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# Systematic Innovation

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**e-zine**

Issue 43, October 2005

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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.

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## ‘Less Than Zero’ Psychological Inertia

One of the exercises we frequently conduct on workshops asks delegates to define attributes of a system and then define how different parts of the value chain might define the Ideal Final Result outcome for that attribute. Typically we will be constructing a table of the sort illustrated in Figure 1. The main reason – during the exercises at least – for constructing this table is not so much for the IFR numbers that get written down, but for identifying the conflicts between different parts of the value chain, different users and different attributes.

Attribute	Customer IFR	Supplier IFR
Size		
Weight		
Efficiency		
Aesthetics		
Life		
Cost		
etc		

Figure 1: Typical IFR Attribute Conflict Table

Our interest in this article is not so much on the conflicts that the table helps to identify, but on some of the numbers that people tend to write in the various boxes. In the large majority of cases (particularly when it is engineers filling the table in) there is a strong reluctance to write in ‘0’ for physical parameters like size and weight. This is because as technical people we ‘know’ that there is no such thing as a paper stapler, say, that weighs nothing and has no size. One of the great aims of the IFR tool, of course, is to encourage people to make precisely this kind of ‘out of the box’ statement.

Even less frequent than writing zeroes in the boxes is the situation where people will write a negative number in the boxes. This phenomenon is most common when we get to the cost related attributes of a system. Most people are quite happy to write ‘0’ as the ideal final result customer cost, and will in fact do precisely that. Almost none, however, will finish the exercise having written something that has veered over into the negative cost regime.

This in itself is an important piece of psychological inertia. Zero cost, or ‘free’ is an important psychological end-point. But of course in reality it is merely a point along a continuum, merely marking the transition from positive to negative. The point here is that we need to be aware when we make these kind of judgements about what an ideal actually is.

The zero cost one is a particularly important one as there are many sectors where that ‘end point’ has already been reached. It is becoming particularly common in fact in the financial services, IT and telecommunications sectors. This has happened in part due to the intense competition in these sectors, but also because the advent of increasingly automated systems makes it a practical reality.

The financial services sector in particular has already had to enter the less-than-zero ideal final result cost scenario in many of its offerings: If every bank is offering about the same services and returns, then increasingly the answer to the question ‘how does my bank attract customers?’ question becomes ‘by paying the customer’ to utilize its services.

Progressively more and more companies are finding themselves facing this situation. Reference 1, to take another example, describes IBM's adoption of the open source Apache web-server software and the adoption of a win-win business model in which they are still able to make a successful business by giving something away.

Whether IBM will be able to sustainably make a living from their relationship with Apache remains to be seen. One thing for certain is that the web-server market will not remain static. Any new player wanting to get into the business, for example, would immediately be faced with the challenge of displacing a system that is already 'free' in the eyes of its users.

Web-server platforms haven't quite made the leap into the negative yet. But several other sectors have. An interesting recent example comes from GetLocalNews.com (Reference 2). Here's an excerpt from their introductory press release:

Most people who write blogs just do it for kicks - as a way to vent, be creative and connect to a community.

But profit motive may soon be added to the mix. GetLocalNews.com, a nationwide network of 6,000 local news sites, is planning to share its advertising revenue with thousands of volunteer writers.

The idea is to reward and motivate contributors whose stories and photos generate the most traffic, which in turn fuels ad revenue, said Edgar Canon, chief executive of the San Francisco company. He hopes the quality of contributions improves, too.

But it's also the principle of the matter. "I think the writing-for-free thing is kind of demeaning to content producers," Canon said.

It's a smart move and a concept that may catch on among more commercial blogs, said Steve Outing, a senior editor at the Poynter Institute journalism school. "You've got to figure out a way to entice people to contribute," Outing said.

It may also further blur the line between professional journalists and amateur scribes - a line already made fuzzy by the rise of blogging.

At GetLocalNews, which started in 1999, it helps to be established. In its earlier years, the company had little left over from its start-up costs to pay writers.

Now the company will pay writers half the net ad sales their stories garner, Canon said. That figure is based on each story's 'page views', or the number of times visitors view its web page. Canon expects it to work out to about \$2 to \$5 per 1,000 page views. The company will send checks quarterly to all writers that rack up \$25 or more in payments, he said.

The company publishes up to 4,000 stories on a good day, nearly all of which are submitted by amateurs from across the country. Its most frequently visited site, BeniciaNews.com, covers the San Francisco Bay Area suburb of Benicia, California, and gets as many as 5,000 page views per month, Canon said.

The idea of 'less than zero' cost is perhaps a little more difficult to conceptualise in markets where tangible goods are being offered. Certainly it is difficult to find examples out there at the moment that are anything other than a temporary gimmick. Our prediction though is that we will increasingly see these 'we pay you' models. And that the first place we will see it is in markets like those consumables sectors where the company first gives away a product into which only their consumables will fit. 'We pay you to try our new razor' is probably not too far away from being a business necessity. The key for businesses is overcoming their own psychological inertia and finding ways of doing the less-than-zero impossible.

## References

- 1) Wind, Y., Crook, C., 'The Power Of Impossible Thinking: Transform The Business Of Your Life And The Life Of Your Business', Wharton School Publishing, 2005.
- 2) <http://www.benicianews.com/cjpinfo.cfm>

## Defining Breakthrough Solutions 2) – Functional Connections

*'Only connect'*  
E.M.Forster



*“When consumers buy a product, they are really hiring the product to get a job done for themselves. The jobs we are seeking to get done in life are remarkably stable. Companies are successful when they make it easier for their customers to get done something they historically cared about.”*

Clayton Christensen, ‘Seeing What’s Next’ (Reference 1)

Think for a second about the Segway. At the time of its public launch at the end of 2001, inventor Dean Kamen was predicting that he would shortly be building 10,000 machines a week to meet demand for the product. One of Kamen’s leading investors was predicting that the company would reach \$1B faster than any other firm in history. So what went wrong? Why has the Segway, shown in various poses in Figure 1, become the butt of a thousand and one jokes and almost as many scenes in science fiction movies?



**Figure 1: Segway – An Advertising Person’s Nightmare?**

Certainly the answer to this question has nothing to do with the focus of our earlier article on defining ‘breakthrough’ (Reference 2). The focus of that article was the Evolution Potential radar plot, and the idea that breakthrough solutions were almost invariably symbolized by a radar plot that was more developed than the equivalent plot for the

system that came before it. To all intents and purposes, a radar plot for the Segway would indicate that it meets this breakthrough criterion. The Evolution Potential success criterion, therefore, although 'necessary' to help us define 'breakthrough' cannot be viewed as 'sufficient'. Clearly something else is there in the picture when we think about the Segway. And indeed the same applies when we think about other notable 'breakthroughs' that turn out not to be.

The key to our understanding of the next 'necessary' aspect in a true definition of breakthrough, then, forces us to think in more detail about the preceding radar plot definition. The key phrase here is 'more developed than what came before it', and the key connection we need to make relates to the TRIZ pillar 'function'.

One of the reasons we haven't drawn a comparative radar plot for the Segway versus its predecessors or equivalents is that it doesn't appear to have any. Sure, we could have drawn a plot for the Segway on top of a plot for a car? Or a scooter? Or a skateboard? Or, err... It is precisely that doubt where the key problem of the Segway lies as far as its potential customers are concerned; what to compare it to?

The general rule here being that if a potential customer cannot link the function delivered by your 'breakthrough' idea to a function they need to get done, then your product is very unlikely to succeed. Moreover, according to the wonderful quote from the most recent Clay Christensen book at the start of the article – in which his word 'job' is a very definite equivalent to our word 'function' – not only must customers be able to connect to something they want to do, but they must see that the newcomer does the job better.

Here's where things perhaps start to get a bit tricky. What is the function of the Segway? According to the marketing blurb it is a 'personal transporter'. So the function is transport? At least when we think about tangible functions, that would certainly appear to ring true. So why doesn't the Segway succeed in the market? It is more compact than a scooter, faster than walking, and easier to learn than a skateboard. Why didn't these advantages allow it to succeed?

The answer we think emerges only when we delve into the detail of what we mean by 'transport'. And by delving into the detail we mean examining some of the attributes of the transport function. We can help make this process more systematic by thinking about the 5Ws and H, and particularly the who, where, when, why and how questions. Thinking about 'where' for example might get us to realize that we are in the ground-transport business. Within this sector there are then road, rail, pavement (sidewalk) and 'off-road' categories. The Segway is intended to fit in the 'pavement' category – in that it doesn't go on rails, it isn't appropriate for roads or off-road situations. So far so good; Segway is in the pavement-transport business.

Next up is 'who'. Since we are in the pavement business and the system is designed to be self-balancing, and therefore easy to ride, we might answer this question as 'everyone that might use a pavement'. That assumption would certainly seem to fit with Kamen and his investors' perceptions anyway. Still no problem. Now we are in the pavement transport business and our customer is anyone currently traveling on foot.

Now what about the 'how' question. The most immediate connection here is that the Segway is a powered form of transport, as opposed to one that is human-powered. At this point we appear to have at least the start of a problem; powered transport is not supposed to go on pavements. The problem becomes worse when we think about another aspect of 'how', this time speed. The Segway is designed to travel at speeds up to 12mph. As soon as customers see this speed aspect of the Segway, we think that a number of distinct

disconnects start to emerge: first because there is no precedent to say that powered devices should travel on pavements, it becomes difficult for the customer to compare the Segway with something they know. Secondly, even though 12mph sounds like people will get from a to b more quickly, there is a second disconnect in that pavement traffic does not travel at 12mph. Actually it travels at 2 or 3 mph.

The disconnects become even worse when we take on board some of the 'when' aspects of the system. Is this an everyday product? Do I use it when the pavement is full of other people? When it is raining? What do I do when I want to go into a shop? Do I leave the Segway outside or bring it in with me? Again, it becomes very difficult for people to connect the Segway with a job that they want to get done.

Maybe the speed difference becomes less important when everyone is on a Segway, and maybe the convenience issue becomes resolved if shops are designed for people to enter on their Segways, but until those sorts of things happen, it is beginning to feel like the machine is not making it easier for users to 'get their jobs done'.

In the final analysis, the Segway, in the way that it was presented to the market, makes little or no functional connection to the needs of just about any of its target users. Hence it is almost inevitably bound to fail in today's world. And it will continue to fail until such times as Kamen can find a way of connecting the Segway to a functional requirement in which the myriad plus points of the system can actually be exploited by the user. Like as a form of transport along the decks of super-tankers. Or in warehouses.

The Segway, of course, isn't the only product to reach the market without recognizing the need to deliver a function better than its predecessors. Still in the field of transport, although this time shifted from pavement to road is the classic (as in UK national joke type definition of the word) C5 electric car shown in Figure 2.



**Figure 2: The Sinclair C5: Road Safety Anyone?**

The functional disconnect with the C5 was primarily safety related. The fact that the C5 was open top and around half the height of a car meant that the attractions of green-power were almost always negated for all but the most dedicated of environmentalists. The functional disconnect here was primarily about 'where' and 'what'.

Not quite as famous as the Segway or C5, but nevertheless a product that found its way onto the market as a 'breakthrough' is the garlic cake (Figure 3). An evolution potential radar plot for the garlic cake is easy to plot on top of a radar plot for a normal cake. All else being equal, the addition of the garlic would look like an advance along the Mono-Bi-Poly trend and hence it could look like a 'breakthrough' confectionery concept. Alas, however, here too we will find a functional disconnect between what a consumer expects to see featured inside their cake and what the chef decided to include. The 'what' mismatch between sweet and savoury is profound enough to prevent all but the bravest to

contemplate cutting themselves a slice.



**Figure 3: Garlic Cake Anyone?**

Note too the cake packaging concept – which serves to create yet another functional disconnect in the mind of the consumer. Cake. In a jar? Are you sure?

### **Only Connect**

The general message from the garlic cake and Segway alike, is that if you are presenting something new to the market, the consumer needs to have some kind of functional datum to which they will connect and therefore compare your offering with their prevailing expectation.

If they can't make that connection, or if the connection they make shows that your product does the job less well than the incumbent product then, tempting as it might be to try launching your garlic cake onto the world, history says that your chances of success are somewhere between slim and non-existent.

### **References**

- 1) Christensen, C.M., Anthony, S.D., Roth, E.A., 'Seeing What's Next: Using The Theories Of Innovation To Predict Industry Change', Harvard Business School Press, 2004.
- 2) Systematic Innovation e-zine, 'Defining Breakthrough Solutions', Issue 41, August 2005.

## **Humour – The Projector Manufacturer**

Here's a scene from a recent workshop with a bunch of designers based at a well known manufacturer of LCD projectors.

I arrive on the first morning of the workshop a few minutes early as usual. This allows me time to get through the security checks at the company's reception, find the conference room and generally get myself set up for the workshop. No problem with the first two of these activities. Not much different happened with the setting up part either. Or rather not much different to what normally happens – the laptop gets switched on, gets connected to the LCD projector, press F5 a few times, and then get the projector lined up with the screen. During the last of these activities, I find myself watching someone else do the job. Someone from the company. Quite a few of the delegates have arrived at this point, and they start doing the same.

The person doing the actual adjustment job then discovers a problem. He cannot get the image from the projector high enough on the screen. So he tries moving the projector further away from the screen. No difference. Checks the legs are fully extended. They are. Still no difference. Now he starts looking around the room for assistance. Finds it in the shape of a copy of Hands-On Systematic Innovation. Would it be okay if he borrowed it? Sure, no problem I say, this is why I bring it.

So the book goes under one of the legs. Now the image is slightly too high. Also the legs are too far apart and so only one of them is under the book. Could he borrow another copy? Again, no problem. So in goes the second book. Followed by a few more seconds of re-adjusting the legs.

I look at the other delegates. Most of them seem to be watching what is going on. I say, 'can anyone see a design flaw here?'

No reaction.

Perhaps I have used a word they don't understand, 'err, can anyone see a design improvement opportunity here? With your projector?'

Still no reaction.

We start the workshop. I skip over the first 40 slides and begin from the group marked 'Hidden Failures and 9-Windows'.

## Patent of the Month – Controlling Surface Chemistry

We are sometimes asked about the sequencing of the two measurement related parameters placed at positions 47 and 48 of the 2003 Contradiction Matrix tool. All of the other Matrix parameters are sequenced according to their typical priority sequence in the evolution of a system through its s-curve. The two measurement parameters don't fit into this sequence particularly well. This is because the things we wish to measure will vary. Actually it will vary in accordance with position in s-curve. So, for example, as the attention of designers shifts from 'make it work' to 'make it work properly', it becomes necessary to find ways of measuring the performance of the system. Then later, as attention shifts to, say, 'reliability', designers need to find ways to measure reliability. And so on.

Measurement can also play a significant role in helping to find new s-curves. The creation of techniques that allow engineers and scientists to measure things that they previously have not been able to measure often acts as the spark for new levels of understanding about the way the world works; which in turn then tends to provoke a whole series of discovery type inventions.

Our patent of the month this month is one that has very much emerged from this kind of starting point. Inventor Professor Artur Utz from the Chemistry Department at Tufts University in Boston has a long established research programme on chemical reactivity at the gas-surface interface. The stated goal of Professor Utz's work is to unravel the mechanisms of gas-surface interfaces on a molecular level. According to the relevant web-page, 'such a microscopic understanding is crucial not only for successfully modeling existing processes, but also for directing the design of new catalysts and materials deposition techniques'.

The patent is US6,951,827, granted on October 4:

**United States Patent**

**6,951,827**

**Utz , et al.**

**October 4, 2005**

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Controlling surface chemistry on solid substrates

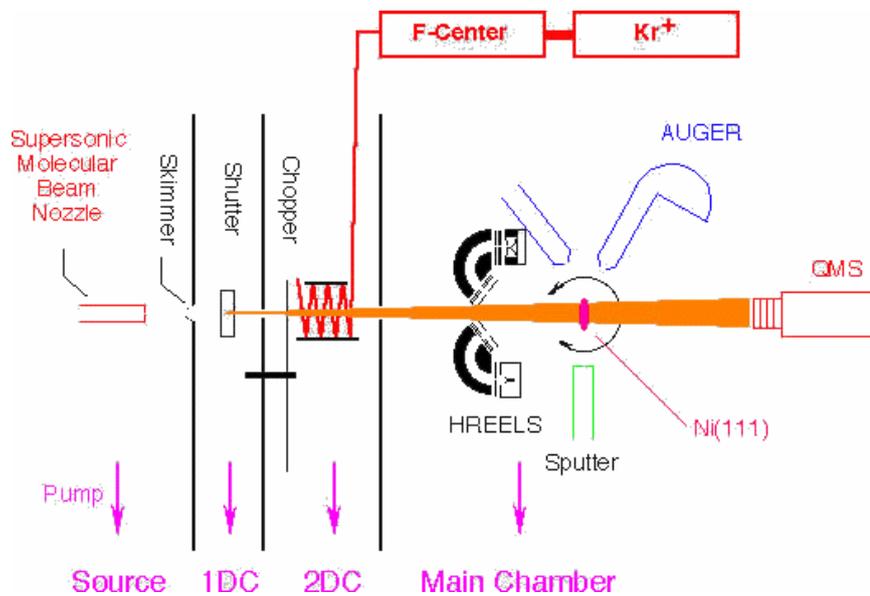
### Abstract

By exposing precursor molecules traveling in a molecular beam to a narrow bandwidth laser beam ( $\nu$ ) tuned to a vibrational resonance frequency of the molecules and aimed orthogonal to the molecular beam (FIG. 6A), only those molecules having velocity ( $v_a$ ) along trajectory (A) orthogonal to the laser beam are excited, becoming several orders of magnitude more reactive, affording a high degree of control over precise locations of reactions of molecules. Controlling a reaction on a surface of a solid substrate, includes; (a) obtaining a precursor molecule that includes (or can be reacted to form) species to be reacted with the substrate; (b) creating a molecular beam (eg., supersonic) that includes the precursor molecule; (c) vibrationally exciting the molecule with the laser beam tuned to a vibrational resonance frequency of the molecule; and (d) causing the exciting molecule to impinge on the substrate, enabling reactions (deposition, etching . . . ) of the species with the substrate.

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Inventors: **Utz; Arthur L.** (Boxborough, MA); **Juurlink; Ludo B. F.** (Leiden, NL)

Assignee: **Tufts University** (Boston, MA)



The invention is very much about the transformation of a useful discovery made while measuring surface interactions at the molecular level. While there are potentially many applications of the discovery, the focus of the invention disclosure is primarily on better ways of applying coatings to materials. Both coating and target substrate coatings could take a wide variety of different forms. The invention disclosure, however, makes particular reference to semi-conductor and metal-based sectors.

As described in the invention disclosure, the discovery:

*..that reactions occurring at the surface of a solid substrate can be controlled by exciting precursor molecules traveling in a molecular beam impinging upon the solid substrate by exposing the precursor molecules to a narrow bandwidth laser tuned to a vibrational resonance frequency of the molecules, and aimed orthogonal to the trajectory of the molecules. Such vibrational excitation increases reactivity of the molecules by up to 1600-fold or more, relative to non-excited molecules. The new methods allow for a narrow region of laser-enhanced reaction on a substrate surface even where the entire surface of the substrate is exposed to the molecular beam. Excitation conditions can be adapted, for example, to allow the precursor molecules to react in a single stripe, or a set of equally spaced parallel stripes on the surface of the substrate.*

By any stretch of the imagination a 1600-fold increase in reactivity from a proportionately tiny input of energy represents something that is interesting. This kind of input-to-output magnification, or lever effect is one of the reasons why TRIZ places so much emphasis on the use of resonance as a resource.

Having discovered the lever effect, the next challenge involves working out why and how it might be useful. In the case of the Tufts work, the benefit appears to be multiple; from the creation of stronger bonds, to more consistent, predictable manufacture, to the ability to coat very small regions very accurately. Traditionally, the inventors note, the desire to achieve all of these benefits is typically hampered by a number of effects. Again from the invention disclosure:

*Dissociative chemisorption is affected by a number of parameters that complicate experimental efforts to unravel the reaction mechanism. Translational, vibrational, and rotational energy in the gas-phase reagent, surface temperature, surface structure, and the orientation and impact parameter of the incident gas-phase molecule can all affect the outcome of the gas-surface encounter*

Because what we have here is an invention based on a discovery, it is very difficult to relate it to the resolution of a contradiction. This apparent absence of a contradiction is common for systems at the very early conceptual stage of their evolution. We can, of course, interpret many contradictions that the discovery now allows to be solved, but none in particular appear to be the focus of the inventors research.

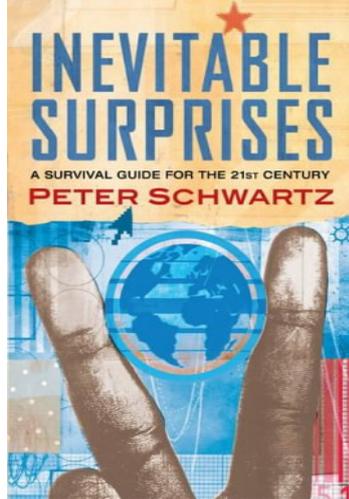
This being the case, it is difficult (or irrelevant) to map the invention onto the Contradiction Matrix. Is it, for example, an accuracy of manufacture versus temperature, or accuracy versus energy or strength versus shape or strength versus angle or any one of a host of other conflict pairs? Answer; we could map the invention onto all of them and probably more. But would that serve any useful purpose? Probably not in our view.

What we can say far more clearly, however, is which of the Inventive Principles lies at the root of the invention. Thus even though we are talking about a 'discovery' here, in the final analysis that discovery may be seen to emerge from the combination of just two known Inventive Principles; firstly Principle 18C, 'Vibration – 'make use of an object's resonant frequency', and Principle 17, 'Another Dimension' – where a laser oriented orthogonal to the direction of motion of a molecule acts as the second trigger to the lever effect.

Although it is difficult to say with any kind of certainty (another phenomenon of discovery type inventions), our bet is that there is much in Professor Utz's work that will have a potentially profound impact on a number of production coating processes.

## Best of the Month – Inevitable Surprises

Very few of the myriad books on trends and predicting the future make it through our initial filter. Even fewer turn out to have anything of significance to offer the overall systematic innovation story. A noble exception is *Inevitable Surprises* by world renowned scenario planner, Peter Schwartz:



Schwartz's tome makes the cut thanks to its focus – as the title implies – on trends that are in effect pre-destined to happen. Schwartz uses the elegant analogy of rainfall in a mountain range finding its way along a river to the sea as a way of defining trends that will make it into his book. The basic idea being that heavy rain in the mountain will inevitably create a surge of water that will progressively make its way along the river to sea.

Many demographic trends fall into this 'inevitable' category; a baby boom in the 50s and 60s inevitably creating a population 'wave' that will lead to an enormous surge of pension-age people starting from the 2010 period. While useful to see such trends collected together in one place, the book transforms itself into an 'essential' trend text when it features some far less obvious inevitabilities.

Like for example the 116 Chinese men born to every 100 Chinese women (an un-intended consequence of China's birth control policy in the recent past), which will create an excess of 500,000 males reaching marriageable age every year for the next 20 years. Or how about the inevitable surprise of increasing amounts of Spanish words finding themselves integrated into everyday language as a result of the growing proportion of Spanish speakers into the US? Or (perhaps more controversially) the inevitability of radical climate change in the foreseeable future, or the inevitability (thanks to the – according to Schwartz – failure of governments to set in place appropriate counter-measures) of some kind of pandemic wiping out large numbers of people, again in the foreseeable future.

If this latter entry sounds somewhat bleak, it is countered by Schwartz's assertion that the much-vaunted population explosion now looks like human population will 'inevitably' peak at something like 9 billion. Or that 'inevitable' technology directions will generate 'greener' products (something we have long been saying in fact in our work on sustainability and the dynamics of the ideality equation).

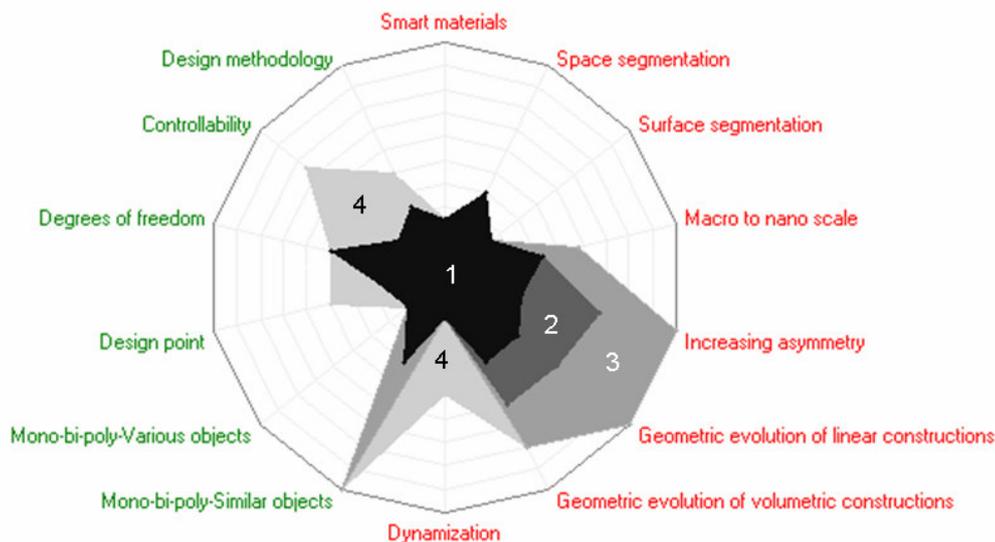
All in all, the book is a highly compelling read. Whether or not you agree with all of Schwartz's assertions and assumptions, that shouldn't stop you from admiring the chain of thought that takes apparently minor perturbations into some fairly profound and inevitable downstream consequences.

## Conference Report – IMechE Compressor Conference, London 5-7 September, 2005.

A fairly short report this one, since we were only able to attend the conference for one of its three days. We were there to present a paper on the future potential and limits to the evolution of compressor systems. Our paper focused primarily on gear and piston type compressors, although the same exercise could have been repeated for any of the other kinds of compressor featured during the conference programme.

Considering that this event was one of the few occasions where the compressor industry has to get together to discuss technology and technology advances at an engineer-to-engineer level, the quantity of breakthrough ideas and innovative new directions on show was notably sparse.

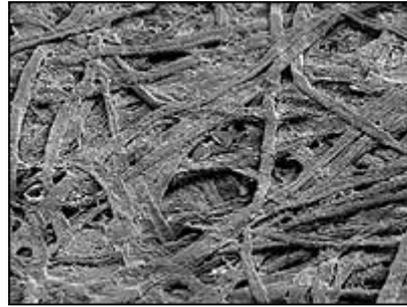
But then again, perhaps this shouldn't be too great a surprise given that our paper had indicated that the gear-type compressor industry had averaged something like 1 trend jump per decade since the first pumps emerged during the first half of the 19<sup>th</sup> century:



The conference was attended by around 120 delegates from around the world. The split between industry and academia seemed to be somewhere around 50:50, which gave the overall event a refreshingly healthy feel.

According to our 'discontinuity rate' calculation, the next conference will be the one where someone will be presenting a paper on an innovation in the industry that, when we reverse engineer it, will turn out to represent the predicted one trend jump. Perhaps emerging awareness of the trends (our usual head-count of TRIZ-familiar delegates at the start of our presentation revealed about 6 out of about 70 (somewhat lower than usual)) might have something to contribute to making this outcome come true. We await the 2007 conference with baited breath.

## Investments – Paper Fingerprints



At a time of rising concern about terrorism, British scientists recently announced that they had discovered a relatively inexpensive and surprisingly powerful new way to defeat forgers attempting to fake birth certificates, passports, and other documents.

The scientists built a laser scanner that sweeps across the surface of paper, cardboard, or plastic, recording all of the unique microscopic imperfections that are a natural part of manufacturing such materials. This scan serves as a fingerprint which, the scientists said, has two surprising properties: The fingerprints are robust, surviving scorching, dousing in water, crumpling, and scribbling over with pens. And these fingerprints depend on structures that are so complex and so small -- on the scale of between one tenth and one ten-thousandth the diameter of a human hair -- that nobody on the planet will be able to copy one for the foreseeable future. Unlike other methods such as using holograms or special inks, the fingerprint is already there. What we have here, in other words, is a natural resource capable of delivering an 'ideal final result' function. To authenticate a passport, for example, someone would scan one of the pages at a predetermined spot, and compare the results to a scan made when the passport was first issued.

"This is a whole new approach to countering fraud and counterfeiting," said Russell Cowburn, who led the research and is a professor of nanotechnology at Imperial College London.

If the technique, which is described in the current issue of the journal *Nature*, proves commercially practical, then it could find a wide range of applications, from securing official documents like birth certificates, passports, and identification cards, to preventing fraud by checking the packaging of pharmaceuticals, cigarettes, and other items to -- to take a commonly experienced problem in the computer printer industry -- knowing precisely where a piece of paper is in relation to the print-heads.

Already, there are security technologies, such as human fingerprinting and hand and iris scans, which identify people by the natural differences among them. This seeks to expand that idea -- using a laser scanner that costs less than \$1,000 -- to the world of products. "If it all pans out, the implications could be huge," said Peter Schroeder, a professor of computer science and applied and computational mathematics at the California Institute of Technology. "It is a very neat idea and like a lot of ingenuity, it seems obvious in retrospect." (Note the word 'obvious' -- a very strong indicator of a TRIZ-like solution.)

A British company commercializing the technology, Ingenia Technology, has been talking with officials at the U.S. Government Printing Office, which prints passports, and the National Institute of Standards and Technology, a federal agency that advises the government on security and a wide range of technology. The Government Printing Office

is planning to conduct an independent test of the scanner in the next few months, according to Michael L. Walsh, the chief technical officer there.

The scientists made the discovery, said Cowburn, after a bad glue job. The laboratory was looking for a new method of securing documents using chips with very small features that could be read by a laser. The chips are difficult to manufacture, Cowburn said, and thus were seen as a way to discourage forgers. One day, though, a scientist got a signal that was strong, but completely different from what was expected. The reason: The chip had fallen off the paper.

Seen at extreme magnification, a seemingly smooth sheet of paper looks like a tortured landscape of sharp cliffs and deep valleys, made by the way the individual paper fibers fell together when the paper was manufactured. This landscape is what gives each piece of paper its unique fingerprint, with no need to manufacture a special chip.

The scanner works by shining a line of laser light on the paper, according to the Nature report. As the light sweeps across the paper, the intensity of light varies at the scanner's four light detectors. A record of these intensities is the fingerprint. The team showed that they can verify a document -- matching a scan to a previous scan of the same document -- with very high accuracy, as long as the area scanned is the same. The method is flexible enough, though, that the center of the area scanned only has to be close to the center of the one scanned before -- within a few centimeters horizontally and a few millimeters vertically, according to Cowburn.

The research was funded by investors, and Cowburn has a financial stake in Ingenia Technology, where he serves as one of the directors.

For more details, check out: <http://www.imperial.ac.uk/P6720.htm>

## Biology – Burrowing Owl (*Athene cunicularia*)

As its name suggests, the burrowing owl makes its home in underground tunnels on the ground. This shift from elevated to a floor-level accommodation arrives with a series of trade-offs and compromises. Not least of these is that being on the ground makes the nest vulnerable to intrusion by potential predators.



One of the great over-riding factors determining evolutionary success in nature is that life-forms make best possible use of their available resources. The process of natural selection tends to have give very little tolerance for waste. By devoting its precious resources to defending its nest, the burrowing owl is inevitably forced to compromise on other factors. Thus, should it decide that posting guards would be a way of securing the nest, the compromise involves time which can no longer be spent doing other things. Or the owl could expend energy flying over the nest site, or (more likely) it could have evolved sophisticated intruder detection and tracking systems. The burrowing owl, however, has found a much more resource-efficient way of tackling the problem: make a sound like a rattlesnake. Imitating a creature more dangerous than yourself – especially when you do it simply by imitating the noise of that creature – is an extremely resource efficient solution to the problem.

We might map the burrowing owl problem onto the Contradiction Matrix by choosing the following conflict pair:

Improving Factor	Worsening Factor	Principles				
Security (37)	System Complexity (45)	2	6	4	17	13
the burrowing owl wishes to secure its nest, but without having to develop 'expensive' detection systems		26				

Even we were surprised with the accuracy with which the burrowing owl's solution matches the recommendations from the matrix:

Principle 2 (Taking Out)

– imitate the sound of the rattlesnake without the rest of the rattlesnake

Principle 26 (Copying)

- 'use simple and inexpensive copies in place of expensive, possibly vulnerable objects or systems'

Principle 6 (Universality)

- 'make an object able to perform multiple functions, eliminating the need for other systems

## News

### **Business Strategy Workshop**

We will be repeating our two-day 'TRIZ for Business Strategy' workshop on 6-7 December. See the diary page of the website for more details. The venue will be....

### **New Office**

Our new UK headquarters offices will be opening during November 2005 in Clevedon, near Bristol. The building is now complete, the carpets go down on 15 October, and the furniture starts arriving from 24 October. The offices will act as a central point for our project work and as a venue for our and other peoples' workshops and events. Expect to see a special opening event to take place during the early part of 2006.

### **Focused Workshops**

November sees the first of our technical TRIZ workshops focused on specific industries. This event – to be held in Kuala Lumpur – will focus on the automotive industry. Future events (for the first half of 2006) will include similar events focused on the bio/pharma, ICT, and food industries.

As per our normal convention, teaching of the TRIZ tools will be done through a combination of real life case study examples taken from the relevant industry, coupled with user exercises on their own problem and opportunity situations.

### **International Dissemination Seminar**

The year-long TRIZ deployment into China ends with a one-day seminar in Hong Kong on 4 November. There will be presentations from each of the companies taking part in the programme, highlighting what they got out of TRIZ, both in terms of new knowledge and new products and processes. See the website diary for more details.