

Systematic Innovation



e-zine

Issue 23, December 2003

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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.

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.
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Abundance Theory versus Scarcity Theory

“Scarcity lies at the basis of economic theory; it supports the economic structure and fuels the engine of economic growth. Advertising, which ceaselessly encourages economic consumption and therefore economic growth, is a response to a lack, a scarcity within us, a deep-felt psychological need for reassurance through consumption. We are not cool unless we have a new sporty automobile; our fragile egos are strengthened by the latest perfumes and brand-name fashion, and new computer gadgets keep us occupied. There is a constant appeal to needs within us, to the hungry ghosts whose hunger can never be appeased.”

The spread of many useful creativity tools, methods and philosophies has been severely hampered as a result of non-creative thought processes by many of the key players capable of enabling that spread. In this article – heavily borrowed and adapted from a well known critique of the music industry – we examine some of the flawed thinking that produces this failure. It seems to us that TRIZ is currently caught in the grip of similarly flawed thinking on the part of many operating in the field. We don't expect this article to have any influence on the way they might think, but rather hope that it might serve to prompt a few 'someone, somewhere already solved my problem' thoughts in other areas. The theme of the article is two distinct thinking processes – one concerned with scarcity; the other with abundance.

The Theory of Scarcity, firstly, tends to appear very early in life for many people.

There are only a few slots open for the school football team. The chosen ones become the school heroes -- the "in crowd", while the rest are relegated to the "outer circle", hoping that one day, somehow, they might find a way into that favoured group.

The Theory of Scarcity is reinforced again when we apply for college or university. The *really good* schools have only a limited number of openings for entering students. So the students who are accepted to universities like Harvard, Yale or Cambridge become part of that elite group whose futures seem to be etched in gold, while everyone else struggles through the average education system and the subsequent competition for a job that will at least pay the rent.

If somehow we escape the scarring that the Theory of Scarcity offers us growing up, those of us who enter Industry will undoubtedly encounter it there. In fact, as suggested in the quote at the beginning of the article, the Theory of Scarcity has dominated Business for most of the 20th Century -- especially the last twenty-five years. The unspoken but hard and fast rule is simply this: *There are only a few select places open in Business for real success and profit. Therefore, if you really wants to "make it", you must...*

- A. Grovel, shove, manipulate and push your way into one of the coveted "positions."
- B. Be sure to protect that position once it is attained -- warding off any younger or more talented newcomers who may threaten to unseat you.

Does the Theory of Scarcity sound harsh? Unreasonable? Perhaps. But by the time we encounter it in Industry, we have become so conditioned to its existence in other facets and seasons of our lives that we accept it as a core reality of life. In fact, many of us have been so cowed into submission to the Theory of Scarcity that we actually foster it

ourselves by sucking up to the "insiders" -- treating them as larger than life and not even being offended when they disregard, patronize or dismiss us.

There are only a couple of problems with the Theory of Scarcity. First, it is a manmade myth rather than a universal truth. Secondly it simply doesn't work.

While it may *appear* to be another case of fortunate insiders controlling and excluding whatever they wish, in reality the Theory of Scarcity creates a self-defeating downward spiral that sweeps everyone into it like a tornado.

- As the limited number of products or services made available to the market head towards maturity, they all begin to look and perform in very much the same ways.
- Anything which is 'different' finds it increasingly difficult to find an outlet.
- Consumers start getting tired of the "same-old, same-old" and, consequently, sales drop.
- Companies react by downsizing and pulling inward. Any new technology or innovation is seen as a threat. Paranoia over job security replaces creativity and innovation.
- Cutthroat business practices abound.
- The vast majority of the 'different' stuff either burns out trying, or disappears altogether.

Contrast this downward spiral with the Theory of Abundance. It is 180 degrees the other direction. The basic premise is this: *There is a big world out there with enough space for every talented person or organisation to achieve their goals -- if they are willing to learn and polish the disciplines of the craft.*

Every organisation has a community of creative people who are developing new and fresh innovations. The more of these people there are on the playing field...

- The more opportunities arise for different combinations of talent, different collaborations and consequently, new ideas
- The more new ideas and creativity, the greater the opportunities for competition on the basis of musical merit rather than "political" connections
- The more competition, the higher the standard of excellence all around, which stimulates still more creativity
- The more creativity unleashed...the better the output in all genres
- The better the output...the more sales...the more profit for everyone

The restaurant business discovered the Theory of Abundance years ago. Have you ever watched a new McDonald's going in on a previously vacant corner of your town? You can bet your french fries that it won't be long before Burger King goes in next door with Kentucky Fried Chicken, Wimpy and Taco Bell just down the way. And do these newcomers take away business from McDonald's? Very definitely, no they don't. The savvy marketing teams in each of these restaurant chains realize that when that corner of town becomes known as "restaurant row," more consumers will be drawn to that area every day. They will decide when they get there which fast food will satisfy their craving today -- but in the end, all the restaurants will profit from the increased and steady traffic.

Another example: It was not too many years ago that the not-too-handy homeowner was forced to hire *trained professionals* to do things like hang wallpaper, lay a tile floor, remodel a bathroom etc. These professionals were often hard to find and very expensive to hire. Enter the Theory of Abundance -- otherwise known as the DIY stores. Instead of trying to control and monopolize the home repair industry, the DIY store marketing teams came up with a phenomenal new concept -- *equip the Homeowner to do his own remodeling and repair*. Some of the first DIY chains began holding classes on how to sponge paint, hang wallpaper, install a toilet, lay a new floor, or landscape a back yard. Each class -- and each department of the store -- was staffed by those *trained professionals*. They made remodeling and repair attainable, affordable and fun. The weekend handyman was able to look at a completed project with creative pride and a newfound confidence to try yet another project next weekend.

And did this new Theory of Abundance bankrupt the home repair industry? Only those who were unwilling to "go with the flow" and embrace the new creativity. Those who insisted on "doing it the way we've always done it" became as outdated as buggy whip manufacturers after the advent of the automobile. But the ones who could roll with the punch started their own home repair classes, produced videos, manufactured do-it-yourself kits and got shows on *Home and Garden TV* -- and they still took care of the many homeowners who had no previous desire to do-it-themselves.

It seems to us, at the end of all this theorizing that it is far better to conduct business accompanied by the Theory of Abundance rather than the traditional Theory of Scarcity. New people, new opportunities and new challenges, keep life and work exciting and rewarding. There will always be younger, more talented, more creative people entering the business scene, whether we try to keep them out or not. Instead of thinking of them as harmful, the Theory of Abundance suggests, hey, perhaps these upstarts might actually be useful resources (does anyone in the TRIZ community ever actually use TRIZ we wonder??). To be honest, we're not sure if large sectors of the "community" will ever "get it" and begin to make the shift Scarcity Abundance Theory. If they don't, the evidence of history suggests they will eventually disappear altogether. The Internet and other new technologies have already opened Pandora's Box. To our mind, there is no going back. The Theory of Abundance is alive and well.

Further Reading:-

1. William Greider W., *'One World, Ready or Not - The Manic Logic of Global Capitalism'*, New York, Simon and Schuster, 1997.
2. Myers, N., Simon, J.L., *'Scarcity or Abundance?: a Debate on the Environment'*, New York, W.W. Norton, 1994.

What Would Make TRIZ *Really* Take-Off

This month we take the theme of last month's article about 'If TRIZ is so good, why isn't everyone using it?' and turn it on its head. The question this time around is 'what would make everyone use TRIZ?' The purpose of posing the question is twofold; in the first instance it allows the TRIZ community an opportunity to identify possible strategies for expanding the use of TRIZ, and in the second it allows us to examine whether the perception mapping tool we demonstrated in last month's article also works when we use it in a positive as opposed to negative sense – trying to identify and develop possible opportunities as opposed to the originally conceived use as a problem solving methodology.

The first part of the process, like the 'conventional' problem-solving use of the technique, involves listing as many possible answers to the posed question. That question in this case was the 'what would make TRIZ really take-off' one that forms the title of the article. In thinking about possible answers to the question, it would be fair to say that we derived far fewer than in last month's attempt to look at what was stopping TRIZ from taking off. As it happens, in this case, we were able to identify just 10 possible strategies. These were as follows (in no particular order):-

- Produce a 'good' introduction book
- Introduce certification an/or a recognized qualification (a la 'black-belt' from Six Sigma)
- Political support
- Solve a major problem
- Get TRIZ into school/college curricula
- Produce a mass-media/popular film/programme
- Celebrity endorsement
- Find the 'tipping point' (see Reference 1 – basically, the tipping point is an event – often quite peripheral to the actual issue at hand at the time it happens – that prompts something to turn from a cult into a popular phenomenon)
- Press support
- 'Guarantee' success to users

Of interest when comparing this list to the 'opposite' list of items preventing TRIZ from taking off from last month, was the fact that considering the positive aspects of the situation produced almost completely different results than might have been expected. Considering the positive, in other words, was not the same thing as negation of the original negative elements. This seems to be an important consequence of specifically approaching the situation from a very different start point.

The next part of the process, then, involved asking the question 'what does this lead to?' for each of the ten listed opportunity generating strategies. The rules of this exercise were as before; each of the ten had to be connected to one (and only one) of the remaining nine strategies. The result of this analysis are reproduced in Figure 1 below. As in the previous exercise, we used the Visual Concept software to produce the picture.

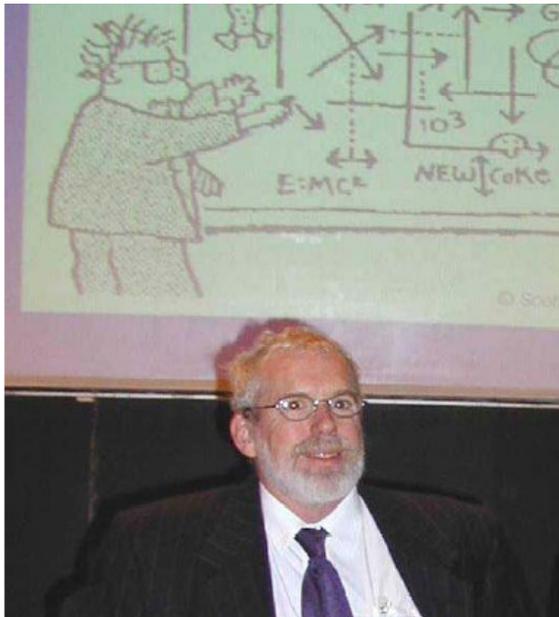
TRIZ its due credibility. Finding Mr or Ms 'Right' needs some of the inventive thinking found in, for example, the Absolut vodka advertising campaign – where Andy Warhol (someone not expected to be associated with vodka necessarily) turns out to set exactly the right context for giving the brand the reputation it now holds. We invite readers to suggest possible celebrity connections to TRIZ and the issue of achieving its wider awareness and use.

More generally, we believe the positive-thinking version of the flow-scaping/perception mapping tool holds significant potential for managing the complex and differing perceptions typically found in situations like the TRIZ one. In fact, it seems clear that the name of several other tools and techniques could very easily have been substituted into the question used in this exercise with little impact on the findings. At this generic level, we encourage readers to give the method a try when they find themselves in need of a simple, easy to use tool for managing complex opportunity finding or problem solving situations.

References

- 1) Gladwell, M., 'The Tipping Point', Little Brown, London, 2000.
- 2) De Bono, E., 'Water Logic', Viking, 1993.
- 3) Cavallucci, D., 'The Role of TRIZ in Technology Development', keynote address at TRIZCON2003, Philadelphia, March 2003.
- 4) 'A Breakout for British Invention?' article in Eureka magazine, March 2003.

Humour – Occam's Toothbrush



Occam's Razor is the principle proposed by William of Ockham in the fifteenth century that "Pluralitas non est ponenda sine necessitate", which translates as "entities should not be multiplied unnecessarily". In more modern terms, if you have two theories which both explain the observed facts then you should use the simplest until more evidence comes along.

Occam's Toothbrush – a far less well-known variant of the original Razor concept! – was first described to us by economic forecaster Bill Swan (picture above) from Boeing during our visit to the International Society of Forecaster's conference in Dublin last summer. In simple terms, Occam's Toothbrush is defined as follows:-

"there is never enough time to do it right, but always enough time to do it again"

The basics of the test are this: Your boss knows exactly what the 'right' answer is. He asks you to run calculation after calculation to find the most reasonable set of assumptions that will allow his answer to be right. If the eventual set of assumptions is in any way believable, then his hypothesis is proven. If not he is going to have to admit he is wrong and come up with another one. This is rarely acceptable. Usually both worker and boss are not fully conscious of what is going on.

We offer a prize to the person with the best example of the Toothbrush in action.

Conference Review x2 – TRIZCON and TRIZ Kongress.

CREAX attended both of the TRIZ conference events scheduled in the first half of the year, presenting papers at both. We were very happy to meet new and old friends and share some of our latest work.

Anyone wanting to read copies of our main papers can download them [here](#).

With regard to the conferences themselves, there were strong elements of both similarity and difference. On the similarities front, we found both conferences disappointingly free of any new content; in other words, as a learning event for those already familiar with TRIZ, there was not an awful lot on offer. Acute lack of case studies (ones from 1983 are difficult to count!) and advances in the methodology were apparent in both Philadelphia and Zurich. (Fingers crossed for a better showing at the TRIZ Future conference to be held in Aachen in November.)

Difference-wise, Philadelphia featured a considerably smaller audience than in previous years – attracting only around 60 delegates – while Zurich, with rather shorter set-up time, managed to attract over 100 delegates, with – despite a strong German language bias – a much more global audience.

Highlights of the two events –

Philadelphia saw our hats go off to Denis Cavallucci for his keynote address on the growing dissemination of TRIZ across the French academic sector. In Zurich, the adjacent pair of papers from Siemens and Samsung probably offered most in terms of observing different approaches to making TRIZ actually deliver real benefit. It was also our great pleasure to spend time with people from both organizations at the conference dinner. Many thanks to all for their frank discussion and friendship.

Lowlights –

The afore-mentioned lack of new content has to be the biggest disappointment from the two events. This disappointment was echoed by Victor Fey via his announcement that there had been no advance in TRIZ for the last 15 years. Unfortunately, Victor didn't seem to be too interested in testing his belief – spending yet another year attending none of the papers and making no contribution of his own. Strange.

Inevitably coupled with the lack of content was a distinct absence of editorial and content control at both conferences (particularly Philadelphia). Far too many of the papers allowed in to both conferences, we are sorry to say, really had no place being there. If TRIZ is going to survive and thrive into the future it really is going to have to demonstrate a much higher degree of competence in future events. Far better, we think, to reject papers and shorten the conference than to make audiences endure sales talks, 20 year old material, presentations that managed to avoid any connection to TRIZ at all, and descriptions of 'things we'd like to do one day'.

Long term conference success generally necessitates the presence of three essential elements; content, content and content.

Patent of the Month

Patent of the month this month was US6,523,016 granted to George Mason University in Virginia on 18 February. Yes, we know, February is not in March, but this patent was left over from our analysis of February patents, and we haven't found anything we liked more in March's collection of new grants.

The invention is titled 'Learnable Non-Darwinian Evolution'. It's focus is in the arena of learning software algorithms. We were initially attracted in the 'non-Darwinian' phrase since the very idea seemed to run counter to the prevailing logic of the mechanisms by which systems evolve, and as such, reverses an awfully powerful piece of psychological inertia. Darwinian evolution, of course, is largely driven by a process of random mutation followed by natural selection. The theme of the invention is that while this kind of random mutation can take place very much more rapidly in a virtual as opposed to physical world, it is nevertheless a very inefficient way of evolving new solutions to software and design problems. Or, as quoted from the background section of the invention disclosure:-

The Darwinian-type evolution is, however, semi-blind: the mutation is a random modification of the current solution; the crossover is a semi-random recombination of two solutions; and the selection (survival) of the fittest is a form of parallel hill climbing. In this type of evolution, individuals do not pass lessons learned from their experience to the next generation. Consequently, computational processes based on Darwinian evolution are not very efficient. Low efficiency has been the major obstacle in the application of evolutionary computation to very complex problems.

As hinted in the paragraph, the invention utilizes an element of lesson-learning in the process in order to speed the evolution process. This lesson learning is called Learnable Evolution Model in the invention disclosure. In simple terms the model employs a machine learning mode at selected steps of evolutionary computation to determine reasons why certain individuals in a population are superior to others in performing a designated class of tasks.

As detailed in the disclosure, below is a general form of the learning evolution model:

1. Randomly, or according to certain rules, generate a population of individuals (in analogy to the evolution in nature, they may represent genotypes or phenotypes). When applying the model to evolutionary computation, individuals can represent problem solutions, designs, concept descriptions, plans, strategies, or any objects that are actors in an evolutionary process).

2. Invoke the Machine Learning Mode:

- a. Split the current population of individuals (solutions) into three groups: HIGH (high-performance), LOW (low-performance), and MEDIUM (medium-performance), based on the values of the fitness function. In some circumstances, the MEDIUM group can be empty.

- b. Apply a machine learning method to create a general description of HIGH individuals, which differentiates them from LOW individuals (and, optionally, a description of LOW individuals, which differentiates them from HIGH individuals).

c. Generate a new population of solutions by replacing non-HIGH solutions in the population by those satisfying the newly generated description of HIGH solutions and hd-lookback (high description-lookback) descriptions generated previously. Alternatively, apply an incremental learning method that uses past descriptions (of HIGH individuals and, optionally, low individuals, and new individuals classified into HIGH and LOW groups, and produces new descriptions consistent with new HIGH individuals (optionally, also LOW individuals). Individuals satisfying these descriptions are generated randomly or according to certain description instantiation rules. This step may also involve generating more individuals that are needed for the replacement, and then selecting the best ones to maintain the assumed size of the population.

d. Continue this mode until the machine learning mode termination condition is met (e.g., the best fitness in a sequence of learn-probe populations does not exceed the best fitness previously found by more than learn-threshold).

e. If the machine learning termination condition is met, one of the three steps can be taken:

(i) If the LEM termination condition is met, end the evolution process (such a condition may be that the best individual generated so far has reached a satisfactory fitness value, or that the allocated computational resources are exhausted). The best individual obtained at this point is the result of evolution.

(ii) Repeat the process from Step 1,

(iii) Go to step 3.

3. Invoke the Darwinian Evolution Mode, which applies Darwinian-type evolutionary operators, that is, some form of mutation, recombination (optionally), and selection to generate consecutive generations of populations. Continue this mode until the Darwinian evolution mode termination condition is met (e.g., the best fitness in a sequence of dar-probe populations does not exceed the best fitness previously found by more than dar-threshold).

4. Go to step 2, and then continue alternating between step 2 and step 3 until the LEM termination condition is met (e.g., the generated solution is satisfactory, or the allocated computational resources are exhausted). The best individual obtained at this point is the result of evolution.

In the terms of the Inventive Principles, the non-Darwinian evolution calculation strategy is using numbers 1, Segmentation (splitting the initial mutation solutions into different groups); 23, Feedback and 5, Merging. None of these represents solutions suggested by the classical Contradiction Matrix for problems in which there is a conflict between desires to improve calculation efficiency and be able to tackle problems of an ever more complex nature. (Our new software matrix will reflect the findings of this and many other software focused patents – see next month's newsletter for more details.)

The patent also sees a form of geometric evolution taking place if we can think of the TRIZ trend of evolution – since instead of taking point mutations and ranking them, the invention

seeks to incorporate a fitness vector (point to line) in enabling more rapid evolution to occur.

While we remain heavily opposed to the idea of being able to patent algorithms like this, we nevertheless like the advance made possible by the inventors since we have our own internal interest in this arena.

(Best of March's patents for those feeling a little cheated that there is no March patent is US6,533,903 'Electrohydrodynamically patterned colloidal crystals' awarded to Princeton University on March 18. As quoted from the invention disclosure:-

The arrangement of colloidal particles in a crystalline array has a variety of potential applications. Immediate possibilities include, but are not limited to the production of a template for photonic band-gap material with two-dimensional channels, biological and chemical sensors (by functionalizing the surfaces of the colloidal particles), micro-chip reactors, and high-density data storage devices.)

Best of the Month

A TRIZ-wise tie between the Denis Cavallucci TRIZCON keynote and Samsung papers at TRIZ Kongress for the honour of best of the month.

In the wider world, we heartily recommend 'Emergence: The Connected Lives of Ants, Brains, Cities and Software' by Steven Johnson. Expect more from us on the impact we expect emergent systems theory to have on the wider TRIZ scheme in future months. This book should get you in tune with our thinking in the meantime.

http://www.amazon.co.uk/exec/obidos/ASIN/0140287752/ref=sr_aps_books_1_1/026-2638752-6905254

Investments – Capacitive Sensing



Quantum Research Group Ltd is a privately held "fabless" semiconductor firm based in Hamble on the south coast of England. Quantum specializes in designing and developing capacitive sensor ICs based on its proprietary QProx™ technology. QProx™ is a revolutionary technology employing charge-transfer ("QT") sensing techniques, combined with sophisticated digital signal processing algorithms. The company was founded in 1996 with the launch of its first major products in 1997. Over the years its solutions have increased in range and number to include different ICs under the QProx™, QMatrix™, QTouch™, QStamp™ and QLevel™ brands, that are used for creating touch buttons, touch keypads, proximity sensors and fluid level sensors.

The Q-Prox devices are designed for appliances, kiosks, control panels, portable instruments, machine tools, or similar products that are subject to a variety of environmental influences or vandalism. They permit the construction of sealed, watertight panels immune to humidity, temperature, dirt, or physical deterioration.

Check them out at www.qprox.com

Biology

The Gibbon

Gibbons in South East Asia are the primate world's fastest travellers, swinging through the tree canopies, a process of locomotion known as brachiation, with astonishing speed and accuracy. Their talent for this requires careful planning and judging of distances and also extreme dexterity and strength in their arms and wrists. Their travelling paths often require them to change direction on each 'swing' at high speed. Other primates of their size are not able to travel at such speeds whilst rapidly changing direction, as the energy usage to twist the body at the shoulder is very high.



Gibbons manage to overcome this problem by twisting at the wrist instead of the shoulder. But how do they manage to twist at the wrist?

Travelling at high speed the torque generated in the wrist and thumb joint would be very great. We can write this as a generic conflict:

Things I am trying to Improve:	Speed
Things getting worse:	Torque translated as Force
Classic Matrix suggests:	(13) Other way round, (28) Mechanics Substitution, (15) Dynamize, (19) Periodic Action

It turns out that gibbons have developed the ingenious solution of a ball and socket joint at the thumb that allows them to twist with ease. A ball and socket joint can be seen as a combination of Principle 15 D, Dynamize: 'Increase the amount of free motion', and Principle 14, Spheroidality.

In agreement with much of what we have seen this year, in this situation it can again be seen that the strongest solution was developed using a combination of inventive principles; the application of a single principle alone would not be sufficient to effectively solve the conflict.

The solution can also be seen to follow both the 'Increasing degrees of Freedom' trend and the move from line to curve of the Linear Geometric evolution trend.