value of a certain property of the target object.

'A solution' : the way to change the value of a certain property of the target object from the current to the desired.

After identifying the problem situation according to the above descriptions, we can search the knowledge required to change the target object. In order to do so, if we use the pointers of effects offered by classical TRIZ, 'function model' is adopted as a guide to search the proper knowledge.

'Function' is defined as 'Action + Object in which the action must change the state of the object'[5]. OTSM defined it more precisely as 'Change (increase, decrease, …) + Value of a Property of an Object'.

According to the above discussion, we can draw two descriptions of function modelling;

(1) 'Function' is formulated as 'Action + Object'

(2) 'Function' is formulated as 'Change (increase, decrease, …) + Value of a Property of an Object'

where 'Object' corresponds to 'the target object' in the general definition of a problem and a solution. If we hope to avoid any confusion with the meanings of words, the second formulation could be better for us to get the clarified meaning than the first.

Figure 3 presents schematically the above discussion. Through abstraction of a real problem situation, we get a function model as a general problem model. The pointers to effects lead us to map the function model to some effects as a solution model.

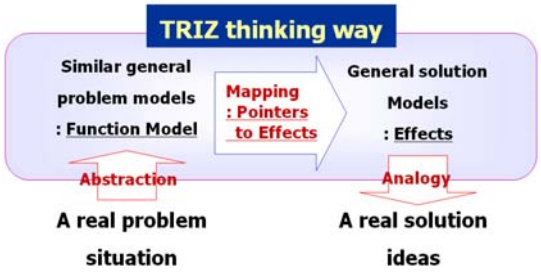

Figure 3: Relationship between 'function model', 'pointers to effects' and 'effects' in TRIZ thinking way

Therefore, in order to use the pointers of effects efficiently, the property of the target object in the function model must be one of physical, chemical or scientific parameters.

The author's experiences have shown that not a few TRIZ beginners formulate functions as ones including performance parameters. Performance parameters like productivity, efficiency, device complexity, etc are not suitable for the property described in a function model for use of pointers to effects. The performance parameters are determined not directly by some scientific laws but by how a certain technical system operates with scientific laws. For example, if we want to increase the productivity of our chemical process, the function model, 'to increase productivity' is not matched with certain scientific effects as solution models. Before checking the pointers to effects, we have to examine how the required functions are performed and what kinds of losses are happening in our specific process. The working way of a certain technical system belongs to a certain particular case. The productivity of a certain process depends on the way that our certain process as a particular case performs with physical, chemical effects. If you want to improve performance parameters of an object, you should analyze the object first, and then formulate function models to map them to physical, chemical, geometrical parameters through the pointers to effects.

When beginners treat non-technical problems with TRIZ, they often make the same mistakes as in technical problem solving. They formulate a problem as a function which has performance parameters like 'to reduce total cost', 'to increase revenue', 'to increase productivity', etc. Those performance parameters are caused by a specific situation. Before searching abstract and general solution models, above all, they must be dealt with analytic tools like multi-screen thinking, function analysis, and root

conflict analysis, etc.

Only if a solver formulates function models according to the above explanation, the pointers to effects serve helpfully. From the above discussion, the author derived necessary conditions of function modeling for effective use of the pointers to effects for non-technical problem solving.

(1) The function model should be formulated as 'Change (increase, decrease, etc) + Value of a Certain Property of an Object' or 'Action + Object' in which the action must change the state of the object.

(2) The property mentioned in the function model of a pointer to effects should not be a kind of performance parameter which mainly depends on a specific condition and then needs deeper analysis of the condition.

2.2 'Effect' as a solution model

The definition of 'effect' in classical TRIZ terminology could be put like below.

: An effect is a relationship of input action(input influence) and output action(the resultant change) of an object(a resource), which is governed by a certain principle of physical, chemical or geometrical viewpoint.

An effect as a tool of classical TRIZ shows the change of an object when we give a certain influence on it. It says about the change of a certain object governed by an objective principle like scientific ones. In order to extend the concept of 'an effect' in classical TRIZ up to non-technical problem solving, the governing principles in it must be replaced by principles in non-technical solution fields.

Therefore, more generalized definition of 'effect' could be like below.

: An effect is a 'relationship of input influence and resultant change of an object, which is governed by a certain objective principle.

When examining the principles in non-technical fields, the author has taken the following points as criteria for selection as effects for TRIZ application.

(1) The principle must be as objective as possible.
For example, the principles as advice given by so-called gurus in economics and management were excluded. Some people say, "The smarter employees you have, the more effectively you run your own company". Is that proven through objective experiments and analyses of them? If not, that must not be included in the pointers to effects for non-technical problem solving.

(2) The principle must say about the input influence and resultant change of a certain object.

In non-technical problems, if objective principles about animals and plants are considered to belong to biological knowledge, the author has not yet found any other kind of non-technical principles except the ones in which the target object is a person or people. If we examine the non-technical principles precisely, we can realize that they say about the change of a certain feature of a person or people through non-technical influence. For example, 'the law of demand' as one of economic principles could be discussed. That states that quantity demanded is inversely proportional to price, that is, 'the higher the price of the product, the less the customers will demand'. That is not about the change of a single object caused by an input influence on it. Figure 4 shows more detail steps of it as a process. There are at least three objects mentioned in that principle. First, the sellers change price of goods. Second, any kind of signs like price tags are renewed to inform persons. Finally, buyers are changed with awareness of negative incentive, or 'higher price'. They get lower demands about the goods. According to this analysis, 'the law of demand' could be a non-technical effect to solve the problem of 'how to decrease the value of the demand of people'. That means it is for human-targeted problem solving.

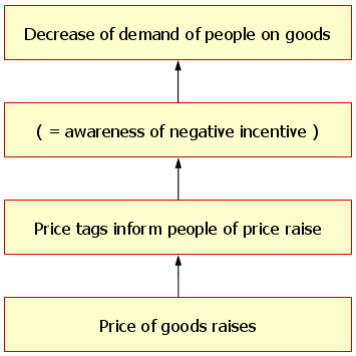

Figure 4: A deep analysis case in a non-technical field

As far as the author's 'up-to-the-present' study is concerned, non-technical principles belong to human-targeted effects if biological principles are excluded. Hence, the pointers to effects introduced in this paper will be composed of human-targeted effects.

3 POINTERS TO EFFECTS FOR SOLVING HUMAN-TARGETED PROBLEMS

Some information on psychology, economics, and marketing, etc were examined in order to pick up the non-technical principles [6][7][8][9][10][11].

Those which have no relationship of input influence and resultant change were abandoned as discussed before. After collected, the principles as effects were classified according to people's property which is changed by them. They could be explained as one sentence, 'People respond to incentives'. It must be put the accent on that the list of pointers to effects introduced in this paper is just the first one, which must be renewed if we get new non-technical principles.

Table 1 shows a table of some of them. In Table 1, the 'what I want' column shows only the changed properties without comments that the properties belong to a person or people.

The use of the table is the same as for the table of the pointers of effects in technical problem solving.

(1) Formulate your problem as a function model.
(2) Find the functions corresponding to your function model from the table.
(3) Examine the effects matched to the functions.
(4) Generate solution ideas according to the matched effects.

These pointers could help application of inventive standards to non-technical problem solving. Instead of 'MAThChEM', these effects could be used for non-technical problem solving.

A simple example of how to use the table is as follows;

In 'Country A', a supermarket intends to sell some fruit imported from 'Country B' which people of 'Country A' hate. People dislike goods from 'Country B'. However, the manager of the supermarket wants to sell the fruit as much as possible because of the high profit. What should she do?

First of all, we try to formulate some function models. If the manager decides to sell the imported fruit, the

problem can be formulated as below;

Problem Model 1 ; I want to decrease the value of the negative attitude of people to the fruit imported from the hated country.

You can find the similar function model from the pointers to effects, ‘to weaken the negative attitude’

The corresponding effects are as follows;

- mere-exposure effect
- ritual effect

Problem Model 2 ; I want to increase the value of the positive attitude of people to the fruit itself.

In this case, she should pick up a different one, ‘to intensify positive attitudes’. She can try to get ideas with more than ten effects.

This problem could be attacked with inventive standards. The pointers to effects would serve ideas on ‘field’.

4 SUMMARY

Based on a precise look into the pointers to effects of classical TRIZ, the guide of development of pointers to effects for non-technical problem solving was proposed. The function model as part of pointers to effects should be formulated ‘Change (increase, decrease, etc) + Value of a Certain Property of an Object’ or ‘Action + Object’ in which the action must change the state of the object. The property mentioned in the function model of a pointer to effects should not be a kind of performance parameter which mainly depends on a specific condition and then needs deeper analysis of the condition.

The generalized definition of ‘effect’ was suggested like below.

: An effect is a relationship of the input influence and resultant change of an object, which is governed by a certain objective principle.

The author suggested that the target object in most non-technical problems be a human being. Some pointers to effects related to human-targeted principles are classified and proposed to help the idea generation for non-technical problem solving. These pointers to effects must be updated as new non-technical principles are offered.

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What I want		Effect	Input Influence
To intensify	Cognition	Effect of Moderately Incongruity	Moderately incongruous information
		State/Field-dependent learning	Signals reminding related states/fields
	Positive attitude	Bandwagon effect	Sales information on others' positive purchase
		Context effect, Primacy effect, Printing effect	First information on good points
		Demonstration effect	Informing on relatively higher classes
		Framing effect	Change of the description frame
		Halo effect	Explicit merit/attractiveness
		Hawthorne effect	Care/consideration
		Priming effect	Stimulus on a certain good experience
		Profess effect	Profession event
		Pygmalion effect	Positive encouragement/expectation
		Ritual effect	Change of usual interactions
		Romeo & Juliet effect	Cognitive dissonance
		Sunk cost effect(=Concorde effect)	Investment of money/ time/endeavor
	Liking	Expectancy-value theory	High probability of success
		Matching principle	Informing on similarity
		Mere-exposure effect	Frequent exposure/contact
		Need-complementary hypothesis	Informing on difference of need
		Priming effect	Stimulus on a certain good experience
	Tendency toward risk	Extremity shift/polarization	Circumstance change

What I want		Effect	Input Influence
To weaken	Cognition	Tunnel vision phenomena	Emotional irritating
		Stroop effect	Signals arranged for involuntary attention
	Negative attitude	Mere-exposure effect	Frequent exposure/contact
		Ritual effect	Change of usual interactions
	Positive attitude	Context effect, Primacy effect, Printing effect	First information on bad points
		Crespi effect	Reward much less than current one
		Devil effect (=Negative halo effect)	Informing on explicit demerit/ugliness
		Framing effect	Change of the description frame
		Inoculation effect	Persuasion message weaker than a threshold
		Priming effect	Informing on a certain bad experience
		Ripple effect	Blaming some other colleagues
		Snob effect	Sales information on others' positive purchase
	Tendency toward risk	Extremity shift/polarization	Circumstance change

Table 1: Table of some pointers to effects for non-technical problem solving

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CONTACT

Hongyul Yoon
TRIZ Center,
Poonglim 2nd Apt, 102-#104, Hongeun1-dong, Seodaemun-gu, Seoul, 120-761, South Korea

www.trizcenter.co.kr/eng/ (in English)
www.trizcenter.co.kr (in Korean)

E-mail: hongyul333@empal.com
Phone: +82-19-288-2746