Subscription 0080

Systematic Innovation

e-zine

Issue 30, July 2004

In this month's issue:

The Systematic Innovation e-zine is a monthly, subscription only, publication. Each month will feature articles and features aimed at advancing the state of the art in TRIZ and related problem solving methodologies.

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.
Send them to **darrell.mann@systematic-innovation.com**

If TRIZ IS So Good Why Isn't Everyone Using It, Part 37

- Pleasure Seeking, Pain Avoidance And Invention Machines

Human beings are highly sophisticated and diverse creatures. It is impossible to categorise any one individual because we are not only all different from one another, but we also change individually under different situations and conditions. Let us, however, take some crude extremes. Two in fact. In the first extreme, let us assume that there are two kinds of people; one kind who believe that they are creative, and the other kind that believe they are not.

Secondly let us assume that, again to grossly generalize, humans are motivated by two extremes of emotion. The first of these extremes is what we might think of as 'pleasure seeking'; human beings tend to like things that they find pleasurable and hence are attracted to the potential of pleasure. The second extreme, then, is what we might describe as 'pain avoiding'. In the same way that we are all attracted to pleasure, we all have a natural aversion to pain, and hence we will seek to avoid any experiences that cause us either mental or physical pain.

Let us then take these two pairs of extremes – creative/not-creative and pleasure-seeking/pain-avoiding – and see how they might begin to work in combination with one another. A simple means of exploring possible relationships between the two would be through a 2x2 matrix as shown in Figure 1.

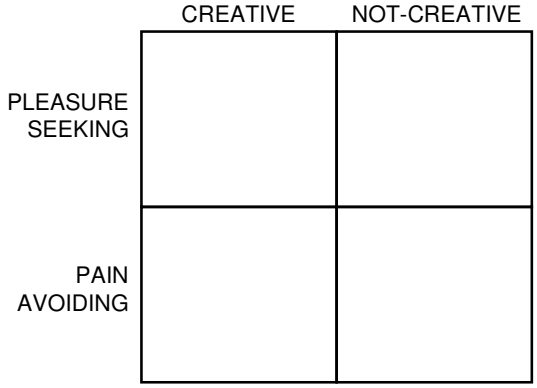


Figure 1: Creative/Not-Creative and Pleasure-Seeking/Pain-Avoiding Matrix

Okay, having designed this matrix, let us explore how we might make use of it. At the risk of making ourselves very unpopular, we will use the expression 'invention machine' as an example. Before going any further, perhaps we should explain that this is invention machine with a small 'i' and a small 'm', and not the name of a company. Invention Machine, the company, let us make it clear, make a wonderful range of products containing many essential tools to help engineers solve problems. Our concern here is purely with the phrase 'invention machine'.

So, if we now imagine ourselves in a position where we believe that we are creative and we *hear* about the existence of an 'invention machine' then very typically our first reaction is likely to be one of pain avoidance – i.e. if there really is such a thing as an invention machine then I might discover that I'm either not needed any more, or I might realize that I'm not actually as creative as I think I am. A person in this position is thus likely to adopt an ostrich-like burying-head-in-sand strategy; either pretending that they never heard about it, or reacting defensively by telling people that the whole idea is nonsense.

SYSTEM ATIC INNOVAT ION

This is a likely reaction when someone who believes they are creative *hears* about the invention machine. If, somehow, they actually *see* the invention machine and can therefore no longer ignore it, they can no longer avoid the pain. When pain avoidance is no longer a possibility, the next most likely strategy is pleasure-seeking. Anyone who thinks they are creative operating in pleasure-seeking mode is most likely to achieve pleasure by demonstrating that they can 'beat' the invention machine. Thus there ensues a mental battle in which, by whatever means, the creative person sees themselves in competition with the machine. The most likely outcome when someone is operating in this mode is that they *will* 'beat' the invention machine. This may involve some cheating, of course, but the strong driving pleasure-seeking motivation is to 'win'. If, somehow, we find ourselves 'losing' than alas our brain is most likely to shift us out of pleasure-seeking mode and back into pain-avoiding mode. When we are back in this mode, we seek to justify our 'failure' to beat the machine by making excuses. The net result, either way, is that the invention machine will lose.

People who believe themselves to be creative, however, may sometimes prefer pleasure-seeking to pain-avoiding. These people tend to short-cut straight to the mode of trying to 'beat' the invention machine. If they do this, then again the most likely outcome is the same; the invention machine will lose whether it actually did or it didn't.

The net result, in every possible combination of actions as shown in Figure 2 is that the invention machine is going to be rejected.

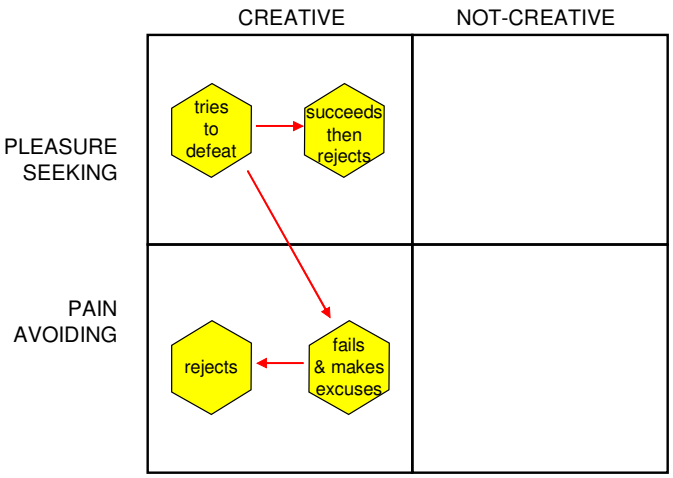


Figure 2: Actions Of Creative People In Response To The 'Invention Machine'

Let us now shift our focus to people who perceive that they are *not* creative. The most likely reaction of this person when they hear about the existence of the invention machine is a shift into pleasure-seeking mode. In this mode, they are likely to see the invention machine as an opportunity to create wonderful inventions that will make them lots of money and, perhaps more importantly, appear to be creative in the eyes of their friends and colleagues. The person who believes they are not creative is thus highly likely to be attracted to the concept of the invention machine. They will want to know more.

But then what happens when they experience the invention machine? Again there are two possibilities; the first is that it works and a great solution appears. If this happens then the person has been rewarded and the pleasure-seeking mode will continue. They will thus use the invention machine again. And again, and again – just so long as it works each time. The second possibility, however, is that for some reason the invention machine

doesn't work. The person tries to use it and it doesn't create a wonderful invention. What happens in this situation? The most likely answer by far is that the person shifts from the pleasure-seeking mode (since they just failed to achieve the pleasure they were looking for) and into the pain avoiding mode. If I think I am not creative and my mind is focused on pain avoiding, then my most likely reaction is to reject the invention machine. If the machine didn't work then maybe it was because I was even less creative than I thought I was, or maybe I needed to work harder. Net result either way is that the invention machine is rejected.

The scenario of possibilities for the person who believes that they are not creative is thus shown in Figure 3.

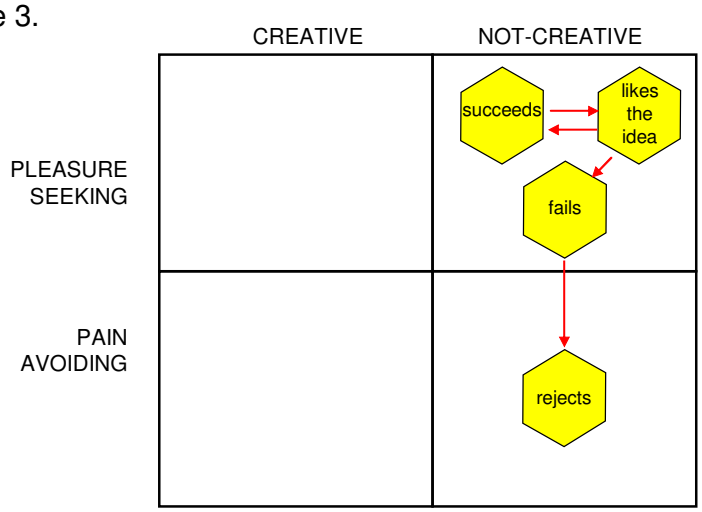


Figure 3: Actions Of Non-Creative People In Response To The 'Invention Machine'

Figure 3 shows a theoretical possibility of a scenario in which our invention machine might succeed – someone who thinks they are not creative, achieving a successful solution is likely to want to use the machine again. Let us then examine how realistic such a possibility is in real life. Let us do that by relating our hypothetical to invention machine to the practical realities of TRIZ. Anyone with any experience of TRIZ at all will know that the main job that it is able to perform is guiding a user to a good solution. Ultimately, however, the generation of that solution is going to require some serious thinking and therefore some hard work. As soon as we hear the words 'hard work' the strong tendency of our brain – particularly if we think we are not creative – is to move firmly into 'pain avoidance' mode. Once in pain avoidance mode, then unfortunately we are back to the scenario that will most likely cause the invention machine to be rejected – if the machine needs hard work and I am trying to avoid hard work then the chances of a successful outcome are very slim. Hmm. If we take this scenario and then summarise the range of possible outcomes in the scenario where our invention machine requires hard work, we will see something like the picture shown in Figure 4. Thus, for the invention machine requiring us to do some serious thinking and hard work the only possible outcome is failure (assuming that the reaction of the person who believes that they are creative will not be affected by the presence of 'hard work'; we believe, based on our experience with many creative people that this is a safe and logical assumption).

Wow. Can this really be true?

It certainly doesn't seem likely. Perhaps more valuable than speculating on the implications of this possibility for our 'invention machine' it is more useful to replace those

words with the word 'TRIZ', and thus perhaps allow us to explore the question in the title of the article, 'if TRIZ is so good, why isn't everyone using it?

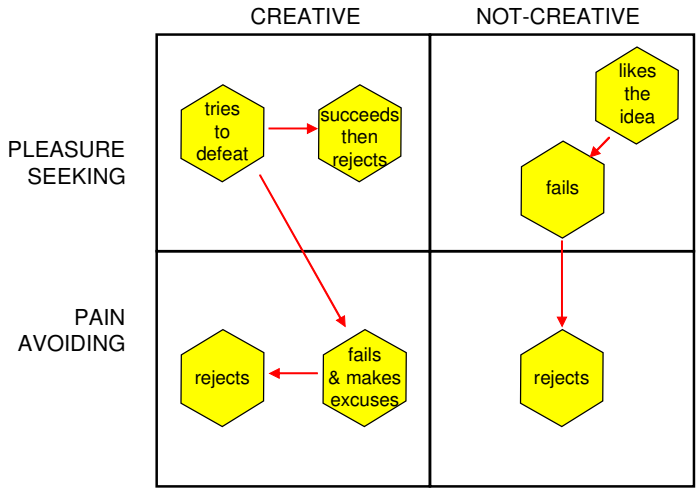


Figure 4: Summary Of Possible Outcomes For An 'Invention Machine' Requiring Hard Work

To begin the analysis, let us replace 'invention machine' with TRIZ in the previous analysis and see the different scenarios:

1) If I think I am creative and I *hear about* TRIZ, I might discover that I am not creative as I thought I was. Net result – I reject TRIZ; either ignoring it or finding arguments against it.
2) If I think I am creative and I *see* TRIZ, and it is presented to me as the world's biggest study of creativity and innovation and therefore an all powerful problem solving tool, I am likely to try and prove that I am stronger than TRIZ. Net result – I either succeed in 'beating' TRIZ and reject it, or TRIZ beats me, in which case I make excuses and also reject it.
3) If I think I am not creative and I see TRIZ, and it is presented to me as the world's biggest study of creativity and innovation and therefore an all powerful problem solving tool, I am likely to try it. Net result – I soon discover it needs hard work and therefore reject it.

So again, TRIZ fails in every scenario. Except. The new scenario descriptions have changed. There was nothing about 'all powerful problem solving tool' in the invention machine description. So how come it has been added here. Well, of course it has been added, but in actual fact has it? Or did the idea of the 'invention machine' in fact imply that it was all powerful. Hmm again.

So what happens if we take away that description? What happens if we describe TRIZ as 'a big piece of ongoing research, where the intention is to put all of the good stuff in one place, but will require some hard work'. What happens to our three scenarios above in that situation? Let's have a look:

1) If I think I am creative and I *hear about* this big piece of ongoing research, where the intention is to put all of the good stuff in one place, but will require some hard work', I might get the idea that 'maybe I can contribute to this research; after all I am a smart and creative person, maybe I can teach the method a thing or two'. In other words I enter into 'pleasure seeking' mode. Net result – I have a look at TRIZ.

2) If I think I am creative and I *see* this big piece of ongoing research, where the intention is to put all of the good stuff in one place, but will require some hard work', and I realise that it contains holes, I open the possibility that I might actually contribute. Again I find myself in pleasure-seeking mode. Alternatively, I try the method and realize that it successfully solves my problem. This scenario is a little more difficult. I could be happy that TRIZ 'worked' or I could become defensive and feel threatened. Now I am on a knife-edge between pleasure-seeking and pain-avoiding.
3) If I think I am not creative and I see this 'big piece of ongoing research, where the intention is to put all of the good stuff in one place, but will require some hard work', I am likely to focus on the words 'hard work' and shift into pain-avoiding mode. Net result – I reject TRIZ.

So what does this tell us about ways that might cause TRIZ to take off? We think there are two very simple conclusions that emerge.

The first involves people who think that they are creative. What the analysis suggests is that so long as these people are encouraged into and kept in 'pleasure seeking' mode, TRIZ is likely to succeed. This means presenting TRIZ in a no-threatening, opportunity opening way – hence the description 'a big piece of ongoing research, where the intention is to put all of the good stuff in one place, but will require some hard work'. In fact, we might add to this description 'and it may contain some holes, so please help us to see if you can fill them'. Such a message is encourages more 'pleasure-seeking' thinking because there is the opportunity for using our creative skills and perhaps actually making a name for ourselves by filling some of those holes.

The second involves people who believe that they are not creative. For these people we need to solve a contradiction – we need to do hard work and not do hard work. We need to do hard work because in actuality TRIZ is hard work, and we need to not do hard work because we don't want to get into 'pain-avoiding' mode.

Summary

The way in which we present something to a person can have a massive influence on how well they receive or reject what it is that we are presenting. The main example described here was TRIZ, but it could very easily have been any subject. Remembering the two main human motivators – pleasure-seeking and pain-avoidance – although they are crude approximations, will go a long way in helping us to ensure that the message we are conveying is received favourably.

In many ways, TRIZ is a difficult thing to convince people about. The term 'invention machine' seems, according to this kind of pleasure-seeking/pain-avoiding analysis, almost inevitably doomed to failure. Hopefully we have highlighted at least two possible strategies – each dependent on whether a person believes that they are creative or not – that offer some hope of success. Of course, they too are not easy to achieve – as TRIZ users will know all too well, solving contradictions may be a systematic process but it is still not easy. So, whatever happens, there is a need for some hard work. But then, as we assumed earlier, no creative person is likely to be deterred by a little hard work.

Evolving Evolutionary Potential

3) Increasing Differences

Useful as they are, if we conduct an evolution potential analysis of evolution potential analysis we will reveal considerable untapped opportunities at this point in its maturity. In this article we explore another simple but effective opportunity that arises when we consider employing some of that untapped potential.

Figure 1 illustrates a plot we often use in workshops. The purpose of the plot is to show how system hierarchies can be modeled using the evolution potential concept.

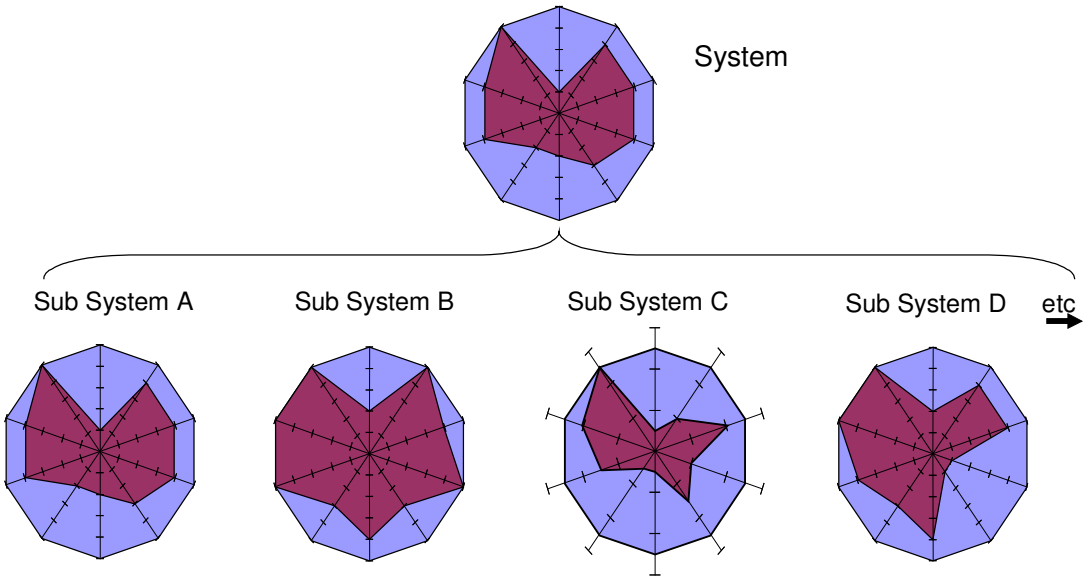


Figure 1: Typical Evolution Potential Plot Hierarchy

The usual discussion accompanying this slide usually passes something along the lines that we can use the plot to help us to work out which sub-systems (and individual components if we delve deeper into other levels) should be the focus of our improvement initiatives. Thus in the hypothetical case illustrated in the Figure, Sub-System B has used up most of its potential while C still has considerable untapped potential, and hence C is likely to deliver the biggest bang-per-buck of R&D funds invested.

At a crude level, this is what this type of plot is telling us. But, hopefully as we stress in those same workshops, untapped potential is merely the start of the necessary prioritization activity.

If we were really trying to understand where we should be putting our R&D money, we ought to have some means of recording the relative importance of each of the sub-systems. There are several ways to perform this kind of importance-rating activity. We will mention just two here; the simplest and the most important:

The simplest means of weighting the plots is to use the cost of the sub-systems or components to ratio the sizes of the various plots. Thus a sub-system with double the cost of another might be drawn such that the area of the circle defining one component is double that of the next.

SYSTEM ATIC INNOVAT ION

A somewhat more sophisticated means of scaling the individual plots relative to one another would be to use a measurement system more closely related to the overall value (as in sum of benefits delivered, divided by the sum of all the costs and harms) of each element. This kind of calculation is, of course, rather more difficult to perform, and thus may require a degree of approximation.

The two ideas of cost-scaling or value-scaling represent what may be thought of as two ends of a sophistication spectrum. It is not the purpose of this article to debate the merits of either approach or any intermediate position along such a spectrum. What is important here is simply the conceptual idea that we can somehow scale the different radar plots to reflect the relative importance of different parts of a system. Figure 2 illustrates the sort of output we might expect to achieve:

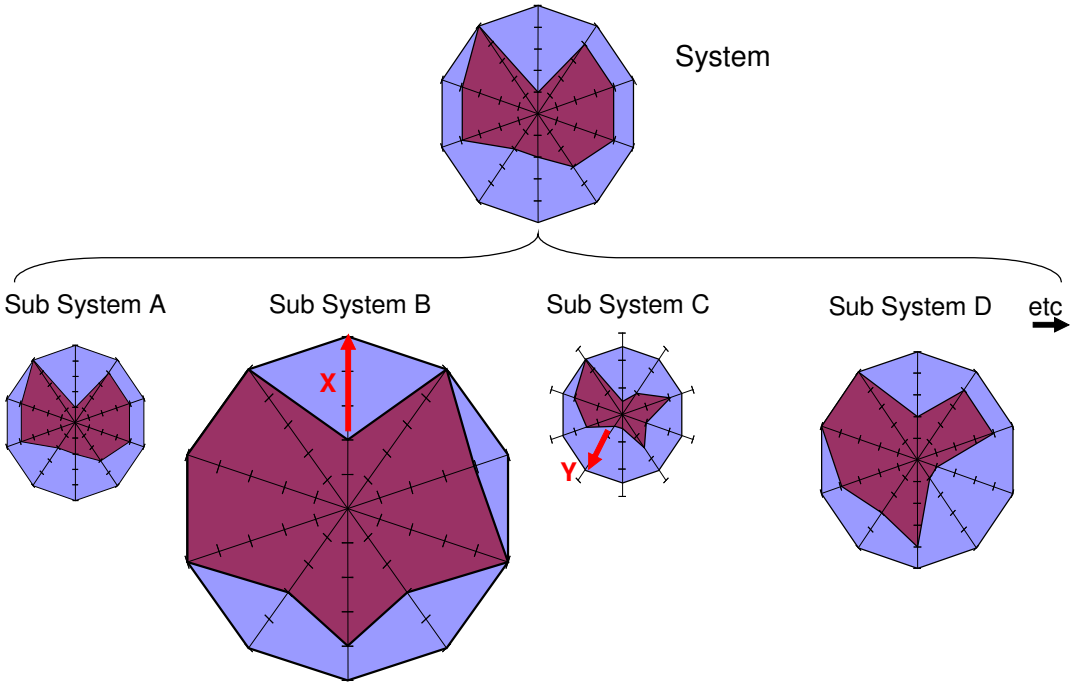


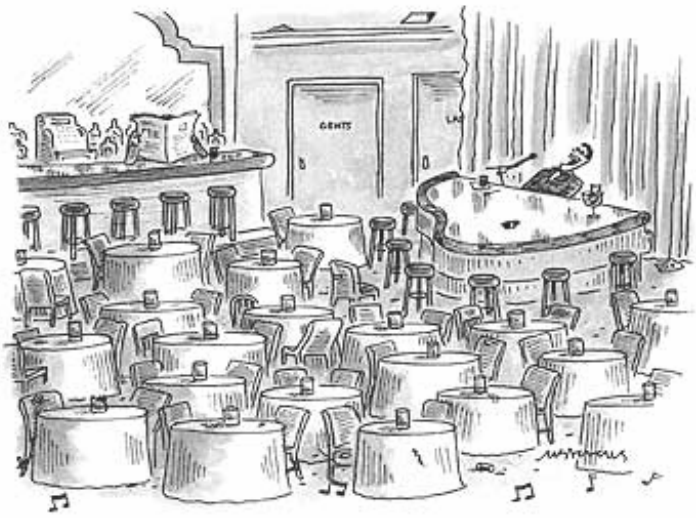
Figure 2: Weighted Evolution Potential Plot Hierarchy

The basic idea behind the weighting concept is in many ways an obvious one. Extremely so when we consider the Mono-Bi-Poly(Increasing Differences) trend – which would have straightaway told us that somewhere there is an advantage in moving from a system in which all of the components (radar plots in this case) are the same, to one in which incorporation of differences between each plot creates a functional benefit.

A final thought regarding the importance of this evolutionary jump emerges, then, when we examine the two evolution options X and Y from Figure 2. If these two are taken to represent two possible R&D programmes, only one of which we have the resources to conduct, then whereas Y would have been the likely choice if the plots were in their unscaled, Figure 1 state, in Figure 2 – where the areas and hence the lengths of the jumps along each trend – option X becomes the more beneficial. Very definite food for thought when it comes to R&D strategy management we think.

Humour

Is this a Principle 39a joke? Replacing a normal atmosphere with an inert one?



"There's no business like show business"

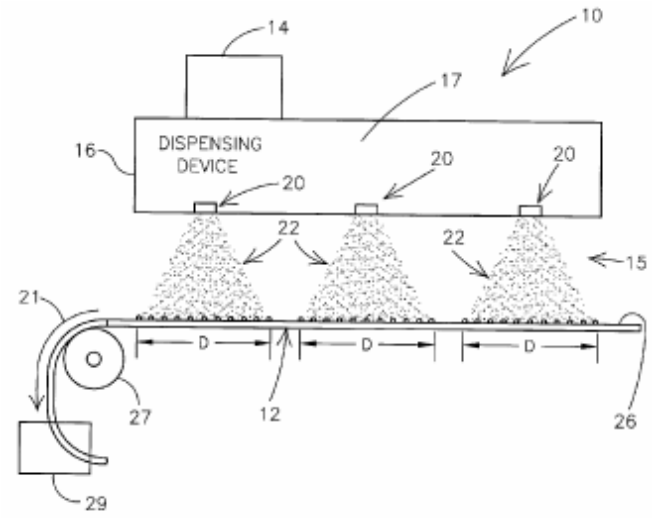
Actually, we could also see it as Principle 2, ‘Taking Out’. Or 13. Or maybe 22. The interesting thing is that seen through the lens of the different Principles, the joke changes slightly. See what you think.

Patent of the Month

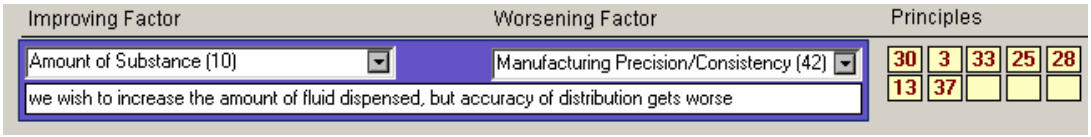
Our award this month goes to the Regents of the University of Minnesota for US6,764,720, 'High mass throughput particle generation using multiple nozzle spraying'. From the invention disclosure abstract:

Spraying apparatus and methods that employ multiple nozzle structures for producing multiple sprays of particles, e.g., nanoparticles, for various applications, e.g., pharmaceuticals, are provided. For example, an electrospray dispensing device may include a plurality of nozzle structures, wherein each nozzle structure is separated from adjacent nozzle structures by an internozzle distance. Sprays of particles are established from the nozzle structures by creating a nonuniform electrical field between the nozzle structures and an electrode electrically isolated therefrom.

In many ways, the patent is a very simple one: in order to increase the mass throughput of a fluid spray injection nozzle, increase the number of nozzles:



The thing that stops this from working is that it is difficult to accurately control the position and distribution of the droplets. We might see this as the following contradiction:-



Which in turn matches nicely with the solution strategy adopted by the inventors –a neat combination of Principle 3, Local Quality, and Principle 28, Mechanics Substitution – using a non-uniform electrical field.

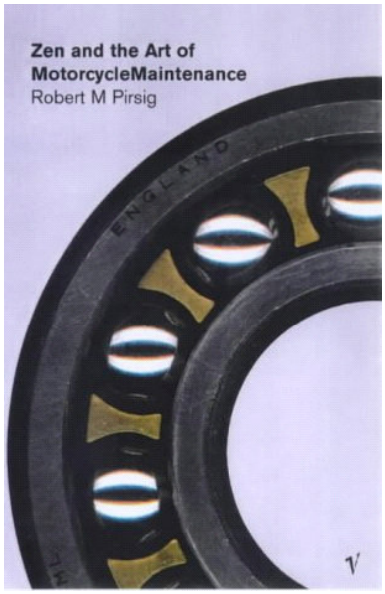
In addition to making a neat illustration of the Contradictions part of TRIZ, the example also serves to remind us about the importance of looking to make connections between the generic solutions offered by the Principles and our specific deployment of them. Having established the use of an electrical field to help control motion, the Local Quality principle asks us to think about turning anything in the system that is uniform into something that is non-uniform. Fields, the inventor's solution serves to remind us are amenable to becoming non-uniform as physical objects.

We will see more on the subject of non-uniform fields in a future article examining the evolution of fields beyond the basic idea of 'the field' suggested by several of the classical TRIZ trends of evolution.

SYSTEM ATIC INNOVAT ION

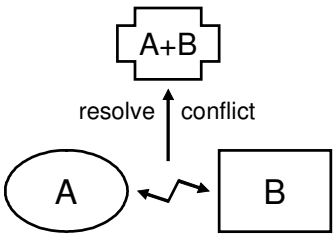
Best of the Month

We're probably walking on thin ice when we say that our 'best of the month' award this month goes to a book first published in 1974. Nevertheless, never being ones to walk away from controversy – no matter how small! – that is what we are going to do. And so our recommendation this month goes to Robert Pirsig's classic Zen And The Art Of Motorcycle Maintenance:



The common ground between the philosophy unveiled by Pirsig resonates enormously with some of the big ideas in TRIZ. Just in case we need to tempt you into giving the book a shot, here are some of the main connection points as we see them:

1) Pirsig talks at length about the resolution of conflict, and specifically the idea that conflicting philosophies need to be resolved by finding a higher-level model that makes both valid:



2) Pirsig also talks about recognizing the importance of the connections between 'Subject' and 'Object'. Amazing given the relatively recent emergence of the subject-action-object idea in semantic search technologies.
3) A quote from the book: "do you want to be remembered for who you are, what you were or what you did?" To BE or to DO, that is the question. Another strong connection to TRIZ and the importance of focusing on the function, or doing part.
4) Finally, if those three aren't enough of a temptation, Pirsig talks about a term defined as 'aretê'. The word "implies a respect for the wholeness or oneness of life, and a consequent dislike of specialization. It implies a contempt of efficiency, or rather a much higher idea of efficiency, an efficiency which exists not in one

department of life but in life itself". One wonders whether this term might actually make a good definition of what TRIZ is all about.

Investments –

Investment of the Month this month goes to Varioptic based in France. Our attention was first drawn to the company thanks to a jump made along the Dynamization trend. Varioptic are in the lens business. Lenses, of course, are traditionally thought of as 'immobile' things. More recent innovations have progressed along the trend to flexible lens systems, and now Varioptic take the trend a step further by creating a fluid lens. Further than that, by making the fluid an active one, they also create what appears to be a highly controllable, lost cost lens system.

From the company's website: "The liquid lenses that we develop are based on the electrowetting phenomenon: a water drop is deposited on a substrate made of metal, covered by a thin insulating layer. The voltage applied to the substrate modifies the contact angle of the liquid drop. The liquid lens uses two isodensity liquids, one is an insulator while the other is a conductor. The variation of voltage leads to a change of curvature of the liquid-liquid interface, which in turn leads to a change of the focal length of the lens."

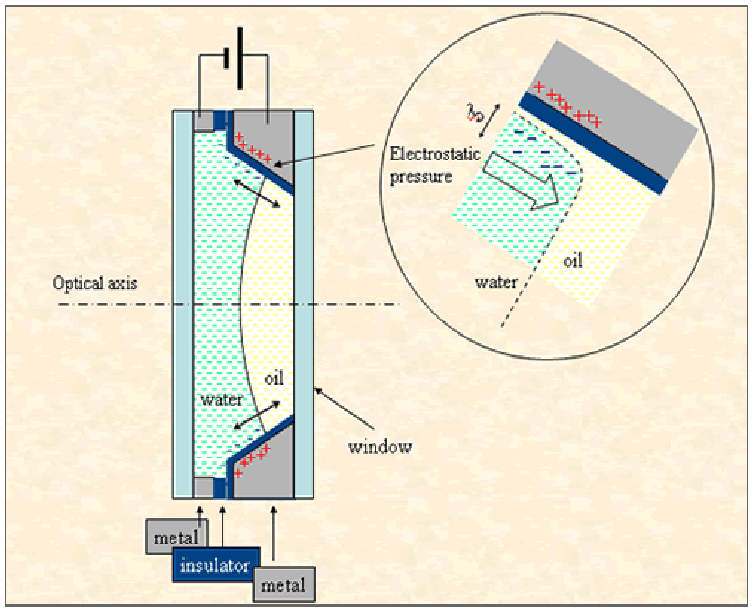
This technology, in turn delivers the following benefit opportunities:
Large inverse focal length range
Ruggedness (No moving parts)
Fast response
Very good optical quality
Good transparency in the visible range
Wide Operating temperature range
Very good stability of the optical axis
Extremely low electrical consumption
Simple low-cost construction

Prototypes have already been delivered to companies like Samsung for consideration in their range of camera phones.

We have a strong tendency to have faith that when we see a technology making jumps along the trends. This is particularly so when we see a jump from a mechanical to a fluid-based system on a product (the 'lens' in this case) that is almost inherently thought of as a solid lump of material.

Check out the company at http://www.varioptic.com/V2/products_tap.htm

SYSTEM ATIC INNOVAT ION



Cross-section view through the Varioptic ‘liquid lens’ system.

Conference Review - MRI Systems Knowledge Creation Symposium, Shezenji, 8-10 September 2004

It was a great honour and privilege to attend and be allowed to speak at the MRI Systems (formerly Invention Machine User Group) symposium held in Japan in September. The event was attended by close to 80 delegates, most from organizations in Japan, over a two and a half day period. Ten papers plus one panel session were available for the delegates. Some of the papers were given a healthy two-hour time slot, meaning that it was possible to get into considerable detail. Most of the presentations were given in Japanese and so precise details are difficult to extract, but the presentations by Hyo June Kim and Nikolai Schpakovsky were presented in English, along with our invited presentation 'If TRIZ Is So Good Why Isn't Everyone Using It, Part 5 Case Studies Of Successful And Unsuccessful Deployment Into Industry'. All three were simultaneously translated for the benefit of the audience.

Hyo June Kim presented an update on some of the impressive work being done by the TRIZ team inside Samsung. Most notably, he presented an insight into his newly published Theory Of Inventive Problem Solving book. The 433 page tome is the first TRIZ book published in Korean. The graphical design of the book is an absolute joy, and it is little wonder that Samsung have already taken delivery of over 1000 copies. I was very honoured to receive a signed copy from the author.

Nikolai presented a description of his new e-Book, also recently published, but this time, thanks to the support of MRI Systems, in Japanese. We are hopeful of being able to make this fine piece of work – based on the Christmas Tree evolution trends model previously presented at the 2002 ETRIA conference – to English readers in the coming months.

Finally, although we were only able to glean a basic overview, it is worth mentioning that one of the other papers presented was a detailed analysis of the Matrix 2003 book. It was both very strange to hear the words 'Darrell Mann san' emerging from the haze of Japanese speech during the paper, and very gratifying to see such a positive assessment of the work performed in creating the new Matrix. It would be nice to see some of the findings from this paper translated into English at some point in order that the TRIZ community might for the first time receive an impartial and independent analysis of how successfully the Matrix compares to its 1973 predecessor. SKI, I'm pleased to say, are busy with their plans to complete the translation and publication of the Matrix 2003 book. As was the case with the HOSI translation, it looks like the Japanese edition will feature a number of enhancements – in this case a translation of the recent TRIZ Journal paper in which we assessed the Matrix against 100 patents granted since the book was published.

The main reason for my attendance at the symposium was the recent publication of that HOSI book into Japanese by Professor Nakagawa and members of the SKI translation consortium. Reception for the book appears to have been very positive, and it was very flattering to receive the complements of many delegates.

Probably the best part of the symposium, though, were the informal sessions conducted in breaks and late into the evening. The memory of constructing radar plots at 10pm surrounded by a group of host of spectators is something that will live with me for some time!

The entire event was an absolute delight. I am very thankful to the organizers for making my visit possible, for all of the hospitality and kindness shown to me, and for all of the new friends I have made. Arigato.

Biology – Deception

It's a jungle out there. Life revolves around the twin imperatives of survival and reproduction. Survival for many life-forms involves finding ways and means of protecting themselves from predators. From the predators point of view, the situation works the other way around, in that they have to adopt ways and means of getting past the defenses of the prey. Amongst the strategies deployed by either predator or prey to achieve their goals are those involving some form of deception. Deception can take on many forms and varieties.

Well known examples include plants and animals that disguise themselves to look like their background (camouflage – Principle 32, Colour Change), or objects that potential prey will deem to be worthless – dead sticks, leaves, etc (Principle 5, Merging).

A particular favourite example from the predator perspective is *Acanthaspis petax*, an African bug with a liking for ants. The contents of an anthill represent a veritable feast to the bug, but unfortunately, it is likely to be detected by the ants guarding the entrance to the hill. *Acanthaspis petax* has thus evolved the cunning yet gruesome strategy of picking off a few wayward ants, killing them and then sticking their carcasses onto its body, thus creating a disguise that confuses the ants guarding the hill well enough that they allow the bug to enter, and thus begin its feast.

This strategy could be interpreted as belonging to several of the Inventive Principles. There are cases that can be made for Principles 5, 7, 24, 30 (possibly), 33 or 40. Or maybe in this case, the best match comes by thinking of the problem in S-Field terms. If we do this, we might think of the harmful effect of the guard ants on the bug – i.e. preventing it from entering the nest. After deciding that this is the problem, the first suggestion offered to us by the Inventive Standards is:

Remove the harmful effect by introducing a substance which is a modification of the existing substances (Standard 1.2.2)