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Systematic Innovation

e-zine

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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.

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

If TRIZ Is So Good, Why Isn't Everyone Using It (Part 24)

Introduction

This article shamelessly steals the title of CREAX StarLab member Brian Campbell's recent TRIZ Journal article (1) in order to try and achieve a number of things. Firstly, Brian's article posed a question that has since provoked a very large amount of correspondence and so the issue is a very definite one for a lot of people, across the complete spectrum from newcomers to providers via in-house champions struggling to get TRIZ integrated into their company. It is also important to the CREAX business. Hence, we have a definite need to think actively about the issue, and how to solve the problems it generates. Secondly, we want to examine a new way (for TRIZ at least) of helping to manage the enormous complexity present in problems like this in order to hopefully allow users to look at other types of problems of their own. How, when we have a situation dominated by many different perceptions do we establish which ones are more important than others. The tool we used is an evolved version of Edward De Bono's 'Flow-scaping' concept. Thirdly, we wanted to give greater exposure to the MagNote toolkit in order to demonstrate another area in which it is able to add something to the creative process that is otherwise very difficult to achieve.

Flow-scaping

A flowscape is a tool developed by Edward de Bono during the 1980s (2). It represents a way of looking at the features and characteristics of a complex problem or opportunity situation. The tool uses the way the human brain works in order to develop lists of our *perceptions* about the situation under evaluation, and then progresses to examine how each of these connects to the others. Flowscape diagrams thus represent perceptions of certain situations. They offer a brain-compatible means of managing complexity. Flowscapes can be used to analyse situations as they are or propose solutions in order to identify what you would like them to be. In many senses the method operates in the opposite way to root cause analysis; in root cause analysis we are looking to identify what causes things to happen. The key question during a flowscaping exercise is to ask the questions 'what does this lead to?' While this might appear to be a rather subtle distinction, the truth of the implementation is often profoundly different. This is because the former encourages negative thinking, while the latter requires us to think in a much more positive frame of mind. Hence, flow-scaping enables us to use the creative parts of our brain rather than the analytical part that is inevitably called for during root cause analysis. The flowscape method operates in three basic stages; the first stage involves recording your perceptions about a given situation. The second stage then involves asking the question 'what does this lead to? for each of the perceptions identified. The idea is that the user draws a line from the perception under consideration to the perception that is most likely to be the thing that the first perception leads to. In each case, it is important that each item in the flowscape has only one arrow from it. If there is more than one arrow from each item, you are looking at theoretical possibilities and not the situation as you perceive it. The third stage then involves interpretation of the resulting flowscape picture. The method in summary:-

a) List down as many perceptions as you like about a situation you are facing. Label them A, B, C etc. Typically you should aim for a minimum of ten perception statements.
b) for each perception, pick one (and only one) of the others on the list that you feel it 'flows to'. Put the letter of this second perception after the first. For a simple example:

A I feel happy *B*
B Life is full of contradictions *A*

c) the third stage of the process involves mapping how the different perceptions relate to one another. In the above (trivial) example, we see the perceptions feeding back to each other in a 'loop' – A leads to B leads to A. Other times, a lot of different perceptions will form a big loop or feed into one 'gathering point'. By making a diagram of the letters and how they relate to each other, you can see more clearly what the 'central issues' are.

We performed a flow-scape exercise on the 'why isn't TRIZ…' problem as a group within the company. In order to help manage the generation, collation and organisation of perceptions we used the MagNotes within the LVT for TRIZ kit (Reference 3).

What follows is a description of the process we went through:

If TRIZ is so Good…'

The first thing that had to be done in trying to understand the current TRIZ situation was to write down our perceptions about why everyone isn't using TRIZ. Initially we did this individually, writing each of our perceptions down on a single MagNote hexagon. It is important to only record one perception on each MagNote. After we had spent about 15 minutes writing down our perceptions, we brought all of the MagNotes together and clustered all of the ideas that were similar to one another. Also, as people saw some of the perceptions written down by others, it prompted them to think about new ideas. These were also recorded on MagNotes and added to the total. Once we had a complete list we were happy with we had agreed 27 perceptions related to why everyone isn't using TRIZ. Those perceptions were (in no particular order): -

A In-fighting amongst TRIZ providers
B Lack of easy to follow products/books
C Fear of the unknown/Ostrich Effect
D 'Cult'ism
E 'Me versus TRIZ' Effect
F Too mechanical/technical
G Not enough real case studies
H Most people have never heard of TRIZ
I Lack of integration into company cultures
J 'Simple solutions make me look dumb'
K Lack of credibility/validation
L 'Doesn't apply to my problems'
M Bandwagon jumping consultants
N Expensive consultants
O 'It didn't work'
P No 'official' journals/publications

Q ‘What have the Russians ever done…’
R Over-selling TRIZ
S ‘Sleeping with someone else’s partner’
T TRIZ is ‘too complicated’
U TRIZ ‘produces too many ideas’
V ‘Its not the ideas, it what you do with them that counts’
W Bad experiences with other methods
X ‘It didn’t work’
Y TRIZ providers ‘don’t understand my way of doing things’
Z Western academic community is not teaching/researching TRIZ
ZZ ‘Lack of managed implementation process after training’

The perceptions in quotes are ones that we have heard directly (often many times) from people in and around the TRIZ world. Hopefully the perceptions are self-explanatory. Perhaps one or two are not:-

‘Me versus TRIZ’ – those situations where new users think they are in a competition to prove that they are ‘better’ than TRIZ, or can ‘beat’ TRIZ. The only certain outcome in these situations is that if someone is determined to compete with TRIZ, they will win!

‘Sleeping with someone else’s partner’ – a (deliberately) very emotive analogy for a sometimes very serious issue. The story behind this idea places the TRIZ consultant in front of a client with the problem that he and his partner are unable to have children. The TRIZ consultant solves the problem by sleeping with the partner. While this act might achieve the desired pregnancy, it is highly unlikely to engender satisfaction in the eyes of the client. Substitute the pregnancy for the solution to a problem, and the analogy describes the resentment and lack of ownership that often results when an outsider tries to present their own solution. This is a perception about solution ownership issues.

Ostrich Effect – the tendency of some people (usually academics in our experience if we’re being honest) to deliberately avoid looking at TRIZ in case it might do something to change their outlook or way of doing things.

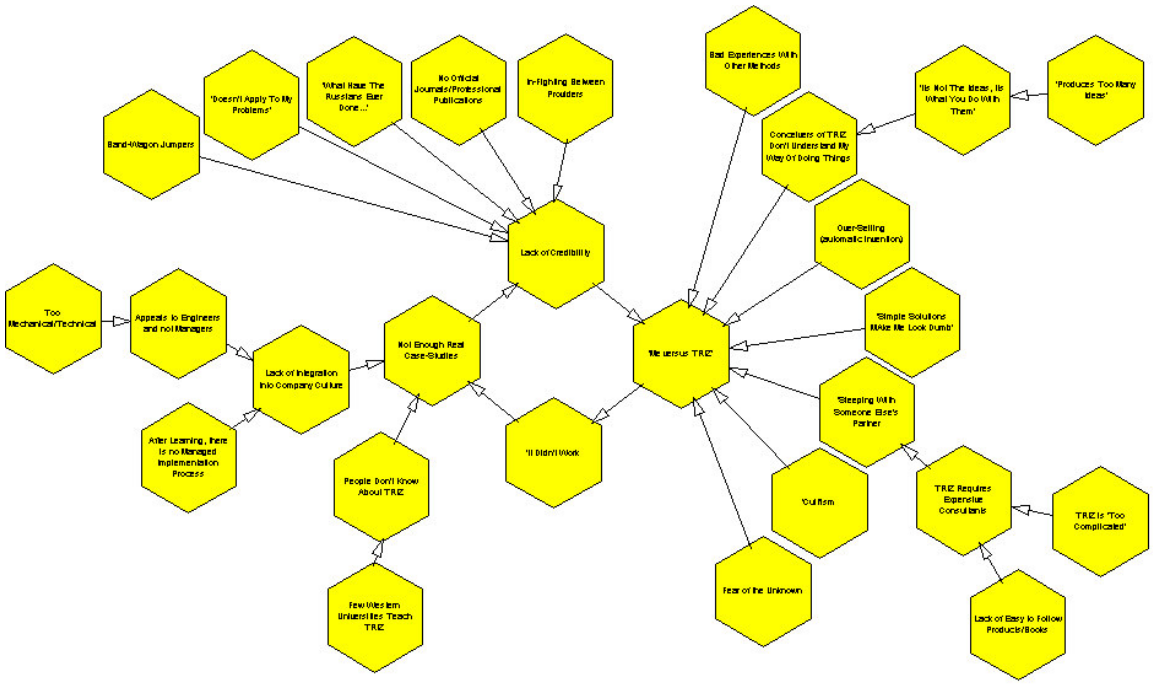
‘It didn’t work’ – a common complaint, which should more accurately be described as ‘we tried consultant X, and he/she didn’t work’. Unfortunately, TRIZ often seems to take the rap for the failures (or perceived failures) of individuals.

‘What have the Russians ever done…’ – horribly inaccurate perceptions held by some parts of the population. These are usually people unable to see beyond the failure and fall of communism in the Soviet Union.

Next up, we had to go through each of the perceptions in turn asking the question ‘which of the other perceptions does this one lead to?’ In each case, we individually found a ‘best’ connection, and then pooled them in order to arrive at a consensus view. For most of the perceptions, agreement came surprisingly naturally. On others there was more of a debate. A large part of the power of the method – and the requirement to only permit one connection – comes through this debating activity.

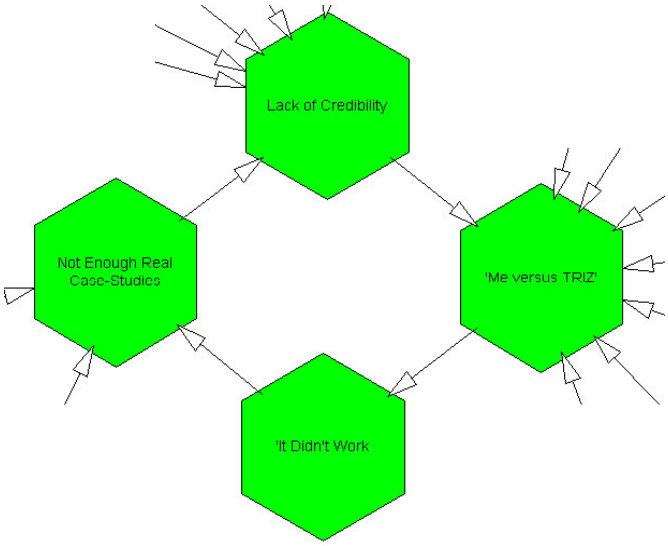
Next, after we had agreed upon a best ‘leads to’ connection for each of our 27 perceptions, we were able to construct a map detailing how all of the perceptions related to one another. The power of the MagNotes at this stage was its ability to allow the perceptions to be moved relative to one another until we could see a coherent picture. The results of that manipulations are reproduced (via the Visual Concept software (Reference

3) that accompanies the MagNotes) in the figure below. You might like to spend a little time reflecting on some of the connections we made.



What the flow-scaping activity is doing is identifying from the unsorted mass of perceptions patterns and structures. Of particular interest are connector points (perceptions that have a large number of other parameters leading to them) and closed loops. The loops are especially important because they represent self-re-enforcing systems – in which one thing leads to another, which in turn leads to another, which in turn… etc until everything leads back to the first thing, at which point the loop starts again.

Our picture (which has not been tampered with in any way) showed the presence of a closed loop of four perceptions in which three of the four also acted as strong collection points for all of the other perceptions.



The downstream analytical part of the flow-scaping process clearly indicates the importance of breaking these self-re-enforcing loops when trying to solve a problem. Breaking down loops eliminates the downward spirals present in typical lose-lose situations, and – according to flow-scape experience – make the other non-critical perceptions either disappear or become much less significant. The self-re-enforcing destructive loop in the 'Why isn't everyone using TRIZ' situation it became apparent may just be the critical factor in solving the problem. This loop of lack of case studies leads to lack of credibility leads to 'me versus TRIZ' phenomena leads to 'it didn't work' leads back to lack of case studies, etc may just be the downward spiral causing the current lack of spread of TRIZ.

By way of testing whether the loop was 'real', we repeated the flow-scaping exercise individually substituting personal opinions for group decisions in the areas where we had disagreed about what a given perception lead to. The outcome of this exercise were a number of markedly different maps featuring three common factors – the self-re-enforcing harmful loop always had 'me versus TRIZ', 'it didn't work' and 'lack of credibility' in it.

Recognising the existence of this loop, of course, is not the same thing as solving the problem. The flow-scaping exercise made us aware of it for the first time, however, and was hence useful. Also, we later convinced ourselves, no form of root cause analysis would have got us to the same level of understanding of an undoubtedly complex situation.

Thinking afterwards about what can actually be done about breaking the loop, we decided that only two of the four perceptions in the loop were amenable to challenge. The first was the 'lack of case studies' perception. Here, it seemed clear that the present strategy of the TRIZ community is (slowly) addressing this issue. The second, was the 'Me versus TRIZ' effect. This is something that, although we had been aware of it for some time, prior to doing the flow-scaping exercise, we had no idea that it played such a crucial role in affecting the whole problem of spreading TRIZ.

The more we thought (and continue to think) about it, the more we see that if we can get TRIZ newcomers into a state where they are wanting to use it, and not to be competing with it, the more likely it is they will produce good results, the more it 'will work', the more real case studies we'll get, the greater the credibility and validation of the method, the more likely that others will want to use it…. and so on. Successfully tackling the 'me versus TRIZ' problem turns a destructive lose-lose loop into a self-re-enforcing virtuous loop in which everyone wins.

Final Thoughts

We conducted this exercise for TRIZ. Looking back on it now, it seems clear that we could have substituted just about any other name and obtained the same result. If QFD is so good, why isn't everyone using it? If Theory of Constraints is so good, why isn't everyone using it? If Axiomatic Design is so good, why isn't everyone using it? (actually, scrub that one – people aren't using Axiomatic Design because the Axioms aren't true axioms in many instances).

Solving the 'Me versus X' problem perhaps holds an important key in many areas.

Next Month

As well as trying to answer the question 'If TRIZ is so good, why isn't everyone…', we also conducted a similar flow-scaping exercise, turning the problem the other way around, and asking the questions 'what is it that would make everyone want to use TRIZ?' We will print our findings in next month's newsletter.

References

1) Campbell, B., 'If TRIZ Is So Good, Why Isn't Everybody Using It? ', TRIZ Journal, October 2002
2) DeBono, E., 'Water Logic', Viking, 1993.
3) **www.creax.com/products/lvt**

Actual Versus Perceived Ideality

In many sectors of human endeavour the perception of value or ideality is often as if not more important than the actual importance. While the concept of perceived ideality is certainly present in evolved forms of TRIZ, several have commented that it is not given enough emphasis. This article is an attempt to begin to address this disparity.

Where perception is included in the definition of ideality, it is usually written (including in Hands-On Systematic Innovation) as:-

$$\text{Ideality} = \frac{\text{Perceived (Benefits)}}{(\text{Cost} + \text{Harm})}$$

It is written in this way because it is often the perception of the benefits part of the equation that is the important factor. Strictly speaking, the equation would be more accurately written as follows:-

$$\text{Ideality} = \text{Perceived}\left\{\frac{\text{Benefits}}{(\text{Cost} + \text{Harm})}\right\}$$

In other words, there is also the possibility – distinct in certain applications – that the perceived cost or perceived harm can be as if not more important than the perception of benefits. This second version of the equation implies that it can also be expressed as:-

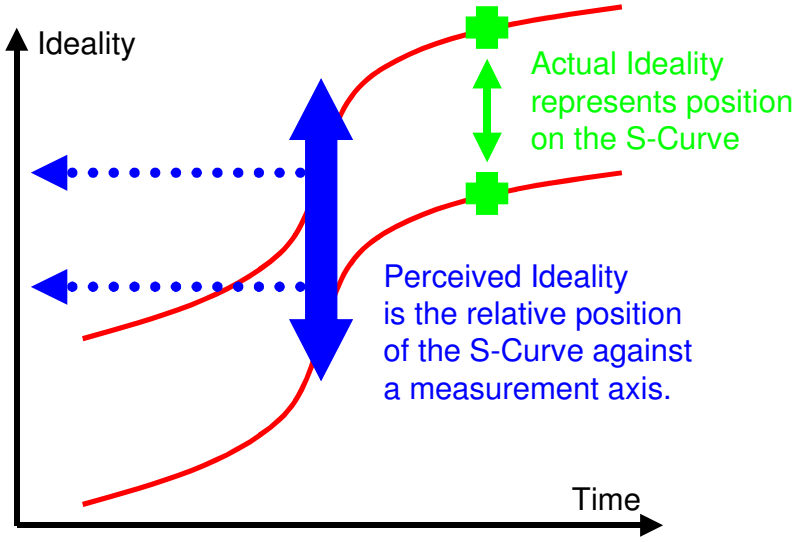
$$\text{Ideality} = \frac{\text{Perceived (Benefits)}}{[\text{Perceived}(\text{Cost}) + \text{Perceived}(\text{Harm})]}$$

With this version of the equation, it is important to distinguish what we mean by 'perceived' and 'actual' versions of each of the three parameters that make up the equation. We attempt to do that, taking the example of a mobile phone in the table below:-

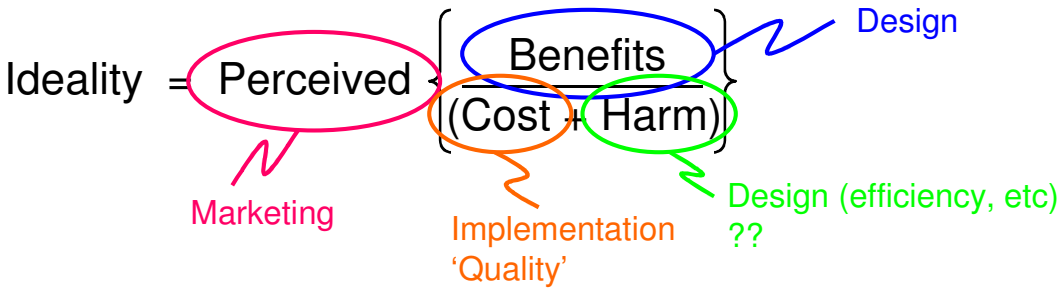
	ACTUAL	PERCEIVED
Benefits	Available talk-time per charge Range/Coverage Text/picture messaging Diary Clock/Alarm clock Etc	"I was standing in China/in the middle of the desert/etc, speaking to my girlfriend at home in the UK" "I can use my phone to switch on my home heating system"
Cost	Manufacture cost of component parts Cost of defects Cost of setting up infra-structure Etc	Retail price "my phone bill is less than…. the price of a Big Mac…"
Harm	Radiation level Non-recyclability of certain components	"the radio-waves fry your brain" "the phone makes an unsightly bulge in my pocket" "I'm addicted to SMS messaging"

Some of the metrics we use to measure the 'actual' values are of course in themselves based on perceptions – in that the concept of a manufacture cost in Euros/unit, for example, is an arbitrary (or almost) decision by a group of countries to provide a common means of describing how the cost of one thing compares to another. This, however, is one of those semantic discussions that we tend to see as irrelevant to the point of the discussion – which in this case is that, however we chose to record it, a mobile phone has an actual use of resources with an actual 'cost' associable with them.

The perceived versus actual comparison table above is the first real the point of this short discussion – that each parameter in the value equation has perception associated with it. The second point is a re-emphasis of previous discussions on the relationship between perceived and actual ideality from the perspective of the S-Curve. As shown in the figure below, actual ideality determines where we are on an s-curve, while perceived ideality describes the position of the s-curve relative to the ideality axis of the graph on which the curve is plotted.



Next time we will take this idea a step further be recognizing the problems that can occur because the responsibilities for different parts of the equation are often split inside organizations:-



This kind of segmentation of businesses into different areas is traditionally deemed to be the most effective means of conducting business. Specialisation and the differentiation of responsibilities is what has given the world mass-produced goods. In the world of today, however, many organizations are recognizing the falseness of some of these inter-departmental boundaries and the conflicts that can arise when one part of an organization

improves their part of the system (i.e. improves the ideality parameter for which they are responsible) to the detriment of other parts. A move towards a more holistic way of doing things – which is something the figure is intended to imply the importance of – is happening in many forward thinking organizations, most usually in the interface between the design (in its most general sense – i.e. services are 'designed' in the same way that products are) and the implementation (manufacture, teller, etc) elements. The gulf between design and marketing remains substantial in all but the most enlightened organizations. We will discuss this issue further in coming months.

Humour – Nested Jokes

From the Ministry for Telling Jokes Badly:

Two flies on a desert island. One says to the other, "I'll see you on Thursday".

What is going on?

Answer:
This joke is actually one inside the other. The joke on the inside is a pun (Inventive Principle 35) on two possible meanings of the word Friday – the first as a day of the week; the second as the name of Robinson Crusoe's desert island assistant (and the attraction of flies to humans). The outside joke – 'from the ministry of telling jokes badly' – sees the joke teller picking a day of the week with no recognizable connection to a desert island character. This second joke is also a Principle 35 (or at a push Principle 16) joke.

The double joke works (assuming it did for you) because of the familiarity of the inside joke in many parts of the world; and certainly if you've never heard the first joke, the second, outside joke is unlikely to work. If you have, of course, there is a possibility of two laughs; one remembering the original joke, and one recognizing the new 'twist' that has been made on it.

Conference Report
Passionate Machines – Tiny Steps Across The Chasm

"There are wavelengths that people cannot see, there are sounds that people cannot hear, and maybe computers have thoughts that people cannot think"
Richard Hamming.

1 February saw the one-day Passionate Machines conference being held at the University of Westminster in London. As suggested by the title, the theme of the conference was an exploration of the gaps that exist between the science and art involved in the artificial intelligence and 'artificial life' arena. The day featured five speakers covering a spectrum from Ken Renaldo's artistic endeavours in designing art installations involving Siamese fighting fish and engineer Steve Grand's attempt to construct a robot built around an array of self-learning, adaptive computer neurons.

With the exception of Steve Grand – who really seemed to have something new to say on the subject – the rest of the conference appeared to offer little of substance. Several of the speakers appeared to be trying to bridge the gap between man and machine by delivering their talks by monotone reading from a script. All bar one of these chose to speak (for nearly an hour) without the use of any visual aids either. This made the going a little difficult for a Saturday. What made the going *really* difficult, however, was a desire on the part of most of the speakers and certainly the most vocal parts of the (100+) audience to get into the tired old debates over whether computers will ever be able to really think, or be able to experience emotions, or whether they would ever pass the Turing test.

All of these arguments seem to fall into the usual either/or kind of trap. Is it human or a computer? Can it think or can't it think? Answer; its irrelevant. Why not start to think about these things from the perspective not of trying to enable computers to think like humans (hasn't that got us into enough problems already?), but how can we harness them to do the things that humans can't do very well only better.

The propensity of speakers to try and pigeon-hole things into this category or that lead to a frustrating number of arguments concerning semantics. Different people drawing boundaries in different places and then trying to justify why their own particular line in the sand was 'right' and others were 'wrong'. As a general rule for future reference, try and keep in mind the idea of 'the map is not the territory'. Language is a very poor means of communicating difficult concepts – there simply aren't enough words to adequately define things – and the Western 'I am right, you are wrong' mentality too often choses to argue the toss over some subtle (but ultimately futile) semantic subtlety. Trying to reduce complex questions like 'will computers ever learn to think' into simple compartments like 'yes' or 'no' is thoroughly pointless and completely misses the central issues at stake. Please, no more of this either/or points scoring. Its like arguing over the pronunciation of tomartoes or tomaytoes – at the end of the day they're both the same red spherical fruit.

Meanwhile – rant over – the whole rather sorry situation was ultimately redeemed by the Steve Grand presentation. For those that don't know, Steve was the architect of the 'Creatures' A-life computer game. Probably because of this background, it seems there has been some reluctance by the academic community to acknowledge that Mr Grand might actually have something new to contribute to our understanding of how our minds and bodies work. This is perhaps one of life's cruel ironies – like those described in the

disruptive technology descriptions in the James Utterback book 'Understanding the Dynamics of Innovation' – in which the so-called experts in a particular field refuse to accept the new ideas of those from a different sector, until its too late and the new idea has proved itself to be a more effective way of doing or seeing things. The evolutionary psychologists, ordinary psychologists, and every other sub-branch with psychology somewhere in the title are still arguing over Freud or Jung or the perennial favourite nature-versus-nurture (hey look, another irrelevant either/or) are busy stuck in one frame of reference unable to see another as it turns out equally valid interpretation of how we work. The fact that Mr Grand's hypotheses were based on self-organising, self-learning, self-adapting systems, we find it a little too hard to say no.

Check out some of Steve Grand's work at **www.cyberlife-research.com**.

Best of the Month

First disappointment of the month was another failure to find anything from around the TRIZ community we felt worthy of recommendation.

Our suggestion for this month is therefore the book ‘The Complexity Advantage’ by Susanne Kelly and Mary Ann Allison (McGraw Hill publishers, 1999). The book concerns itself with the importance of self-organisation in business systems. It is well written for the most part and contains several must-do implementation ideas. It also contains the seeds of an interesting trend that might find its way in some form into our collection of business trends.

Second disappointment of the month was ‘More With Less’ by Paul Ciotti. The book purports to be about Paul MacCready. For those that don’t know, Paul MacCready is the inventor of the human-powered aeroplane that flew from London to Paris, the Solar Challenger and a host of other well known inventions. Some of you fortunate enough to be present at TRIZCON01 will remember that he was one of the inspirational keynote speakers.

Although Mr MacCready apparently knew nothing about TRIZ at the conference (or since to our knowledge), he certainly fitted into the category of ‘people who think in naturally TRIZ-like ways’. His ‘doing more with less’ design philosophy is very highly in line with the TRIZ evolution direction, and making maximum use of resources. Consequently, we picked up the book with a strong hope that we would get more of an insight into the way that Paul MacCready thinks, and how that in turn might suggest some nuggets that might feed into TRIZ for the benefit of all of us.

Unfortunately author Paul Ciotti was much more interested in heading down inconsequential cul-de-sacs (Normandy landings, what his literature teacher taught him, the British class system, the mistakes the US made by trying to control oil prices in the 70’s, etc, etc) and very little about either Paul MacCready or, more to the point, about doing ‘More With Less’.

As it turns out the most insightful comment in the book related to the MacCready way of doing things was a story from a long time employee (which we will para-phrase as):-

“A salesman and an engineer go hunting. They hunt all day and don’t see anything, so the engineer goes back to the cabin and the salesman goes picking berries. As he is doing this, the salesman looks up and there’s a bear. The bear sees him and begins chasing him down the valley, up over the hills. When he gets to the cabin, the bear is getting angrier and closer. The salesman yells ahead, ‘open the door, open the door’. The engineer opens the door just in time, and the salesman bursts into the cabin with the bear right behind him. Seeing no let up by the bear, the salesman continues running through the cabin and jumps out, head first, through the rear window. As he lands he yells back to the engineer, ‘you skin that one. I’ll go about and find another’.

In case you’re wondering, Mr MacCready plays the part of the salesman in the story.

As far as the rest of the book is concerned, we vote ‘give it a miss’.

Patent of the Month

Anyone that has suffered the problem of un-reliable thermo-couples when trying to measure temperatures in difficult to access, unfriendly environments, will be pleased to learn of the granting of patent 6,517,240 last month. The invention – for an ultrasonic thermometer – is intended specifically to solve these and other problems associated with thermocouples. A number of conflicts have been solved in the invention – most notably the one between the need to make the device small in order to get good response and transient characteristics, and the parallel desire to make it robust enough to survive handling and fixing in aggressive atmospheres.

For those that might not be interested in either thermocouples or temperature measurement, you might like to observe the switch from mechanical to field-based ways of delivering the desired function used in the design (ultrasound is also one of our favourite fields anyway), but also the use of a pulse-echo (Periodic Action, Other Way Around) and interesting use of grooves (Local Quality or surface segmentation trend) cut into the probe part of the device. Like many high quality inventions, it is possible to observe several inventive steps taking place simultaneously.

Anyone still puzzled about how ultrasound can be used to measure temperature (is there no end to its capability?) might like to take a closer look at the patent. We have no hesitation awarding it our patent of the month award.

United States Patent **6,517,240**

Herb , et al. **February 11, 2003**

Ultrasonic thermometer system

Abstract

The ultrasonic thermometer system of the present invention includes a rod or probe of high temperature, grain-stabilized material that has a magnetostrictive or piezoelectric transducer bonded to one end. The transducer is excited by a transducer driver, creating short, periodic, ultrasonic pulses that travel down the length of the rod in a "pulse-echo" fashion. Along the length of the rod, circumferential grooves are cut which reflect some of the ultrasonic energy back to the transducer thus creating a reflected or echo signal. Two such reflected signals from two adjacent grooves, or a signal from one groove and a signal from the end of the rod, establish a temperature zone. This is the zone of interest to the user, which would be inserted into the user's process that needs to have the temperature monitored. As the temperature of the zone changes, the transition time of the ultrasonic pulse through the zone also changes, thus providing a measurable indication of average temperature and changes in average temperature of the temperature zone. There may be one or multiple temperature zones on one rod. A processor is also provided to correlate the signals generated by the transducer and reflected by the grooves with template signals to generate a temperature reading.

Investments – Electrically Conducting Plastics?

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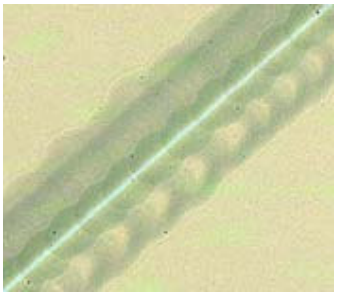

Find out more at: www.plasticlogic.com.

Biological Solution of the Month – Tengmalm's Owl

Tengmalm's owl has solved a problem faced by several predators of the animal kingdom related to how it locates its prey. Location is a particular problem in the initial stages before visual identification has occurred. Visual location in predators is generally limited to a relatively small field of view (in order that once visual location has happened, they can gather accurate depth of field and hence distance information using binocular vision). This limited field of view means that a large area can be tracked only by large head movements (which can make the predator easier to spot by the prey), or by using another non-visual means. In the case of owl's the non-visual prey location means is auditory. The problem with listening for prey is that it is often very difficult to identify *where* in three dimensional space a sound is coming from. Humans are particularly bad, for example, at working out where sounds come from – and the designers of emergency service vehicles everywhere have had to use many tricks to help the public identify which directions a vehicle is coming from.

Tengmalm's owl on the other had has evolved a rather simple solution to the acoustic location problem. By employing asymmetries (Principle 4) in the shape and position of left and right ear openings, it is able to exaggerate differences in time, loudness and phase of sound waves reaching the two ears, and thus far better able to establish what (elevation) direction a particular sound is coming from.

One of the great things about using Asymmetry is that it often requires no additional use of resources. This might explain why there is also the trend of evolution towards increased use of asymmetry – benefits increase, while cost is usually unchanged.