Subscription 0080

Systematic Innovation

e-zine

Issue 31, September 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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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**

Solving Lean Conflicts
- TRIZ And The 15 Lean Wastes

As the worlds of TRIZ and Lean get ever closer, in this article we examine how the TRIZ contradiction elimination tools may be configured to help Lean practitioners to overcome the various forms of waste. Figure 1 details the 15 main wastes defined within modern versions of the Lean method (Reference 1).

waste – process, business (employees, managers suppliers, etc), pure
waste of over-production
waste of waiting (internal and external)
waste of transporting (internal and external)
waste of inappropriate processing (using a hammer to crack a nut)
waste of unnecessary inventory
waste of unnecessary motions
waste of defects
waste of untapped human potential (empowerment)
waste of inappropriate systems (over-specified computers, machines, etc)
waste of energy and water
wasted materials
service and office wastes (excess meetings, food, photocopying, etc)
waste of customer time
waste of defecting customers

Figure 1: The 15 Lean Wastes

As with the great majority of methodologies, Lean offers little by way of suggestion as to *how* organizations actually go about eliminating such wastes as and when they are identified. According to the iceberg image that usually accompanies such wastes, as 90% of them are hidden, then simply making them visible is enough to permit Lean practitioners to begin the necessary work to eliminate them. Sometimes this may well turn out to be the case since 90% of a problem is very often the identification of the problem.

But then there are those situations in which simply identifying a source of waste is not sufficient to permit elimination actions to take place. More seriously, the evidence of many failed Lean initiatives would seem to suggest that whenever we seek to eliminate waste by traditional trade-off and compromise strategies, we simply move the problem from one place to another; such that one form of waste is eliminated at the expense of either another (less obvious) waste or that other aspects like system adaptability, ability to shift, robustness, etc become worse.

When we find ourselves in either of these situations, TRIZ will tell us that there are stronger and more effective ways to deal with the problem. At the heart of these ways is the Contradiction Matrix.

As experienced TRIZ users will know, the Matrix operates by identification of pairs of (improving/worsening) conflict parameters. A fairly direct link, then, between Lean and the Matrix occurs if we can find a way of mapping the 15 wastes onto improving parameters in the Matrix. A first attempt to make a match between the wastes and the Matrix is thus presented in Figure 2. Very simply, the figure suggests connections between the Lean wastes and the available parameters in the new Matrix 2003 (Reference 2) and Business

Conflict Matrices. These are selected over the classical TRIZ Contradiction Matrix since, because they were defined by this author, it is possible to directly interpret the intended meaning of each of the parameters that form the sides of the two tools.

Type Of Waste	Equivalent Matrix Parameters
Process/Business ('pure')	Production/Supply/Support Cost
Over-Production	Production Cost
Waiting	Loss Of Time
Transporting	Ease Of Operation
Inappropriate Processing	Complexity or Communication Flow or Interfaces
Unnecessary Inventory	Production Cost or Amount of Substance
Unnecessary Motions	Length or Function Efficiency
Defects	Manufacturability or Manufacture Consistency or Production Cost
Untapped Human Potential	Interfaces or Tension/Stress
Inappropriate Systems	System Complexity or Control Complexity
Energy And Water	Loss Of Energy/Loss Of Substance (water)
Materials	Amount of Substance or Loss Of Substance
Service And Office	Loss of Substance or Function Efficiency
Customer Time	Supply Time or Support Time
Defecting Customers	Customer Revenue/Demand/Feedback

Figure 2: Mapping The 15 Wastes To TRIZ Matrix Elements
(Matrix 2003 parameters in black; Business Matrix parameters in blue)

The first thing to emerge from examination of the Figure is that there is a fair degree of fuzziness present when matching Lean to TRIZ. We can see this particularly in the 'energy and water' waste category in Lean. Lean is able to group these – in TRIZ terms quite distinctly different parameters – together as it is simply trying to say to Lean practitioners, 'think about environmental type wastes'. The reason TRIZ is forced to treat 'loss of energy' and 'loss of water (i.e. 'substance') as different things is simply that, when we examine solutions that have successfully challenged the prevailing trade-offs, we see that people solving loss of energy problems have used different strategies to those solving loss of substance problems.

As far as TRIZ users are concerned, the main lesson to be gained from this comparison between Lean and TRIZ is simply that the worlds of 'business' and 'technology' are not two separate entities. Lean is built around the idea of identification and elimination of all forms of waste in an organization, and as such makes no distinction between business and technology; the lean enterprise will seek to eliminate both. In other words, 'waste elimination' is a subject for both the technical and the business matrices.

As far as Lean users are concerned, probably the main thought presented by Figure 2 is that, when it comes to the transition from the identification of a waste to the systematic elimination of it, the categories used currently within the Lean framework are often either too general or can be interpreted in several ways, and as such, in their current form do not make it easy to deploy the TRIZ tools. The Figure presents a first attempt at easing the transition from using Lean to identify waste and then using TRIZ to seek to eliminate such wastes without compromise to other factors.

It is our plan to produce a bespoke version of the TRIZ contradiction matrix specifically for Lean practitioners (Reference 4). Such a tool will necessarily have to bridge the gaps

present between ‘business’ and ‘technical’ and will require Lean thinkers to think a little more precisely about how they categorise the different forms of waste.

References

1) Bicheno, J., ‘The New Lean Toolbox’, PICSIE Publications, Birmingham, 2003.
2) Mann, D.L., Dewulf, S., Zlotin, B., Zusman, A., ‘Matrix 2003: Updating The TRIZ Contradiction Matrix’, CREAX Press, July 2003.
3) Mann, D.L., ‘Hands-On Systematic Innovation For Business & Management’, IFR Press, August 2004.
4) Systematic Innovation, ‘The Next Common Sense: Lean-SixSigma-TRIZ’, Workshop.

Evolving Evolutionary Potential

4) Achievable Now And Achievable In The Future

The latest stage in the evolution of evolution potential is in the role of helping to write the strongest possible piece of intellectual property. Typically, the way the concept is used is that we construct a plot for the current system – Figure 1 – and then use the untapped potential to help us to configure the strongest possible set of patent Claims.

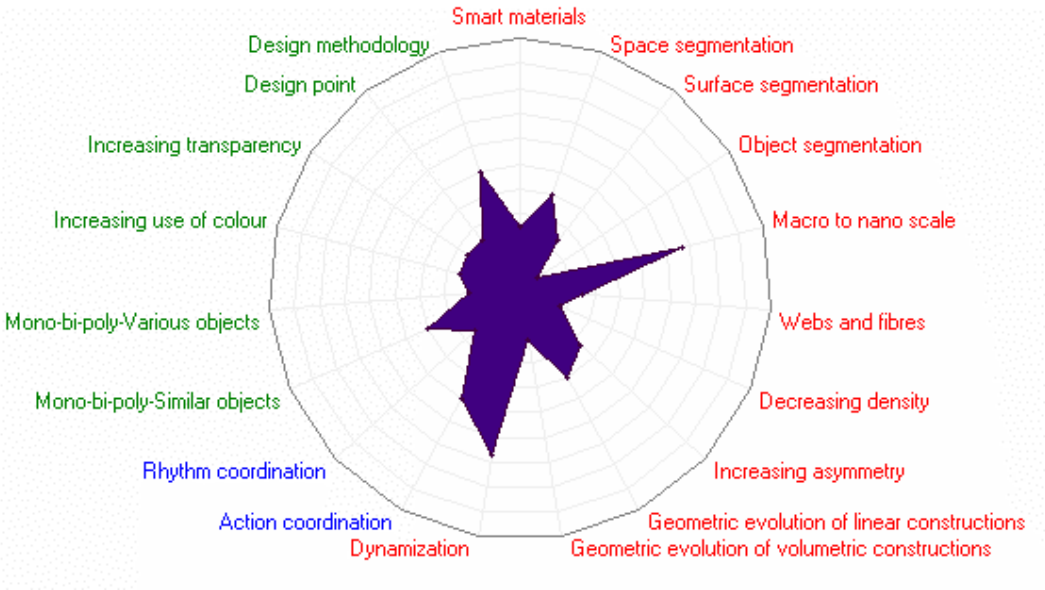


Figure 1: Typical Evolution Potential Plot

Some of the things we need to think about when we are doing this Claim definition job are the rules employed by the Patent Office when determining whether a patent is valid or not. The main four rules for dis-allowing inventive claims are reproduced below:-

* If the claim includes a device already known or in use (‘*Prior art*’)
* If the idea is obvious (‘*contains no inventive step*’)
* If the claim describes an idea in the abstract *(‘What I claim is an internal combustion engine that uses water as fuel’)*
* If the claim describes a new collection of known things *(‘I claim a zip fastener for pillow cases’ ought not to be allowed)*

The second and fourth ‘rules’ tend to be the ones that will make the lawyers rich – since what is ‘obvious’ or ‘a new collection of known things’ are both open to considerable degrees of interpretation. These two probably account for a significant proportion of the 43% of patent claims that will end up being successfully challenged after patents have been granted (Reference 1).

It is the third of the rule, however, that is of concern here: ‘if the claim contains an idea in the abstract’. In some countries, this rule is further expanded into a requirement that the invention has to be ‘produceable by one skill in the art’. In other words, we cannot claim an invention that cannot be realised in a practical sense.

This rule can give us a number of headaches when it comes to using the evolution potential trends to help define the future evolution of a system. The trends, of course, exist

because someone, somewhere has found a way of deriving a solution based on the end stages defined in the trends. But just because someone has managed to evolve a flexible mechanical system into a field-based system – as predicted by the dynamization trend:

- does not mean that I can necessarily claim an umbrella (another flexible thing) that uses a field to keep me dry in the rain.

What is implied, then, is that we need a means of discerning what is 'produceable by one skilled in the art now versus what might be produceable in the future. In practice, such things can only be established on a case by case basis. Figure 2, however, illustrates the basic concept of discriminating between achievable-one-day and achievable-now.

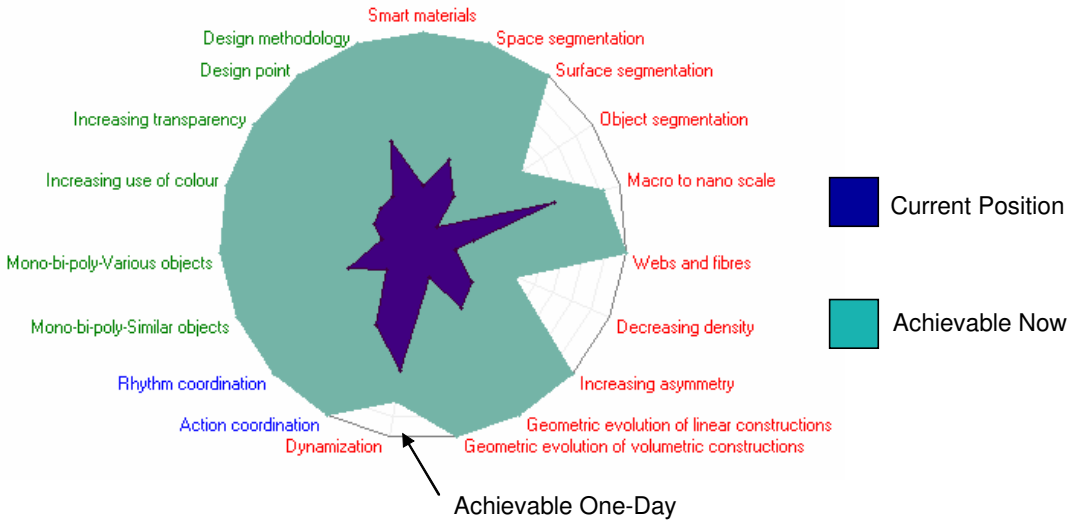


Figure 2: Evolution Potential Plot Differentiating 'Achievable-Now' And 'Achievable-One-Day'

We recommend the construction of such a picture for any serious patent definition activity. Generally speaking – as shown in the plot – the trends where we are most likely to see examples of 'achievable-one-day' will be the dynamization and object segmentation trends, plus the macro-to-nano trends. I.e. we cannot go about claiming our field-based umbrella or picometer dimensional accuracies if there is no means of producing such dimensions with today's manufacture technologies.

What we can do, of course, is to make sure that the invention disclosure that we construct contains all of the jumps predicted by the 'achievable now' shaded area in the plot.

Then, if we are smart enough to then be actively managing an IP strategy, we continue to make sure we know when any of those 'achievable-one-day's turns into 'achievable now'.

References

1) Martin, D., ‘Insurable Patents? Global Metrics For Actuarial Patent Risk Management’, Denmark, October 2002.

Humour

Engineers and Inventive Principles. An oldie, but a goody…

A priest, a doctor, and an engineer were waiting one morning for a particularly slow group of golfers.

Engineer: What's with these guys? We must have been waiting for 15 minutes!

Doctor: I don't know, but I've never seen such ineptitude.

Priest: Hey, here comes the greens keeper. Let's have a word with him.

Priest: Hi George. Say, George, what's with that group ahead of us? They're rather slow today, aren't they?

George: Oh yes, that's a group of blind firefighters. They lost their sight while saving our clubhouse last year, so we let them play here anytime free of charge.

SILENCE.

Priest: That's so sad, I think I will say a special prayer for them tonight.

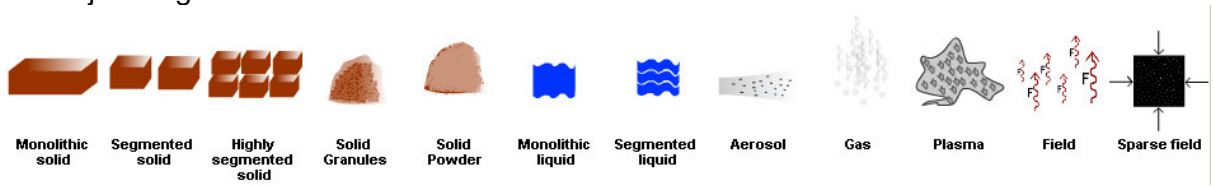
Doctor: Good idea. I'm going to contact my ophthalmologist buddy and see if there is anything we can do for them.

Engineer: Why can't these guys play at night?

Patent of the Month

Our award this month goes to Honeywell for invention US6,795,792, granted on September 21. The invention 'Continuous flow method and system for placement of balancing fluid on a rotating device requiring dynamic balancing' represents a significant advance in the balancing (or rather self-balancing) of rotating systems.

Anyone that has visited one of our technical workshops is likely to have seen an early self-balancing example from the automotive industry. The basic idea we discuss involves the use of dynamic self-positioning of small masses inside a rotating structure. Examination of the object segmentation trend:



will give us the fairly obvious suggestion that as such balancing systems evolve, those masses will get progressively more and more segmented, before they transition from solid to liquid form. It is in fact this jump that is made in the Honeywell invention.

As is often the case with the trends, while they give us the direction of evolution, they do not tell us why or how such a direction will be realized. What the Honeywell patent tells us is that the answer (or one of the answers) to the 'why' question is that the switch to a fluid allows the self-balancing properties to be more readily maintained across a wide range of different operating speeds and conditions.

Matched with a simultaneous advance along the 'Controllability' trend, the inventors appear to have created an extremely effective solution to the balance problem. The following text is extracted from the disclosure abstract:

Methods and systems for continuously transferring balancing mass to a rotating system or rotating device in order to dynamically balance the rotating system or rotating device are disclosed. A flow of balancing mass can be continuously provided to the rotating system at a controlled flow rate. A pump integrated with the rotating system can be utilized to provide via pump the flow of the balancing mass to the rotating system at a controlled flow rate. The flow of balancing mass can be thereafter discharged at a shutter device integrated with the rotating system, such that the balancing mass passes through a window of the shutter device if the window is open. The balancing mass is passed through the window so as to be transferred to the rotating device at predetermined locations, thereby contributing to the balancing of the rotating system. The balancing mass is generally automatically recirculated through the rotating system if the window of the shutter device is closed. The window of the shutter device may be configured as a fixed or adjustable window. The shutter device itself may be, for example, a solenoid actuated shutter or a slotted-disk device. The controlled flow rate to the shutter device may be adjusted for varying control need across the range of rotational speeds. This method and system overcomes flow and timing difficulties experienced with solenoid actuated valve mass transfer techniques.

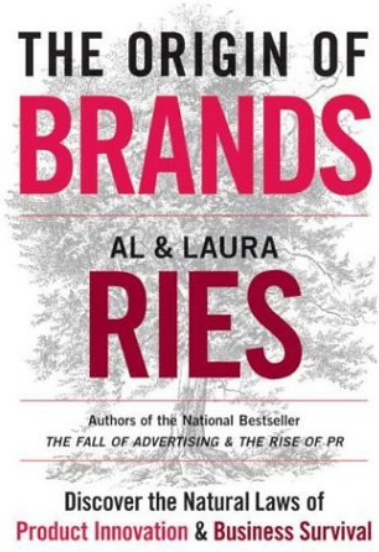
The rest of the patent is also well worth a more detailed examination.

SYSTEM ATIC INNOVAT ION

Best of the Month

Right up to date this month, with the new book from father and daughter authors Al and Laura Ries. You may already know the names from earlier books ‘The 22 Immutable Laws of Branding’ (which aren’t necessarily immutable in strict TRIZ terms) or 11 Immutable Laws of Internet Branding (ditto).

New book, ‘The Origin Of Brands’ is someway short of describing the importance of the contents, and so we need to go to the sub-title ‘discover the natural laws of product innovation and business survival’ to get a better flavour of the value of the book.



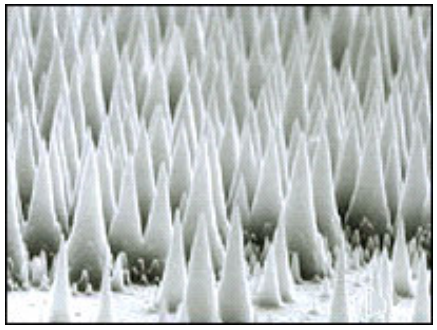
In actual fact, the book is little more than an exposition of the TRIZ Mono-Bi-Poly trends and the system-complexity-increases-and-then-decreases phenomenon. What makes the book so valuable is the number of case studies presented and the wonderful Darwinian ‘tree-of-life’ analogy.

I picked up the book in a Hong Kong bookshop and read it from cover to cover with as few interruptions as possible. Highly recommended for anyone interested in TRIZ (the book never uses the word of course), irrespective of your interest in branding. TRIZ devotees, however, might wish to skim through the 60 or so pages devoted to making a futile convergence-versus-divergence argument; in any kind of either/or situation like this, we know that the answer is ‘both’: convergence happens sometimes and divergence happens sometimes. What the Ries’s do is balance up the argument more in favour of divergence.

Buy the book here:
http://www.amazon.co.uk/exec/obidos/ASIN/0060570148/qid=1097994269/sr=1-8/ref=sr_1_11_8/026-9770702-6003606

Investments – Nano-Turf

Professor CJ Kim's micro-manufacturing laboratory at UCLA is where we head for this month's recommendation. Although first brought to widespread consciousness by a BBC World article last year, the story has not advanced too far since. We feel the time is now right for the ramp-up to take place, given that we have seen many companies struggling with problems of drag and water resistance in recent months. One of the projects in the lab, then, is so-called 'nano-turf:



The material surface is highly water repellant. The 'turf' spikes are densely populated so it will let the water flow against air instead of a solid surface, which makes it very slippery. Quotes Professor Kim, "when we roll a drop of water on this surface, we make it 99%, or more, less sticky than the flat surface."

The BBC article talks about non-stick submarines and (expensive) raincoats, but this is really just touching on the immense number of possible applications. Over to you…

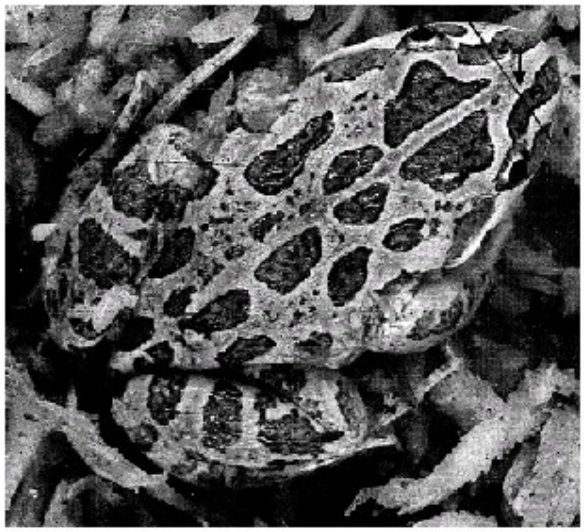
Biology – More About Deception

While searching around for examples of deception in preparation for last month's biology example we came across 'Motion illusions & active camouflaging' at http://www.ucl.ac.uk/~ucbplrd/motion/motion_middle.html and decided that it deserved a special article of its own.

One of the sections in the paper covers the subject of deceiving edge detectors. From the paper:-

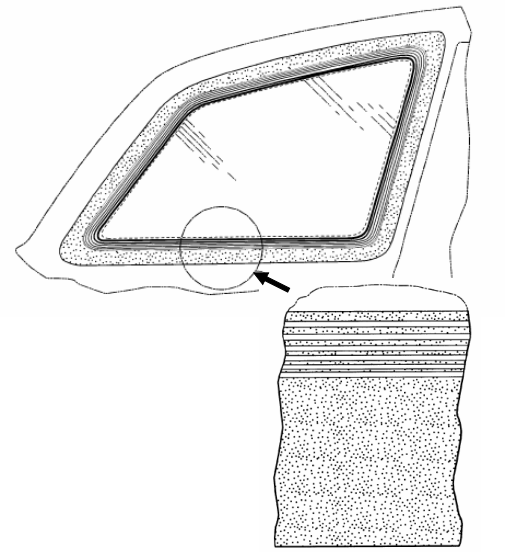
Osorio & Srinivasan (1991)[10] present evidence that some cryptic patterning has evolved to exploit a very specific feature of a predator's visual system. The Australian frog, Limnodynastes tasmaniensis, utilises border enhancement, with the edges of pigment regions sharply demarcated with adjacent narrow black and white bands, as seen in (the Figure). Its main predation threat is from snakes and birds... It is believed, therefore, that these markings have evolved to directly effect a predator's visual system, specifically by super-exciting edge detectors. The high contrast contours must be perceptually indistinguishable from 'natural' step edges to the predator's visual system, otherwise they would provide a distinctive 'prey signature' for the snake to target.

In simplified terms, what appears to have happened with Limnodynastes tasmaniensis is that it has evolved a camouflage pattern that not only matches the frog colouring to its favoured habitat, but also effectively deceives its prey by using arrays of dark and light coloured areas that hide the frog-shape. As can be seen in the Figure, the patterning makes it very difficult to make out where the frog starts and ends.



In TRIZ terms we see here an example of Principles 1, Segmentation, 3, Local Quality, and 4, Asymmetry in action.

We can see much the same strategy in action (albeit with less Asymmetry – probably due to manufacturing constraints) in many image-enhancement software tools and, perhaps more visibly to most, in the edge patterns found on many windows, where there is a desire to blend the transition from one surface to another for aesthetic reasons. From an evolutionary standpoint, the emergence of the straight edges present in any mass-manufactured goods is quite unnatural to the human eye; which has spent the vast majority of evolutionary time looking at naturally curved and edge-blended shapes.



The higher degree of sophistication obtained by nature's solutions perhaps offers a number of thoughts regarding the future improvement of such designs.

Meanwhile, the entire paper is highly recommended for those wishing to obtain more information about illusions and camouflage.