System Operator Tutorial - 2) Between The Boxes - Changing Perspectives

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Introduction

One of the problems commonly associated with the use of the system operator tool emerges from the way we draw it or see it presented to us. Almost inherently in either situation, we are separate from the 9-Windows; we sit above them, looking down on them from a third dimension; we are outside, separate from the windows, looking in. While this can sometimes be a very useful stance to take (indeed in the next article in the series, we will be examining this vital three dimensional aspect in some detail), it can also inhibit our understanding of the reality of a problem situation, and -we will hopefully see here - seriously impair our ability to solve a problem in the most effective way.

This article is thus aimed at examining the consequences of us looking at the 9 windows as outside observers versus what happens when we are able to enter the windows and look at the problem situation from within.

One way to look at this is that we place ourselves 'in' each window and view the other windows from this new perspective. Something like the 9-windows picture shown in Figure 1.

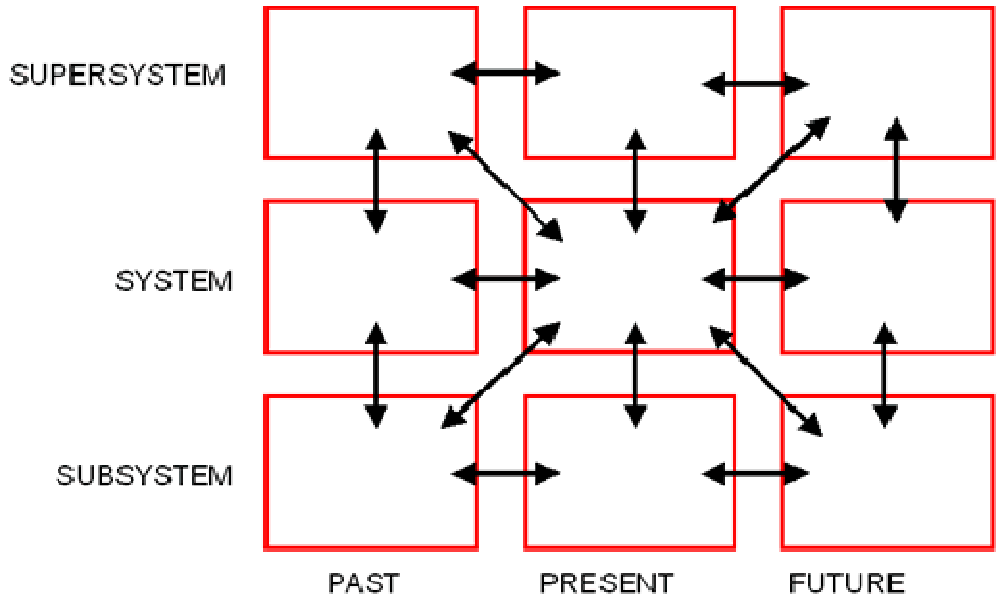

Figure 1: Using The 9-Windows To Change Our Viewing Perspective

If this picture is difficult to imagine (we do after all live in a three-dimensional world), some people find it useful to recast the windows as 'rooms' they become a part of, and from which they can see each of the other rooms - Figure 2.

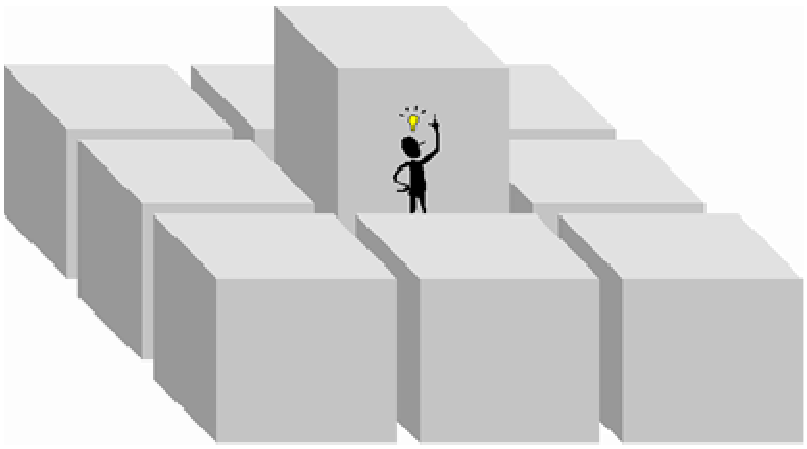

Figure 2: Turning The 9-Windows Into 9 Rooms

In any given problem or opportunity situation, any or all of the viewing directions shown in Figure 1 may provide a valuable new insight into a solution. Rather than look at all 16 of the viewing perspective possibilities, the article examines some of the ones most likely to be useful in the greatest number of instances. We start with a viewing perspective already likely to be familiar to experienced TRIZ users - that found through the eyes of the Smart Little People:

Connections With Smart Little People (SLP) Tool

The Altshuller derived SLP tool - like its earlier precedents independently derived from other sources (e.g. Synectics) - was developed as a means of helping problem solvers to empathise with the problem situation by 'becoming the problem. This is in effect changing the viewing perspective of the problem owner; the person (or rather the smart little people) 'becomes the problem'. The problem owner enters the sub-system and re-examines the problem situation from that new perspective - Figure 3.

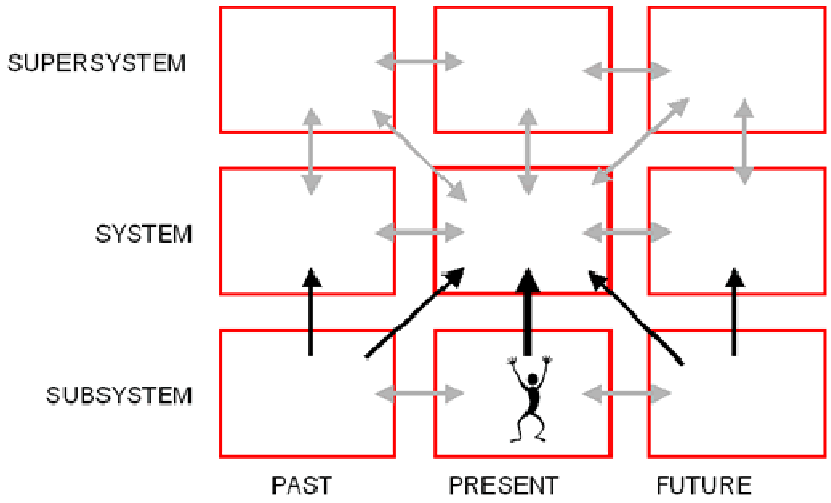

Figure 3: SLP Is About Entering/'Becoming' Part of the Sub-System

A classic example of this kind of empathetic viewing perspective change is Einstein imagining how someone traveling on a ray of light would view their surroundings; viewing the bigger picture from the perspective of a small part of it was crucial to the formulation of his theory regarding the speed of light.

In order to demonstrate the value of the SLP tool and the new viewing perspectives they force upon us, we choose to examine a problem somewhat closer to the practicalities of engineering design; that of designing components that are resistant to erosion damage. In trusting that readers will be able to connect a specific example to a much more generically applicable situation, we will examine the case of sand erosion of helicopter rotor blades (Figure 4).

Figure 4: Helicopter Flying In Sandy Conditions

This is a potentially serious problem for helicopters expected to operate at low altitudes in sandy or dusty conditions - the helicopter rotor blades rotate at very high speed and stir up a lot of air. If the aircraft is close to the ground, this air will cause sand to be lifted into clouds, and thus potentially be struck by the high speed rotors. The relative size and strength of helicopter rotors perhaps suggests that such impacts won't cause problems, but the reality of the situation is that the impact of hard silica-based particles onto a plastic and fibre based composite rotor at velocities of several hundred metres per second can cause rotor life to drop by several orders of magnitude.

As recommended by the classic SLP tool, Figure 5 sees us zoom-in to the zone of conflict - at a region of the composite rotor blade about to strike a sand particle at very high speed. Although useful, this view is still not going to provide us with too much assistance in developing effective solutions to the problem. In fact the view drawn is quite likely to encourage us to maintain an 'external' view of the problem. A typical solution response to this kind of problem view would be to stick a layer of protective material to the outside of the vulnerable rotor surface. This is indeed a solution we can find many examples of in the patent database, across many industries facing similar impact erosion problems. In the large majority of cases, subject experts now know, this type of solution offers little more than temporary relief, and may in the longer term actually make the problem worse than if there had been no protective layer added.

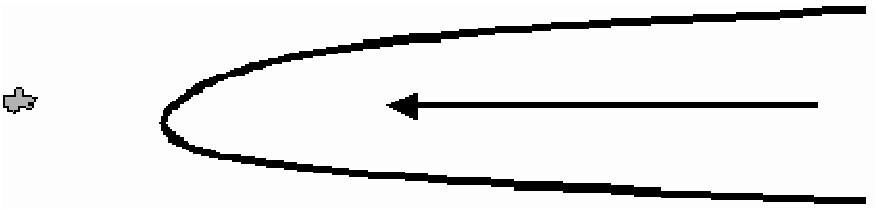

Figure 5: Helicopter Rotor/Sand Zone Of Conflict

The SLP view, on the other hand, encourages us to take on a viewing perspective in which we become the problem. In this case we become a group of smart little people sat on the rotor, watching a sharp edged rock approaching us at very high speed.

Given that situation, my response as someone looking at this big, sharp thing hurtling towards me is three-fold; 1) I would like something to shield myself with, 2) I would like someone around me to help, and, 3) I and they should brace ourselves, and then try to absorb and/or deflect (turn the harm into a resource!) the energy of the incoming projectile. Thinking about myself surrounded by neighbours (I'm in the system, looking at the rest of the system now) I imagine a situation like that illustrated in the sequence of figures shown in Figure 6.

Translating this SLP solution concept back into the real world situation, I might then imagine a blade construction in which a hard outer armour layer is used to cover an inner layer which is able to 'give', elastically absorb energy, and then use that stored energy to encourage the sand particle to be deflected away from the blade. This hard layer/soft-layer concept in fact turns out to be a protection technique used quite commonly within nature. It has yet to see any significant inroads into the word of engineering yet, however, and so there is probably scope for the generation of some significant intellectual property in the concept.

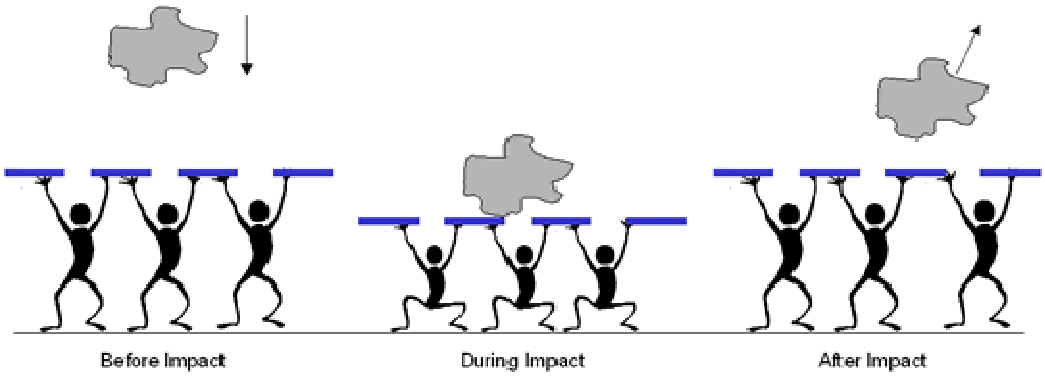

Figure 6: How I Imagine I and My Fellow SLP's Might Solve The Sand/Rotor Problem

What Happens If I Apply The Same Viewing Perspective Change in Different Windows?

So we have seen the 'becoming part of the system' concept produce some different solution perspectives via the SLP tool. What about when we place ourselves in some of the other windows and view a problem from their perspective?

The opposite of the SLP direction is the 'becoming part of the super-system looking in at the system' view. Or, 'what does my system look like, when I view it from the perspective of the outsider?' In crude terms, this perspective might be seen as that of a customer looking at a product. More importantly, from a problem solving perspective, it is not just about encouraging the problem solver to recognize that the super-system exists (which is what the classic 9-Windows tool is trying to do), but encouraging them to adopt the position of that customer and to see the system from their perspective (including therefore, all the things they are surrounded by). In some places, this is known as 'empathy'. To many the concept sounds so trite it shouldn't require mentioning. Unfortunately the plethora of 'bad' designs in the world suggests that problem solvers (or more likely the system they are constrained to work within) do not adopt this position as a matter of normal or even occasional practice.

Airports perhaps provide a good example. Most of the systems known as 'airport' appear to have little to do with empathy with the customer. This is especially unfortunate when thinking about airports we might visit in other countries for that establishment gives us our fast and last impression of the country. Anyone unfortunate enough to have to use airports a lot will probably feel that they are very much part of a super-system which has little to do with the smooth running of the airport designed by the architects and managers who organize how they operate.

What if there was a better way? What if the architects and managers saw things from the perspectives of the super-system?

- Would they think it was a good use of passengers' time to have them sitting doing nothing in a departure lounge and then moving them on to an aeroplane to do more nothing for several hours and then force them to endure another possibly several hours (a tie between Moscow and Atlanta for this author) passing through immigration?
- Would they recognize that passenger consumption of electrical power - for laptops, phones, personal stereos, etc - has risen phenomenally in the past five years but that battery power hasn't matched the change? There are a host of passengers who would love (and may even be willing to pay for) recharging facilities.
- Would they recognize that more and more passengers are more and more likely to use carry-on luggage and are therefore less and less likely to want to check their baggage if they can possibly help it?
- Would they recognize that many business travellers travel to get to meetings and that these travellers would be as happy to have that meeting at the airport as locating appropriate ground transportation (in an unfamiliar location) to get them to a meeting somewhere else?

And so on. Not to mention the 'empathy' discussions we might get into if we refocused on the system ('instrument of torture'?) known as the airliner.

Standing In The Future And Looking To The Present

A current favourite example of this kind of empathy comes from a possibly apocryphal, but nevertheless hopefully instructive tale relayed at a recent architecture conference. The story relates to an architect appointed by NASA to help think about the design of a possible future manned base on Mars. Such a job no doubt presents an architect with an incredibly enticing combination of freedom and new design challenges - with a good many of the boundary conditions found on earth (gravity, temperature range, atmosphere, etc) considerably altered. The architect concerned apparently reveled in the challenge and was very proud to eventually unveil his design solutions to all and sundry. Among the audience were some astronauts. They were not too enamoured of the chosen solution, however, especially since at no stage during the design

process had they or the equipment they would be wearing been included. Funny but unfortunately also common (one famous architect - a different one by the way - has been quoted on more than one occasion as saying customers should not expect the structures he designs to be functional; his first and foremost role is to make a 'statement'. Oh dear.)

Other examples of benefits accruable from problem solvers standing in the future and looking back - just about every recycling issue currently known ("your customers are your grandchildren"), changing demographics (what will I think about the pension system in twenty years time when I might actually become the recipient?), maintenance issues (this author has direct personal experience of designing small components and their ability to be maintained in the field only to find out when actually out in the field that it could be -30°C and the operators are wearing inch thick mittens on their hands), and, thinking about future super-system, a whole host of contradictions that emerge as different parts of society evolve at different rates.

Final Thoughts

In its original form, the 9-Windows system operator, whether intentionally or otherwise, separates us from the problem; we are encouraged to see it from 'outside' each of the windows; we look into the windows. On some occasions this can be a very useful position to hold. On others, however, it separates us from the problem in a harmful way.

The SLP tool is a way of getting ourselves to become a part of the problem, but it only does so at the sub-system level; we become part of the sub-system and view the bigger picture from that perspective.

We have hopefully seen that there is value in placing ourselves 'inside' the other windows ('rooms') in the tool, and that our viewing perspective can have a significant influence on both the problems we define and the solutions we reach.

In the next installment of this series of articles exploring the system operator, we will be following one of the TRIZ evolution trends and examining the implications and opportunities arising when we explicitly add a third dimension to the 9-Windows.