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In this month's issue:

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New Trends – 'Nest-Up' And 'Nest-Down'

(And Their Connections To Inventive Principle 7)

Given the convergent nature of the evolution of systems and the existence of only a small set of tools pointing users towards useful solutions, it should not be too big a surprise to learn that there is considerable overlap between such tools. The two most frequently used tools in the TRIZ armoury are the Inventive Principles and the Trends. Overlap between the two is nowadays rapidly approaching 100%. One of the few apparent areas of difference is the lack of a direct parallel to Inventive Principle 7, Nested Doll, in the Trends.

Awareness of the gap has prompted us to be on the look-out for 'Nesting' trends for some considerable time now. Despite finding a considerable number of examples of nesting trends, it is only recently that we have, we think, found a meaningful way to make sense of those examples. The result feels to us like another of those blinding flashes of the obvious where we're left thinking 'why on Earth didn't we see that before?'

That 'blinding flash' was the recognition that the 'nesting' effect works in two distinctly different directions. Rather than there being one 'nesting' Trend, it looks like it is sensible to look for two. The first of the two is when a system becomes nested into its surrounding super-system. We will call this Trend 'Nest-Up'. The other form of the Trend happens when we nest something into an existing system. We will call this trend 'Nest-Down'. In this Trend, the nesting occurs in the sub-system.

The aim of this article is to begin the process of defining the form of both of these Nesting trends. Over the course of time, other articles and no doubt future editions of the Hands-On books – both technical and business – we will continue to refine and describe more examples of the Trends in action. By way of starting that process, however, let's begin the process of describing what the Trends look like. In common with the way in which we have defined all of the other Trends, we are particularly interested in the non-linear jumps that describe how a system shifts from one state to another. Crudely speaking, what we are looking for is what happens when a system jumps from one s-curve to another. Let's start our investigation with a look at the 'Nest-Down' Trend:

Nest-Down

Nest-Down evolution jumps occur when we nest something new *into an existing system*. Typically, therefore, each new level of nesting occurs at a progressively smaller size scale than was previously considered by the designer of the system. A non-linear jump occurs each time a new level of nesting is introduced into the system. The Trend looks like the picture shown in Figure 1:

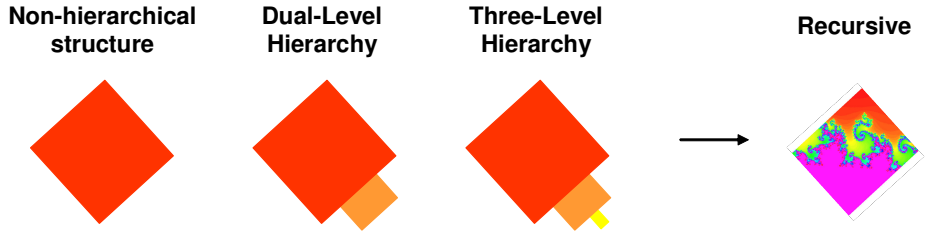
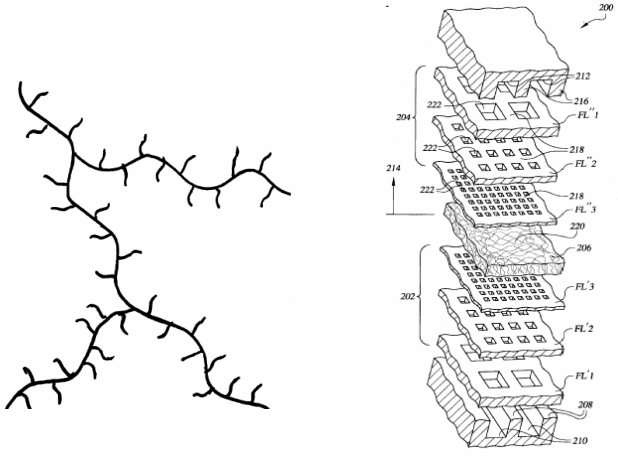


Figure 1: 'Nest-Down' Trend Stages

In some ways, the trend can be interpreted in a similar fashion to the Macro-to-Nano scale trend. What we have described far more completely here though is the importance of not

just the smallest engineered dimensions in the system, but also the importance of the inter-relationships between the different dimensional levels. We can observe what we mean by this when we examine one or two examples. Figure 2 presents a typical pair.



a) b)

Figure 2: Typical Examples Of 'Nest-Down' Evolved Systems

Both of these pictures come from previous e-zine Patents of the Month (Reference 1 and 2). The picture on the left is of a 'comb-branched polymer'. What we can observe in this structure is a system with two levels of nesting: The main fibres are branched together to form a network and then each fibre branch then has multiple mini-fibres growing from it. Figure 2b) is a capillary evaporator. It is described by the inventors as a 'fractal structure' – as such it would be classed as having achieved the final stage on our Trend description. Looking at the picture, however, it would be fairer to describe this system as one containing four levels of nesting – three layers of progressively smaller holes (FL'1 to FL'3) plus a fourth level formed by a mesh of micro fibres (220).

Another really important use of the physical interpretation of the Nest-Down Trend is contained in the Blind Watchmaker concept of evolutionary biologist Richard Dawkins (Reference 3). In this landmark book, Dawkins creates a beautifully simple model to illustrate how apparently very complex biological systems can be created from some very simple evolutionary rules. One of the most important of those rules is how many levels of nesting are present in the system. Starting with a straight line and then allowing 'mutations' to occur on the length of the line, the number of times it branches into smaller lines, the angle of branching it becomes possible to evolve some very realistic looking models of biological systems (Figure 3). The number of times branching occurs (i.e. the number of Nest-down trend jumps) is the primary main contributor to the overall complexity of the resultant picture.

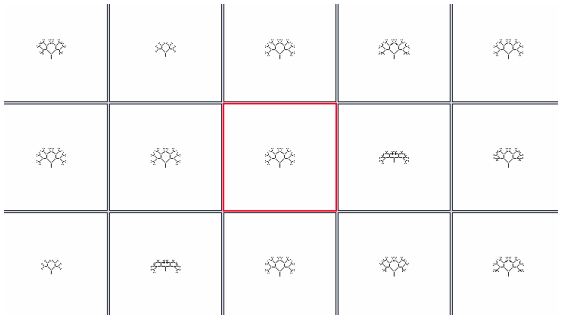


Figure 3: 'Blind Watchmaker' Example Of Biological System 'Nest-Down' Evolution

Although probably easiest to visualize as nesting within physical systems, the Nest-Down trend should also be viewed in a temporal sense. In this way, the Trend allows us to think about the Nesting of actions within other actions. Figure 4 illustrates the basic idea.

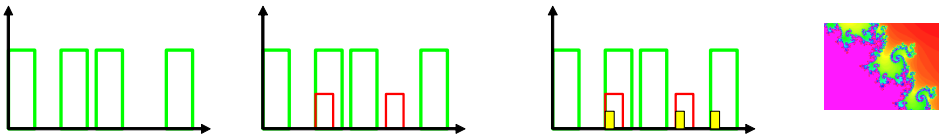


Figure 4: Temporal Interpretation Of 'Nest-Down' Trend

The first jump in this version of the Trend is very closely related to the final stage of the 'Action Co-ordination' Trend – where the jump involves 'adding a new action into an interval'. What the Nest-down trend now reminds us is that that new action introduction may well happen at multiple levels of temporal nesting.

The Nest-Down Trend is very closely linked to Inventive Principle 7, Nested Doll. The instructions provided within the classical Principle description are 'put one object or system inside another', 'put several objects or systems inside others' and 'allow one object or system to pass through others'. These instructions are near enough identical in fact to what the Nest-Down Trend is designed to remind us to think about. Principle 7, however, does not directly ask us to think about our next version of the nesting trend, 'Nest-Up':

Nest-Up

A Nest-Up trend jump occurs when our system becomes nested into something else at a higher hierarchical level. A classic example of Nest-Up can be seen in the ongoing evolution of standard TRIZ evolution case study, the toothbrush. As illustrated in Figure 5, a hierarchical illustration of a typical toothbrush, the system will progressively lose sub-system elements as their function migrates into something at a higher level. Thus sooner or later the bristles of the brush will disappear and 'Nest-Up' into (at the moment) an ultrasonic cleaning device. Another 'Nest-Up' jump will occur when the brush itself disappears and something in the super-system (probably the food we eat – e.g. a tooth-cleaning gum – delivers the function.

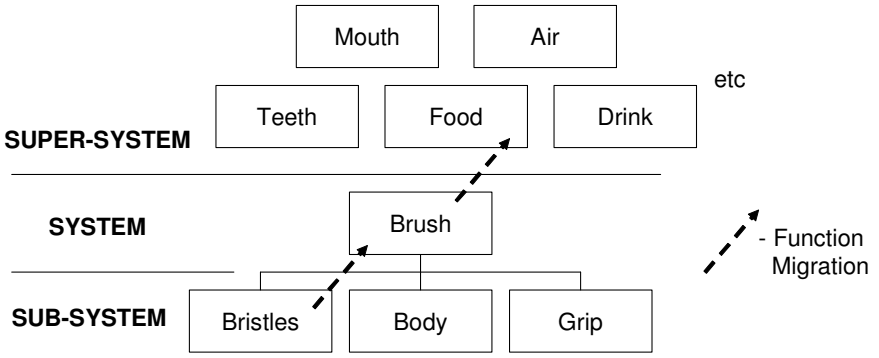


Figure 5: Current And Emerging Future 'Nest-Up' Evolution Of Toothbrush

In a more general form, then, we might illustrate the 'Nest-Up' Trend as shown in Figure 6. This trend illustration suggests three distinct possible stages in a 'Nest-Up' evolution (of course, as with all of the other TRIZ trends, systems are allowed to leap-frog different stages). In the first stage, we have an independent entity. That system obviously interfaces with its surrounding super-system. At some point, then, the system becomes

connected in some way to something in that super-system. At first that connection may be a partial or temporary one (also spacial or temporal), but then eventually the system function will become completely subsumed within the higher level entity and the original system will thus effectively disappear.

Figure 6: 'Nest-Up' Trend Stages

Another good likely future example of 'Nest-Up' in action is the windshield wiper on a car, which we can anticipate disappearing at some point in the future as its function (permit driver visibility in the presence of rain, sleet, snow, insects, dirt, etc) migrates to the windshield itself. The windshield may also then eventually 'Nest-Up' and have its function delivered again by something in its super-system.

'Nest-Up' is also very closely connected to biological evolution. Humans – probably currently the pinnacle of biologically complex systems – are the result of the nesting of a whole bunch of levels of sub-systems, some of which are totally subsumed into the whole (the nucleus in every one of our cells) and some of which are as yet less completely connected (e.g. the 'friendly bacteria' that make up 10% of our dry weight and without which we would have enormous difficulty digesting any food). Figure 7 from Reference 4 is a good illustration of the dynamics of the Nest-Up Trend.

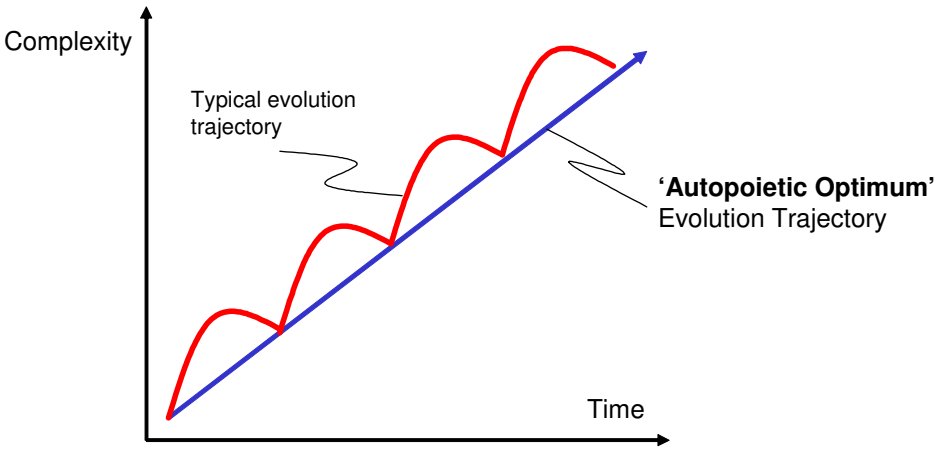


Figure 7: Natural System Complexity Evolution Trend

Overall, then, we believe that the two 'new' Trends 'Nest-Down' and 'Nest-Up' – both of which should be interpreted in spacial and temporal senses – are an important addition to the Evolution Potential concept. By forcing ourselves to think about both of the Trends we are opening up the possibility of finding important evolutionary opportunities in any system we care to analyse. You are likely to hear more on this subject in future articles. In the meantime, we hope that you will begin to find – and perhaps create! – applications of the Trends in the world around you.

References

1) Systematic Innovation e-zine, 'Capillary Evaporator', patent of the month, Issue 37, April 2005.
2) Systematic Innovation e-zine, 'Comb-Branched Polymers', patent of the month, Issue 41, August 2005.
3) Dawkins, R., 'The Blind Watchmaker', Penguin Books, London, 1989.
4) Mann, D.L., 'Complexity Increases And Then….(Thoughts From Natural System Evolution)', TRIZ Journal, January 2003.

Pleasure, Pain, Leaky Integrators And Getting People To Buy Into Change

Have you ever been in the situation where you have to write a letter or a report, but you can't summon the will to start writing? The deadline is looming and still, somehow you can't bring yourself to sit yourself down in front of that keyboard?

Or what about the time you were sunbathing on the beach; you're totally relaxed and in the wonderful semi-conscious state and out of nowhere one of your loved ones comes along and throws a bucket of cold seawater all over you. How did you react?

Or what about the situation where you're out on a walk, you're in your clean clothes and freshly shined boots eventually you come across a muddy field between you and your destination. You're tired and the field disappears into the horizon on either side, so it looks like you have no alternative but to try and cross it. So you look for the least muddy path and make your first few tentative steps. You're desperately trying to keep your boots clean. You nearly fall, arms swaying in the air to try and keep your balance. And then it happens, a footfall that looks solid turns out to be the opposite. Your foot sinks into the mud. Now you have a muddy boot. But the other one is still clean, and so you carry on, now trying to protect it. Finally there is so much mud around you that you have no choice but to get the clean boot dirty. But, you realize, there is an alternative; you can take the boot and your sock off and roll-up your trousers, safe in the knowledge that you will be able to clean up on the other side. Your bare foot then makes its first step. The cold mud squelches between your bare toes and your foot disappears up to your ankles. It's cold, but you realize there is no alternative. Then the mud warms a bit and you figure 'hey, this isn't so bad', and so off comes your other boot and sock, up rolls your other trouser leg, and squelch goes the second foot. Now you're away and walking bold as can be across the rest of the field.

Hmm. Do these three situations have anything in common? And if they do, is there anything useful we can learn about other similar situations we might one day soon find ourselves in?

Based on what we know about the way the brain works, emotional responses like pleasure seeking and pain avoidance (Reference 1) are triggered by the release of the appropriate chemicals. If the amount of chemical released is small, then nothing happens. On the other hand, if the amount reaches a certain level, then we are provoked into action. There is, in other words, a certain threshold level, which as soon as it is reached we 'automatically' shift into 'action mode. In the case of the bucket of cold water situation, the 'pain' chemical release rate is very high and, therefore we are very likely to jump up and start shouting. In the case of sitting ourselves down in front of the keyboard to start writing the letter, the release rate is somewhat slower, and may well not reach the threshold level. If the threshold isn't reached, then we don't start writing. The reason the threshold might not be reached is that all the time one part of our body is creating the 'pain' chemicals, other parts are busy disposing of them. We need to dispose of them otherwise we'd soon be totally overwhelmed. As far as we can tell our chemical disposal rate remains fairly constant. Enter the concept of the brain's emotional response system as a 'leaky integrator'. Like a hole in a bucket. As soon as we start producing the pleasure or pain chemicals, they start leaking out of the bucket at a fairly constant rate. If the rate of production is greater than the rate of disposal then the overall chemical level increases; if

the production decreases and then stops, then pretty soon the ‘leak’ will bring the level back down to zero. If we simplify the story even more and say that the pleasure chemicals and the pain chemicals are polar opposites, then we can draw the whole pleasure/pain/ ’leaky-integrator’ story in a picture like the one shown in Figure 1.

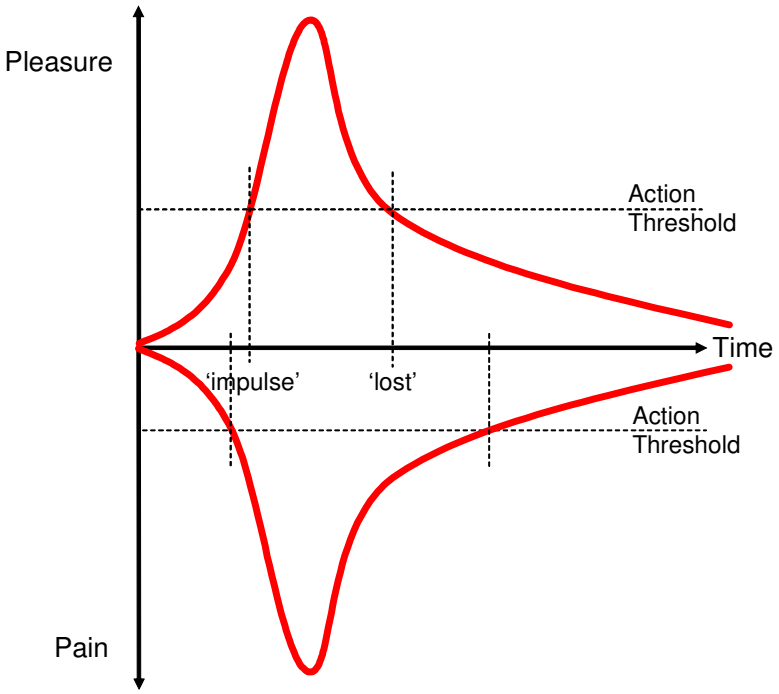


Figure 1: ‘Pleasure’ And ‘Pain’ Chemicals In The Brain And The ‘Leaky Integrator’ Effect

Let’s think about the ‘pain’ half of the picture first. If the ‘pain’ chemicals are released at a sufficient rate then, even though they immediately start leaking away, enough new stuff is arriving that the overall level exceeds the ‘action threshold’. As soon as this threshold is passed, we are inclined to do something. To all intents and purposes, the impulse to act is automatic when this threshold is hit. When we ‘see red’ for example, we are likely to snap at someone or something that has caused the pain or annoyance, even though it may be someone or something near and dear. The bucket of seawater is very likely to fall into this category, and before we know it, we have reacted angrily and shouted at our loved one.

If we are very controlled, however (‘we count to ten’) then, because the pain chemical was only released in a short intensive burst and then stopped, the ‘leak’ effect will mean that we’re soon back to our normal more rational emotional state. When this has happened, the amount of pain chemical has leaked back down below the action threshold level.

Because the report-writing scenario operates over a longer timeframe than the bucket of seawater, the rate of release of ‘pain’ chemical is often insufficient to overcome the leak effect to the extent that the threshold level will be released. Except, of course, until the time when the deadline has loomed too close. When we reach that ‘critical’ moment of panic – not knowing whether there is now quite enough time left to finish the job and therefore we must do something – it is because the ‘pain’ chemical release rate has finally increased sufficiently for the action threshold to be reached.

The exact same mechanism works when we consider the ‘pleasure’ chemical; nothing happens until we reach the action threshold. When we do reach that threshold then, bam, we are automatically triggered into action again. We see an attractive person in a restaurant, or we get a craving for a bar of chocolate. In either case, it is probably not going to be long before we’re automatically set into motion, striding across the restaurant

or into the store (unless we're an engineer of course – in which case the 'pain' chemical starts to flood into the brain when we start thinking about how the attractive person is likely to reject our advances, so no doubt we'll never make even the first step (☺)).

This aside, taking the pleasure and pain mechanisms together we have here a pretty good model of how all of our emotions work. In the extreme, the affect is the basis of how addictions form and perpetuate.

More practically, it is also a phenomenon that, once we understand it, can be enormously helpful in motivating ourselves or seeing why we often find it so difficult to get people to change. Failing to get people to 'buy-into' change is very definitely one of the biggest single challenges in the whole innovation story. In just about every company we've ever had the privilege to work inside, this question has come up as one of the problems problem-solvers want to work on.

Change – or the prospect of change – tends to cause the generation of 'pain' chemicals in all of us. Change takes us out of our comfort zone and into the unknown. Past experience tells us that a lot of times 'change' results in something bad. If this is the case – and again it is for most of us – then just the word 'change' can be enough to provoke the pre-emptive release of pain chemicals. Generally speaking the release rate is insufficient to 'beat the leak' and so we end up living in a state of mild anxiety. Only when the threshold limit has been reached are we likely to be stirred into action. This is where our third, walking across the muddy field story comes into play. Only when we see that first muddy boot are we provoked into the 'drastic' action of taking the other boot and our socks off. Once we're past this point, then nothing matters anymore (unless the mud turns into swamp and we're suddenly up to our necks in danger!). We stop producing 'pain' chemical and we're feeling okay again. Slightly inconvenienced, of course, because we have to wash our feet and clean that boot when we get to the other side of the field, but, hey, life really isn't so bad afterall.

The opposite happens when we think about 'pleasure' chemicals. A very relevant issue here is when we are trying to sell something to someone. Expose someone to a potentially pleasurable thing and get the 'pleasure' chemical release rate high enough to the action threshold and people will automatically want that thing. In a selling context, if that intent to action is able to be fulfilled there and then, then undoubtedly they will make a purchase. If the intent is unable to be fulfilled, however, then pretty soon the 'leak' will cause the level of 'pleasure' chemical to fall below the required action threshold. This phenomenon is in all likelihood one of the biggest problems faced by TRIZ and in fact any kind of workshop. Get the teaching right and everyone will leave the session enthused and full of intention to go back to their desk and start changing the world. Pretty soon after – very soon if they get back to their desk to find 200 emails in their inbox – and like it or not, the pleasure chemicals leak away. A week later and their wonderful learning experience is a mere memory. From a selling perspective then, there is a certain time window – between the 'impulse' and 'lost' lines on Figure 1 – when a person will have an intent to buy what you're offering. Providing you can achieve the sale within this window, you're onto a winner. Miss the window and miss the sale.

With change and the 'pain' chemical issue it is slightly different. Firstly, in most people the pain action threshold is set lower than the pleasure action threshold. In other words, it takes less pain chemical to stir someone into action than pleasure chemical. Key to getting people to change is getting them to that action threshold. We can do this either by somehow switching the change=pain correlation into a change=pleasure one or creating a short sharp pain shock. The latter is very definitely the easier of the two. A bucket of cold

water will tend to induce people into action very quickly, but unless you're a loved one, they're very likely to resent you for what you just did. Which basically leaves us with the muddy boot option. How to get people into that state where their boot is muddy – that may just be the central key to getting people to buy into change.

References

1) Systematic innovation e-zine, 'If TRIZ Is So Good… 37) Pleasure Seeking, Pain Avoidance and Invention Machines', Issue 51, July 2004.

Humour – Increasing Transparency

Here's a picture that appeared when the team were recently working on a project to plot the future evolution of office divider furniture (no, really, this is the kind of project companies sometimes give us!). While we could see a few potential advantages of this solution, we didn't actually suggest it to the client:

They say good things come in pairs, well, in a completely different job, we also came across another increasing transparency example. This time transparent Play-Doh! Not sure whether it was the same when you were growing up, but the first lump of Play-Doh we got irretrievably stuck into the carpet was the day or mother threw the rest of it away and henceforth banned it from the house. Now, on their 50th anniversary, we can re-live at least the wonderful smell of the stuff, thanks to the company's decision to launch a Play-Doh scent product onto the market:

Patent of the Month

Patent of the month this month falls into the category of ‘unexpected discovery’. As such the only real contradiction present is what TRIZ calls an ‘administrative contradiction; the inventors have a desire to solve a problem and what’s stopping them is that they don’t (nor does anyone else in this case) know how to do it.

The problem being tackled in US7,062,385 granted to inventors at Tufts University in Boston is for simple, fast, low-cost means of detecting and identifying of volatile compounds. The patent was granted on June 13. From the invention disclosure ‘background’ section we read the following:

“… different chemical analyses have been used to detect the presence or absence of a known target chemical in clinical diagnoses, to identify unknown compounds and mixtures in basic research and drug discovery, and to document the identity and purity of known compounds, e.g., in testing and quality control in drug manufacturing processes. In addition to laboratory analyses, chemical detection is also important outside of the laboratory. Examples include bedside diagnoses, and environmental monitoring for hazardous materials. The "field" applications, including detection of explosives and chemical warfare agents, require small, portable, reliable, easy-to-use, inexpensive devices.

“The serious threat of explosive, chemical and/or biological attacks pose a particular challenge for national security in the current "post September 11th" era. A method that could detect a wide range of compounds, and that could also be automated and remotely controlled and that could be used in field conditions including airport, seaport, or other screening systems, would be particularly desirable. For example, currently only about 2% of all the containers are screened by any means that come through the seaports to the United States, because there are no suitable reliable, fast, easy and relatively cheap screening methods available. For national security, it is imperative to develop screening methods that could detect, for example, explosives and toxic chemicals that may be transported into the United States. Detection methods for identifying trace amounts of volatile compounds from, for example, explosives or chemical warfare agents, would be one possible way to approach such novel screening methods for national security purposes.

“There are a number of methods currently available for chemical analysis, each appropriate for a particular application and each having its own strengths and weaknesses. Examples include the various forms of chromatography, including gas chromatography (GC), high performance liquid chromatography (HPLC), and spectroscopy, including mass spectroscopy (MS), ion mobility spectroscopy (IMS), Raman spectroscopy and infrared spectroscopy, as well as other chemical, immunological, and gravimetric methods. Also, combinations of different methods can provide a powerful means of identifying unknown compounds, e.g., GC/MS which is used extensively in analytical chemistry laboratories.

“A common feature of these analytical methods is that the chemical sample needs to be prepared prior to analysis. Liquid and solid samples are usually dissolved into an appropriate solvent. For analysis of vapor-phase chemicals, a preconcentration step is often required to increase the quantity of material for analysis.”

Precisely how the inventors at Tufts came upon their solution, the invention disclosure does not reveal. It merely says:

“We have, surprisingly, discovered that nucleic acids with attached fluorophores and dried onto a substrate react with volatile chemical compounds in ambient air and can be used as sensors to detect compounds in the air that reacts thereto.

“Accordingly, the present invention provides a nucleic acid-based chemical sensor, sensing system and sensing and identification method which provide for a nucleic acid-based multi-sensor,

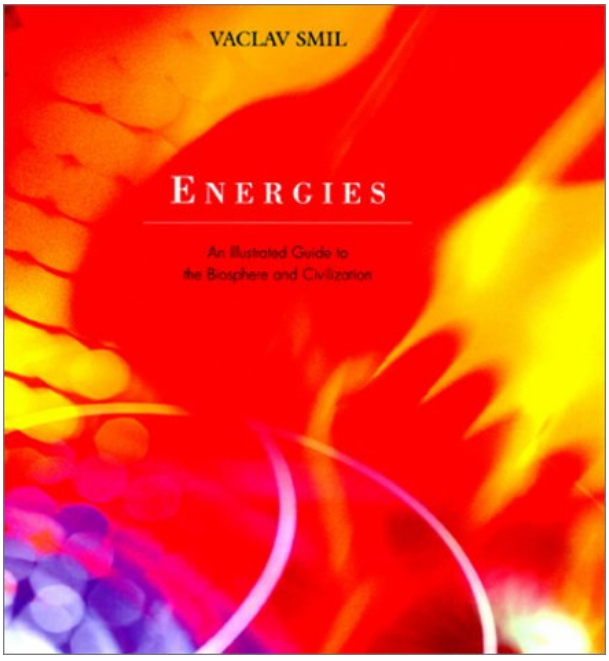
cross-reactive, sensor array having a rapid response time, a rapid sampling time, dynamic modulation of sampling and detection parameters, intelligent feedback control of analyte sampling conditions, smart mode sampling, smart detection through application of sophisticated analyte detection algorithms, high throughput screening of sensors, and high sensitivity, discrimination, and detection capability for a variety of target analytes."

Not much more to say than this as far as our report here is concerned. The invention gives us a new entry in our Attribute database – a new way of measuring volatiles – which is always nice. More importantly, it makes our Patent of the Month slot because what we have here is what we think is a genuine Level 4 invention. Assuming the Tufts researchers have not over-sold the capability of their invention, we think there is something here that will deliver a long stream of spin-off benefits in the future.

Best of the Month – Energies

Despite adding around 20 business and management books to our research pool during the last month, we have nothing that comes even close to meeting our 'best of the month' criteria. Best thing we've acquired in the period then has been 'Energies: An Illustrated Guide To The Biosphere And Civilisation' by Vaclav Smil. The book represents a truly inspiring reference for anyone interested in and/or using TRIZ. As the TRIZ S-Field tool tells us, any viable system requires at least one 'field' or source of energy. Several TRIZ resources – including Hands-On Systematic Innovation – contain check-lists of different types of field. None of those references has anything like the depth, breadth or extent of quantified information of Smil's book however.

Smil is an academic ecologist. Without any acknowledged awareness of TRIZ, he takes the principle of universality and goes on to present a comprehensive and integrated survey of all the forms of energy that shape our world. The book is divided into 82 readable essays categorized under six basic headings: Sun and Earth, plants and animals, people and food, pre-industrial societies, fossil-fueled civilization, and motion and information. Each essay explains the science of the energy form as well as its implications for the functioning of the universe, life or human society. Cross-links and summary diagrams allow easy comparisons among the various levels and flows of energy. From the terminal velocity of a rain drop to the amount of energy the sun transmits to Earth to the energy transfer efficiency capability of photosynthesizing bacteria to mapping the energy flows in and around an internal combustion engine, this book has pretty much everything you're ever likely to need in terms of identifying and quantifying the energy resources in and around whatever kind of system you might be interested in.



Expensive (unless you know where to shop!), but worth every penny either way.

Conference Report – 'Creativity Jamboree', University of Greenwich, London

Every once in a while – about annually as far as we're concerned – it is useful to get a chance to observe how the non-TRIZ world of creativity is advancing. This year that opportunity came at the 'Creativity Jamboree' held at the beautiful University of Greenwich campus in South London. The event was essentially a first UK version of the annual CPSI event held in the US and its European mainland equivalent. In all around 80 people were in attendance. The programme for the day comprised the following sessions:

Time	8.15 - 8.45	8.45 - 8.55	8.55- 9.25	9.25 – 10.55		10.55 - 11.15	11.15 - 12.45	
Programme		Welcome and introduction to the day	Creative climate and risk taking	The Osborne–Parnes CPS Model: Growing Corporate Assets			'The Eureka Moment!'	
Speaker				Irene Balestra & Branko Broekman			Kevin Byron	
Programme	Registration			A New Kind of Creativity for a New Kind of Century		Cobikky break	What's your brand?	
Speaker	& Coffee		Oliver MacDonald & Patrizia Sorgiovanni	Dr. Kobus Neethling			Linda Caller	
Programme		Dr. Kanes Rajah		How to Inspire Your People to Innovate			The Art of Deferring Judgment	
Speaker				Cora Robinson & Darrell Mann			Patrizia Sorgiovanni & Tim Morley	
Time	**12.45 - 1.45**	**1.45 - 3.15**		**3.15 - 3.45**	**3.45 – 4.30**	**4.30 - 5.15**	**5.15 - 5.45**	**5.45 - 7.00**
Programme		"NLP: Tools for personal excellence in problem solving "			Creativity beyond problem solving	Creativity Beyond the Chunnel		
Speaker		Dr. Kanes Rajah			Dr.Kevin Kraus	Andrea Montuschi		
Programme		Innovisation' -- a concept for continuous creative culture			Breaking the Habit		Final plenary session.	Trafalgar Pub
Speaker		Gregg Fraley			Jonathan Morris			
Programme		Creative Problem Solving (CPS): Music as the metaphor		Cobikky break	Beautiful – Imperfection			Greenwich
Speaker	Lunch	Oliver MacDonald and Tom Carr, RedZebra UK			Pip Wilson		Kanes & Linda	

The scene and theme for the day was admirably set by Oliver McDonald and Patrizia Sorgiovanni who got everyone banging out rhythms on a pile of plastic tubes. Not sure what it had to do with creativity per se – i.e. typical for the rest of the day – but entertaining nevertheless.

Everything else during the day was done in parallel sessions. This was a little frustrating since a lot of the things we wanted to go and see weren't possible because they clashed with something else. We missed what turned out to be the best session of the day – by Dr Nobus Neethling – because we were facilitating our own session on 'inspiring people to be innovative'. If you get an opportunity to see Dr Neethling then you should do it. Ditto with his books. A genuine contribution to the psychology of the creative process.

Our session was a collaboration with NLP expert Cora Robinson. Always interesting to work with Cora, what we were trying to do at Greenwich was explore the links between the internal psychological and physiological aspects of creativity and motivation to be creative and the external aspects brought into the story by TRIZ. Expect to hear more on this subject in the future.

Back to the Jamboree, the next round of sessions found us in Kevin Byron's session since we'd already heard Linda Caller's presentation at an earlier conference and we'd already

given up on the prospect of deferring judgment for the day. Kevin's session was a useful recap of the CPS method. As such it also fell into the usual CPS trap of getting people to generate a bunch of ideas that appear to be creative ('re-invent a café by changing an attribute of current cafés') but ultimately have no direction because there is neither any context or any kind of definition of what direction a 'better' café was.

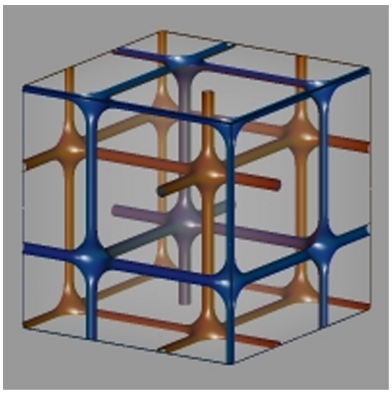
The rest of the day – for this author at least – then proceeded to spiral downwards at a frighteningly rapid rate. The 'innovisation' session was as bad as the title suggests; the NLP session was toe-cringingly worse (in the delegate exercises, our team swiftly discussed any subject other than the one we were supposed to be talking about), and the music session continued the long-standing and misguided theme that people will be much more creative if they're jumping up and down, banging on drums and blowing whistles. The biggest misconception here seems to be that non-technical creatives think technical people are not creative. They fail to see that the big difference between creating piece of art and creating something that delivers a useful function is the difference between divergence and convergence. There are a million and one ways to create 'art'. There are only a very small number of ways of creating something useful. Engineers and scientists (I think) have the same million and one dumb ideas that artists have, but they're forced to filter them out during the process of down-selecting to find the useful solution. This is not to say that art is un-important; it is clearly very important. But, please, don't let the drum-bangers continue in their belief that we'll design a better car or jet-engine or chemical if we've spent ten minutes pretending to be a dustbin-lid.

All in all, then, the day ended up with a strong message that there is nothing of any significant note happening on the soft side of the creativity community. Here's to the hope that next year things will be different….

Investments – Flexible Ceramics

Researchers at Cornell University have recently announced their development of a new class of hybrid materials that they describe as flexible ceramics. The new materials, emerging from work in the nano-chemistry arena, appear to have wide applications, from microelectronics to separating macromolecules, such as proteins.

What is most striking about the new material is that the molecular structure of the new material -- known as a cubic bicontinuous structure -- conforms to century-old mathematical predictions. "We in polymer research are now finding structures that mathematicians theorized long ago should exist," says Ulrich Wiesner, associate professor of materials science and engineering at Cornell. The structure of the new material appears so convoluted that it has been dubbed "the plumber's nightmare." Wiesner reported on the new flexible ceramic material in his paper "Phase behavior of block copolymer directed nanostructured organic/inorganic hybrids," presented at the annual March meeting of the American Physical Society at the Indiana Convention Center, Indianapolis earlier this year.

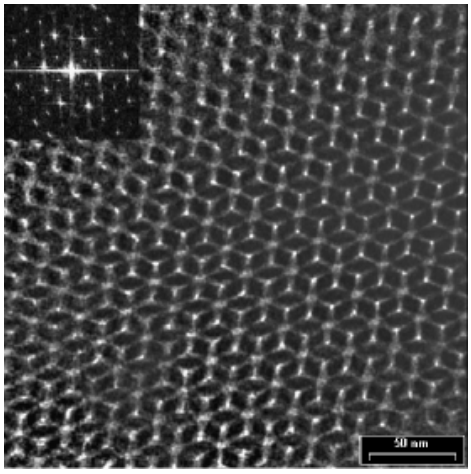


‘Flexible ceramic’ is almost an oxymoron, since in most minds, ‘ceramic’ is closely associated with ‘brittle’. The Cornell development represents a significant advance of ceramics along the TRIZ ‘Dynamization’ trend. We will, we feel sure, begin to see connections to a whole series of ceramic applications that are currently stuck at the first ‘immobile’ stage of that trend.

Wiesner's research group was attracted to chemistry on the nanoscale by the perfect, symmetrical shapes that are found in nature. An often-cited example is the elegant structure of diatoms, unicellular algae whose shell walls are made of perfectly replicated silica pores. Nature's key to this replication, says Wiesner, "is perfect shape control governed by self-assembly of organic components directing inorganic materials' growth." The Cornell researcher reasoned that the simplest way to mimic nature's pathways was to use organic (or carbon-based) polymers -- more particularly materials known as di-block copolymers – that have the ability to self-assemble chemically into nanostructures with different symmetries. If the polymer could somehow be melded with an inorganic material -- a ceramic, specifically a silica-type material -- the resulting hybrid would have a combination of properties: flexibility and structure control from the polymer and functionality from the ceramic. This, Wiesner's group has now achieved. "The resulting material has properties that are not just the simple sum of polymers plus ceramic, but maybe something quite new," says Wiesner.

Thus far the Cornell researchers have made only small pieces of the flexible ceramic, weighing a few grams, in petri dishes, but that is enough to test the material's properties. It

is transparent and bendable but with considerable strength, and unlike pure ceramic will not shatter. In one form the hybrid material is an ion conductor (an ion is an electrically charged atom), with great promise as highly efficient battery electrolytes. There also is the possibility that the new material could be used in fuel cells, he says.



Transmission electron micrograph of the cubic structure of the new hybrid material showing poresabout 10 nanometers across.

The porous structure of the flexible ceramic forms when the material is heat-treated at high temperatures. In fact, says Wiesner, this is the first material with such a symmetry and narrow pore-size distribution. Because the material has pores only 10 to 20 nanometers across, Wiesner is collaborating with Larry Walker, Cornell professor of biological and environmental engineering, to see if the material can be used to separate live proteins.

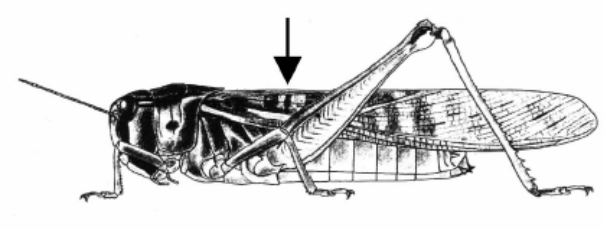
Wiesner also believes that because of the material's self-assembling ability, it could be produced in large batches. "We have perfect structure control," he says. "We can structure the material down to the nano-scale with unprecedented control. We now know how to make a suite of structures of assorted shapes and pore sizes." The researchers can do this by controlling the "phases," or molecular architectures, of the material just by controlling the mix of the polymer and the ceramic. The material goes through several shifts in shape, from cubic to hexagonal to lamellar – thin and plate-like – to inverse hexagonal and inverse cubic. After the lamella phase and before the inverse hexagonal, the material forms the cubic bi-continuous structure – the "plumber's nightmare" – that was not previously known to exist in polymer systems. The "plumber's nightmare" may be only the first of these highly adaptable structures made possible by the specific combination of polymers and ceramics, says Wiesner. "There is a good chance that we will find a whole zoo of other bi-continuous structures that people didn't know existed in polymers. We have opened the avenue to finding further such structures," he says.

Check out http://www.ccmr.cornell.edu/~uli/index.html for more details of the Cornell work.

Biology – Locust Ear

How does a locust work out what direction a sound is coming from?

The ear drums (*tympanum)* of a locust are thin chitinous membranes, located to the right and left sides of the first abdominal segment.



Humans localize sounds by binaural intensity differences: the ear nearest to a sound source hears that sound source more strongly because the far ear is 'shadowed' by our head. Unfortunately, the locust and other small animals cannot localize sounds by 'body shadow' (refraction of sound around the body) because they are too small in relation to the wavelengths of the sounds.

Instead, they must rely on the phase differences created by the pressure difference between ears to know where a sound is coming from. As the locust turns and moves relative to a sound source, the relative path lengths of the sound to the inside and outside change and so the phase changes and the strength of eardrum movement changes accordingly. So, to some extent, the locust *does* localize sound by binaural intensity differences. However the differences are not created by body 'shadow' (refraction) but by differences in time of arrival at the outer and inner sides of the eardrum.

We can map the problem solved by the locust onto the Contradiction Matrix as follows:

Improving Factor	Worsening Factor	Principles
Length/Angle of Stationary Object (4)	Length/Angle of Moving Object (3)	3 1 4 19 17 35
the locust needs to localise the direction (angle) of a sound source but is too small in relation to the sound wavelength		

The time difference strategy used by the locust is closely aligned with Principle 19. Specifically Principle 19B which states, 'if an action is already periodic, change the periodic frequency or magnitude to suit external requirements'.

The locust also needs to discriminate between different sound frequencies. It does this by using its ears as a frequency analyzer. A part of the ear known as 'Müller's organ' responds differently to sounds of different pitch. This is achieved due to the fact that the eardrum varies in thickness and mass and so vibrates distinctively with different incoming sounds. Contributing to these vibration differences are tiny pieces of sclerotized cuticle, embedded on the eardrum like small weights. These pieces of cuticle are the pyriform vesicle, folded body, elevated process and styliform body.

Sound moves the ear drum but because the eardrum differs in thickness and mass, there is unique movement for each incoming sound frequency. The neurosensory cells that make up the acoustic ganglion are grouped and oriented in four different groups. Each group is directed to and 'monitoring' a different region of the ear drum. Action potentials will be developed by these neurosensory cells if they are subjected to movement.

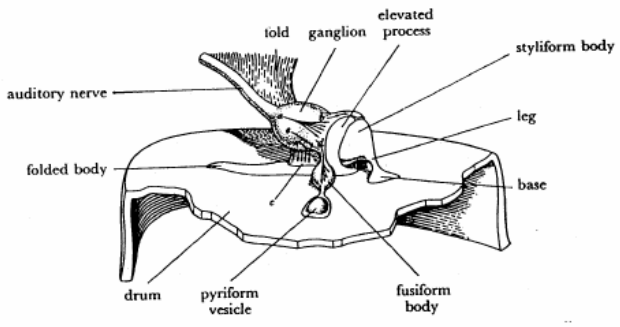


Figure 5: The ear drum and the auditory ganglion seen from the inside. The receptor neurons in the ganglion are attached in four groups (a-d) to four specialized regions of the drum : the elevated process, the folded body, the styliform body and the pyriform vesicle (drawing taken from [20]).

As an example of how this frequency analysis proceeds, consider just the fusiform body. This is a separated strand of neural tissue that extends outward from the ganglion angling down toward the eardrum. At its tympanal end the fusiform body is attached to the pyriform vesicle. Compare what happens when two different sound frequencies hit the ear, 8 and 3 kHz. At 3 kHz because of its mechanical properties (shape, mass, thickness) the whole organ (ganglion and most of the eardrum with its chitinous bits) vibrates up and down with the impinging sound, *moving as one unit*. Thus the whole of the fusiform body (ends and middle) moves together and the body itself is relatively stable. But when the incoming sound is 8 kHz (8,000 waves /s) then the pattern of movement of the eardrum is quite different: the region near the pyriform vesicle begins to vibrate very vigorously relative to the rest of the eardrum: under these conditions at its ganglion end the fusiform body is relatively inert, while its other end at the pyriform vesicle is being vigorously displaced by the moving eardrum. With one end not moving and the other moving a lot, the fusiform body and the neurosensory cell group it contains are jolted about: this mechanical disturbance causes the cells of the fusiform body to fire very vigorously. So because of the form of the ear's cuticular parts and because the neurosensory cells monitor different locations the locust can tell the difference between 3 and 8 kHz. The same principle applies to the discrimination of other sound frequencies.

Again we can map the problem solved by the locust onto the Contradiction Matrix. The issue this time is about a desire to measure different frequencies without wishing to complicate the hearing system. Here's how we can map the problem:

Improving Factor	Worsening Factor	Principles
Ability to Detect/Measure (47)	System Complexity (45)	28 37 10 15 3 / 24 25 32
the locust needs to be able to detect different frequencies but we don't want to increase system complexity		

The Principles used by the locust are 37, Relative Change and 3, Local Quality. Relative Change is found in the translation of different frequencies into different relative movements of the membrane. Local Quality is also found in the membrane, the thickness of which varies at different points – thus affecting how it responds to sounds. Another close link between nature and the best of human knowledge.

For those wanting to find out more about the incredible capability of the locust and how it might teach human engineers to design microphones and a number of other acoustic systems, a multidisciplinary team at the University of Bristol in the UK have been exploring the subject extensively. See more details at www.bris.ac.uk.

Short Thort

June has been a time for reading through what have turned out to be some mainly bad books. Here is the only vaguely salvageable bit from Edward De Bono's latest and quite probably worst ever book ('H+'):

"Our brains like certainty. Perceptions seek certainty. We then lock onto that certainty with rigidity, arrogance and intensity."

The meaning of which is very similar to this quote from Barbara Annis' slightly better book exploring the differences between the way men and women think:

"Answers are things we use to solidify our own positions. Look for insights. Insights mean we are learning something. Insights mean that we're filling that hole in our minds called 'what we don't know we don't know.'"

News

'Systematic Innovation Live' Workshops

We are pleased to announce two workshops to be held in our UK office in October and November. Both workshops will be looking to teach the Systematic Innovation tools in the context of a big problem. The big idea is that delegates will see a realistic and complete start to finish process working on a real-life, previously unsolved problem. The October (5-6) session will be spent working on a problem donated by a local charity. Delegates will have the chance to make a positive difference to the charity and to be involved in publication of the results of the workshop. In the second workshop – to be held on November 1-2 – the focus will shift to an open-ended new product conception and development. In this workshop delegates will have an opportunity to take a share in the intellectual property generated during the workshop and to see their efforts turn into a commercial product.

www.creativetalks.com

…is a new website accompanying a new creativity and innovation book by well known author Richard Tierney. Darrell was one of the people interviewed by Richard for the book. A very enjoyable meeting, Richard is a genuine renaissance man and we look forward to reading the new book in due course.

Distance Learning

September 2006 sees the launch of the distance learning version of our full certification programme for the technical version of Systematic Innovation. With a following wind, we are also hopeful of getting a distance learning version of our new 'TRIZ-for-Business' certification programme by November.

2nd Japanese TRIZ Conference

We are happy to announce that we have two presentations accepted for the conference to be held between 31 August and 2 September in Osaka. More details can be found at Toru Nakagawa's "TRIZ Home Page in Japan"
http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/