

Systematic Innovation



e-zine

Issue 45, December 2005

In this month's issue:

Article – Hero-Artist-Prophet-Nomad Cycles And Discontinuous Business Trends

Article – A Limited Resource Problem

Not So Funny – The Worst Of 2005 Awards

Patent of the Month – Quantum Logic Gate

Best of The Month – What *Were* They Thinking?

Conference Report – TRIZ Future Conference, Graz

Investments – Crystal Sponges

Biology – Mudskipper

Short Thort – Function Analysis

News

The Systematic Innovation e-zine is a monthly, subscription only, publication. Each month will feature articles and features aimed at advancing the state of the art in TRIZ and related problem solving methodologies.

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

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

Hero-Artist-Prophet-Nomad Cycles And Discontinuous Business Trends

Let us delve into 'theory of everything' territory for a few moments. One of the aims of TRIZ is to create a framework into which all knowledge fits. A fascinating piece of that knowledge jigsaw is 'The Fourth Turning' (Reference 1). The book attempts to draw a picture of repeating cycles in the evolution of the United States. Each of these cycles – which the authors describe as a saeculum – has a duration of between 80 and 105 years and contains four different generation types, each at different phases of their life. These generations are represented by the Hero, Artist, Prophet and Nomad archetypes described in the title of this article. According to the book, the underlying evolution dynamic of family-based societies always produces these four characteristic types, in the same sequence within each saeculum – Figure 1.

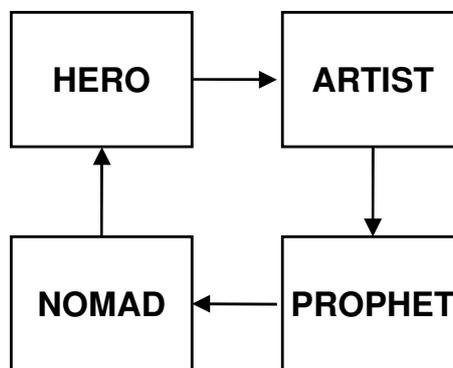


Figure 1: Repeating Cycle Of Four Generational Characteristics Inside A Saeculum

The basic idea behind this repeating cycle is that the life-perspective of one generational type has an impact on the offspring they produce. Thus, to take a simple example, the latest generation of 'prophets' were the so-called 'baby boomer' generation, born in the 1946-1960 period after World War 2. Prophet generations are fundamentally raised by 'artist' generations. In this latest cycle, that 'artist' generation comprised people born during the 1929-1946 'crisis' years like those between the Great Depression and WW2 (the so-called 'Silent Generation'). Children raised during a crisis era tend to be somewhat suffocated by their parents. As a result, when 'artists' grow-up and produce their own offspring in a non-crisis era, those children tend to be very indulged. Post-war 'Boomer' generation babies were thus brought up during a 'New Frontier' period, when there was plenty of everything to go around, and 'everything was possible'. Because they were indulged and had plenty, this generation subsequently tended to rebel (a la James Dean 'Rebel Without A Cause') when they expected and didn't get their own way.

Although difficult at first glance to see how such gross generalizations can be justified, the basic idea is that even small societal differences in the way in which children are raised tend to re-enforce to produce large-scale societal differences. The DNA of family and societal life, in other words, influences the way in which different generations behave at different times of their life. The societal result of these differences then in turn influences the manner in which individuals and families behave. What we have here is the ultimate in complex systems theory – complex societies emerging from the accumulation of millions of individual behaviours, which in turn are influenced by the societal systems they create. The Reference 1 text uses up several hundred pages to explain why the theory works. We

won't try and repeat any of that explanation here, except to point out the important role played by feedback loops. There is a fundamentally random element present in any system never mind something as complex as human societies. Thus a major technological innovation can occur at any point in time, so can a conflict between two people or two nations, or there can be a terrorist action, or release of a particularly popular film or song. The reason that these random events have little impact on the repetition of the Hero-Artist-Prophet-Nomad and other repeating cycles is not that they occurred but the manner in which society responded. The bombing of Pearl Harbor, for example, produced an immediate US national unification and resolve to respond because society was at an appropriately decisive phase of the saeculum. Earlier and later events (like WW1 or the Cuban Missile Crisis or Vietnam) provoked far less decisive action because they occurred at less decisive periods in the saeculum.

So what makes a society enter decisive or indecisive phases? Figure 2 illustrates some of the 'societal DNA' characterizing the different generational archetypes at the four main age stages of life:

	0-20	21-41	42-62	63-83
HERO	protected	heroic	hubristic	powerful
ARTIST	suffocated	sensitive	indecisive	empathic
PROPHET	indulged	narcissistic	moralistic	wise
NOMAD	abandoned	alienated	pragmatic	tough

Figure 2: Typical Personality Characteristics Of Generational Archetypes At Each Life Stage

At the time of Pearl Harbour, pragmatic Nomads held much of the political power, and a Hero generation was entering their heroic 21-41 life-stage; all the right combinations of characteristics to respond decisively. Vietnam, on the other hand was fought during a period when the 'Silent Generation' Artists were in their most influential and simultaneously indecisive life stage, and the 21-41 year old Baby Boomers were at their most narcissistic. Net result; two very different national responses.

Before we take this story too much further, we need to introduce another repeating cycle. This time one relating to calendar time. Because of the Hero-Artist-Prophet-Nomad and generational effects, at any given point in history, there will be different generational archetypes at different lifestages. The various combinations of types and ages present at any point in time then serve to characterize that time. The Reference 1 authors identify four such stages, or 'turnings' – High, Awakening, Unraveling and Crisis. These four stages, like the Hero-Artist-Prophet-Nomad sequence, always follow the same cyclical sequence. Thus unravelings will always follow awakening periods, crises will always follow unravelings, and so on. Not mentioned in Reference 1, but very definitely consistent is that these four historical stages represent different stages of a societal s-curve. We can see the correspondence crudely in Figure 3.

Each of the four stages of the s-curve typical lasts for one generational span of time – i.e. approximately one quarter of a saeculum. One S-curve thus has a total span of one saeculum or 80-105 years. Each stage of the progression maps elegantly to what TRIZ people will know as the various different stages of an s-curve:

'High' periods occur in the birth and initial growth stages of the s-curve. Societal emphasis during high periods (e.g. post WW2 boom period) is on growth, great periods of innovation and productivity.

'Awakening' periods are then characterized by the often difficult transition from birth to widespread growth. There are often several competing ideologies present in society, one

of which will tend to become dominant. In the US, the Woodstock/flower-power period illustrates the sort of inter-generational tension that often appears during awakening periods.

'Unraveling' periods represent the maturity end of the s-curve, and thus the emergence of societal level stagnation and inertia. This is also the period where societal level conflicts will begin to emerge.

'Crisis' periods then correspond to the periods when the society can no longer live with the fully emerged conflict. Emergence and resolution of the conflict crisis then ultimately results in the emergence of a new s-curve, and a repetition of the overall High-Awakening-Unraveling-Crisis cycle.

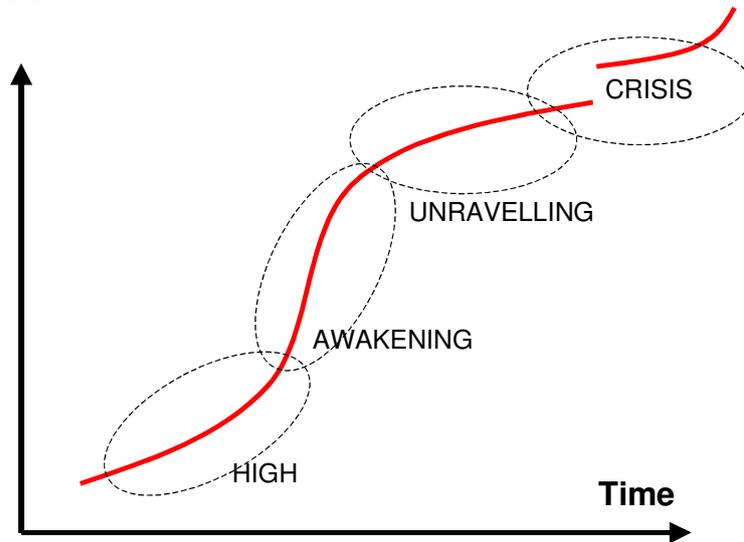


Figure 3: Relationship Between High-Awakening-Unraveling-Crisis Sequence And Societal S-Curves

When we put this S-curve cycle together with the earlier Hero-Artist-Prophet-Nomad cycle we get something like the picture illustrated in Figure 4. This figure represents a one-image attempt to summarise many pages of description and validation in the Fourth Turning book.

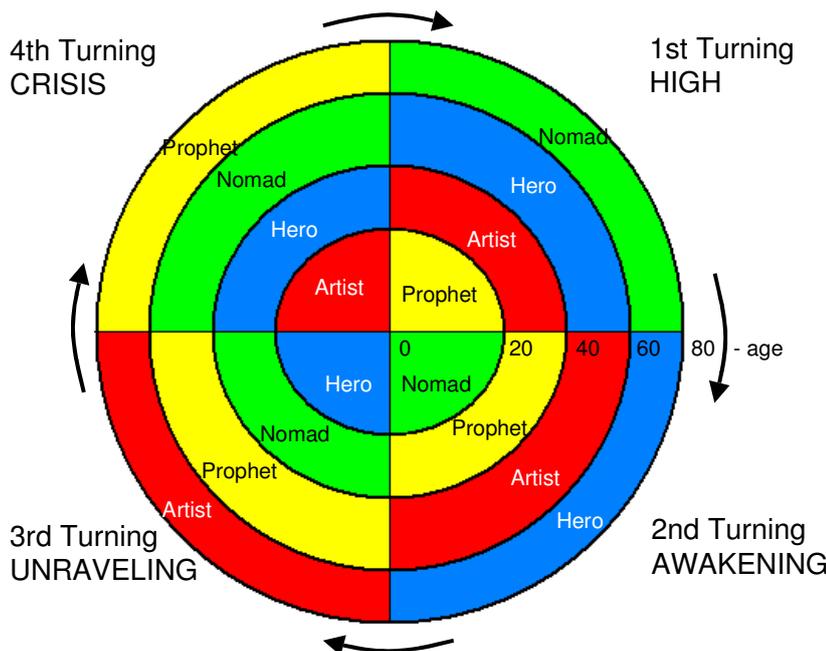


Figure 4: Combination Of High-Awakening-Unraveling-Crisis And Hero-Artist-Prophet-Nomad Cycles

The figure shows the age stage of the different generational archetypes at each point in the s-curve cycle. A full rotation around the cycle represents the span of one s-curve and thus one complete saeculum. Again we get a self-re-enforcing system in which individual characteristics influence societal patterns, which in turn influence individual characteristics. Figure 5 goes on to illustrate some of the other high-level societal outcomes that occur during each quarter Turn of the saeculum.

	High	Awakening	Unraveling	Crisis
Families	strong	weakening	weak	strengthening
Society	unified	splintering	diversified	gravitating
Culture	innocent	passionate	cynical	practical
Worldview	simple	complicating	complex	simplifying

Figure 5: High Level Societal Outcomes Resulting From Generational Archetypes And Saeculum Periods

Interesting in this figure is a comparison with known TRIZ trends like the law of increasing-decreasing system complexity and the tendency of systems to flip-flop from one extreme to another.

The point of this article is to highlight the presence of these cycles. What we have here in essence are a series of repeating continuous progressions that result in non-linear societal behaviour. We believe that the cycle has much to say about many aspects of innovation. At the most base level, design and advertising of new products ought to take into account the target saeculum Turning. We have already seen this trend have a major impact on the design of certain consumer products for example. At a higher level, coming back to the 'theory of everything' idea, what we have thanks to the cycles uncovered in The Fourth Turning is an important piece in what will hopefully turn out to be a much more comprehensive and accurate 'model of the world'. That being said, even though the book was published in 1997, much of what it prophesied about the years since is remarkably accurate. The title of the book relates to the prediction that the US will enter another 'Crisis' period starting from the year 2005, 'plus or minus a few years'.

Our primary interest is in a more global model than what will happen specifically in the US in the next 20 years. To that end, expect to see several more articles in future months linking the Fourth Turning to Spiral Dynamics (how individual thinking 'DNA' might influence collective behaviour), to the concept of Rhythmic Entrainment (how trends patterns in one society tend to influence behaviour in others), to analyses of other nations – especially China and India – which may well have very different patterns to the US Hero-Artist-Prophet-Nomad cycle. Picture if you can a hierarchical structure of DNA behaviours at individual, family, village, societal and ultimately global levels, all in turn influencing what happens at higher and lower levels and you have an image of the sort of model we are trying to construct. Hopefully this introduction article starts us along that long road in a manageable step. Forget about its role in the big picture and at the very least we have presented a new discontinuous trend of evolution that should influence the design of your next new (US) product. Hopefully, though, future articles in the series will begin the process of building a coherent overall story that will allow us to answer much broader questions.

References

- 1) Strauss, W., Howe, N., 'The Fourth Turning: An American Prophecy', Broadway Books, New York, 1997.

A Limited Resource Problem

This article is a write-up to accompany an exercise we sometimes conduct on workshops in the post-lunch 'resources' teaching slot. The problem is undoubtedly both dumb and outside the normal experience of delegates. The advantages of such case studies is that there is very little prior-knowledge psychological inertia, and, because the problem is such a trivial one, people are able to concentrate purely on the process.

Here is the problem: Figure 1 illustrates the initial problem situation. A steel tube has been set into concrete in the middle of the floor of a large room. The pipe sticks out of the floor by around 100mm. The internal diameter of the tube is slightly bigger than the diameter of a table-tennis ball. The overall clearance between ball and tube is 0.03" (0.75mm).

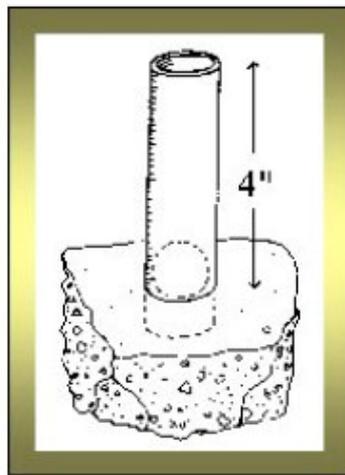


Figure 1: Initial Problem State

The room is totally empty apart from six people and the objects illustrated in Figure 2. The room has no electrical power or other services, and is lit naturally. The object of the exercise is to determine as many ways as possible to extract the ball from the tube. Only the available resources may be used, and the ball, tube and floor must not be damaged either during or after the ball has been successfully removed.



Figure 2: Limited Resources

Usually five minutes is ample time for generating solutions. A typical score would be two valid solutions and half-a-dozen invalid ones. A good score would be four or five solutions.

Here are a few solutions that will not work:

- using the chisel to get the steel tube out of the concrete – this will damage the floor and so does not meet the no-damage criterion

- using the hammer or adjustable spanner to hit the side of the tube in an attempt to 'vibrate the ball up the tube'. This solution doesn't work because the gap between ball and tube is too small and the height the ball has to be raised is too high
- crushing the Rice Krispies and dropping them into the tube. Assuming we can crush the cereal fine enough, fragments may pass to the underside of the ball, but once we have filled the underside, no more fragments will enter and we will never raise the ball (surprising that many people think this solution will work!)
- hooking the ball using the coat-hanger – the diameter of the wire is considerably bigger than the gap between the ball and the tube

Here are solutions that will work:

- unravel and reshape the coat-hanger into a u-shaped pair of tongs and then use the file to remove material from the two ends until the remaining wire does fit into the gap between ball and tube
- tear a strip or sheet from the Rice Krispies box, roll into a tube that just fits inside the steel tube, then insert into the gap between ball and steel in order to grip the ball
- get one or more of the six people to chew mouthfuls of Rice Krispies until sticky cereal-glue is produced; stick the glue on the hammer handle, chisel, adjustable spanner handle or coat hanger, lower into the tube so that the 'glue' also attaches to the ball, then lift
- get several people to blow horizontally across the top of the steel tube (possibly assisted by forming blowing tubes out of the Rice Krispies box); this will lower the pressure in the volume in the tube above the ball, thus causing the ball to rise
- get one or more of the six people to pee into the tube (depending on culture this will usually be the first solution that emerges from the session!)

(Any other viable solutions greatly appreciated if readers are interested in working on the problem over the holiday season.)

Meanwhile, the serious learning point from the exercise is that the resources available to us are not always so obvious. None of the 'resources' present in this problem in fact is sufficient on its own to realize a valid solution. Successful solutions to the problem thus require the adoption of at least one of the following generically applicable strategies:

- 1) **modification** of an existing resource – turning the Rice Krispies packaging into a tube in this case
- 2) **combination** of resources – e.g. using the file to transform the tips of the coat hanger 'tongs'
- 3) utilising a **sub-element** of a resource – using bodily fluids in this case
- 4) utilising **environmental** resources – in this case using moving air to reduce pressure
- 5) combinations of these four strategies

Although all of these strategies are present somewhere in TRIZ, they are rarely brought together in one place. The 'dumb' ping-pong ball problem is intended to serve as a reminder that sometimes a problem is so constrained by limited resources that these five strategies are literally the only options available to us.

Not So Funny – The Worst Of 2005 Awards

Generally speaking, we here at Systematic Innovation Towers live a remarkably privileged life; traveling to many different parts of the world and working with some of the world's smartest people. Our half-full glass is thus usually in danger of brimming over. Fortunately, there is another side of life to make sure that it doesn't. Here then are a few of our low-light awards for the year:

The Ryanair Seat-Pitch Airline Of The Year Award

Bad service is an expected part of the Ryanair experience. In many ways, the company has made a virtue out of just how rude their staff can be – to the extent that everyone's own personal 'do-you-know-what-they-did-to-us-this-time?' party-piece becomes a challenge for everyone listening to see if they can outdo it on *their* next Ryanair flight. Bad Service is the Ryanair USP.

USP's being what they are, other airlines should try and avoid the Ryanair strategy. Alas, not every airline appears to understand this concept. Our joint Airline award winners for this year then are KLM and Emirates. KLM were – as ever – set to walk away with the award thanks to their inflight anti-entertainment systems (one film per 8 hours of flying time, guaranteed straight-to-video quality) and propensity to cancel flights that don't quite have enough passengers – our record in 2005 was 6 out of 8 flights cancelled. But then Emirates upped the ante with a spectacular flight from London to Dubai which managed to combine latest-boarding, longest boarding (one hour, twenty minutes for a $\frac{3}{4}$ full 777 – if you hadn't seen it, you wouldn't have believed it possible), most objects dropped by cabin attendants, most passengers shouting at each other, and least luggage sent to the right destination. A quite staggering achievement.

Motel-6-10Watt-Lightbulb Hotel Of The Year Award

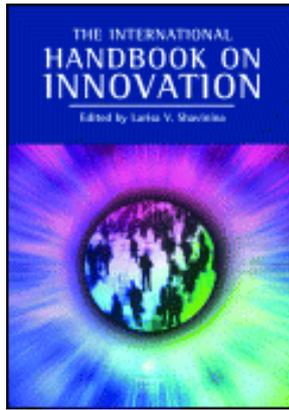
No contest with this one; congratulations to the Sheraton Hotel in Dubai. From being told upon arrival at 3am that 'the room isn't ready yet', to a room directly above the bass-bins of the hotel disco (which – neat coincidence – ended at 3am), to no-hot-water-room to full-ashtray-yellow-ceiling-no-smoking-room to being charged a full overnight rate for a late check-out, the hotel managed to first build and then maintain a uniquely high level of bad-service momentum. Probably (hopefully?) unbeatable.

The British Rail Don't-Ask-Me-I-Only-Work-Here Customer Service Award

Everyone on the planet knows how bad the British railway system is. Quite clearly, no other company could hope to even come close to their astonishing combination of high prices, late trains and grumpy staff. Congratulations, then, to the US Immigration Service for coming close. This year's re-enactment of the Robert DeNiro Are-You-Looking-At-Me movie scene at Detroit Metro Airport was a wonder to behold. Give the officials 'Detroit: The City Where They Eat The Weak' t-shirts (later spotted in a local mall) and airport overcrowding could rapidly become a thing of the past. First impressions last!

Jeffrey Archer Services-To-Literature Award

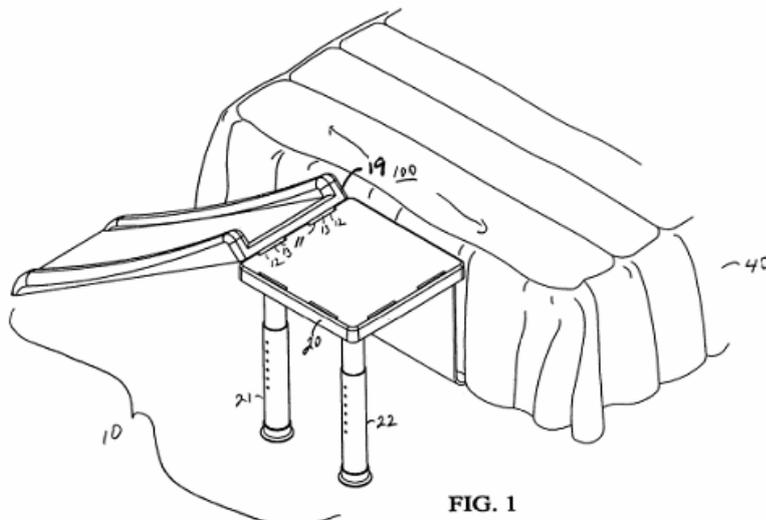
A close call this one. Fiction category award goes to Dan Brown for his supposedly non-fictional mega-million selling DaVinci Code effort. Great idea – pick up an idea from a 1970s hoax, ignore the fact that it was a hoax and then proceed to convince a whole new generation of unsuspecting readers that you have something new to say. Also, hands-up those readers who didn't get half the clues about thirty pages before Dan revealed them? Non-fiction category and overall award winner, however, is the International Handbook of Innovation.



How it is possible to produce a 1200 page tome on innovation and somehow not manage to discover TRIZ these days is a feat of some considerable magnitude. Couple that with a hefty \$300 price tag and we might just have the un-bargain of the century on our hands.

The only way to beat that achievement is with our **Unnecessary Patent Of The Year Award**. As regular readers will know, we have a longstanding active programme of research on patents. As ever the statistic about 97% of patents never paying back the cost of filing the patent continues to look like it will hold true for 2005. Amongst the seemingly infinite number of possible candidates for our Award, the pet-owner sector of mad-inventors leads the field by several furlongs. Our eventual winner is Floridan inventor Lawrence Bishop for his 'Pet Ramp' patent, granted as US6,968,810 in November. As described by Lawrence:

"The invention describes and adjustable ramp which allows a pet to move on and off a bed with minimal disruption to the appearance or function of the bed. It comprises a ramp and a platform which are adapted for adjustable height. It may be supported by both the mattress and box spring of the bed and adjustable legs. It may be further adapted to avoid interference with a bedspread or comforter".



Mr Bishop wins the award thanks to his unique triple whammy of defining the wrong problem, coming up with the least inventive concept possible, and then designing a solution that manages to combine poor functionality, maximum complexity and extreme inconvenience. A round of applause is also due to the USPTO for deciding that the invention was 'non-obvious'.

Patent of the Month

Patent of the month this month sends us into the world of quantum computing, and what appears to be an important step forward in overcoming one of the major technology bottlenecks. US 6,974,967 was granted to the National Institute of Advanced Industrial Science and Technology in Tokyo on December 13:

United States Patent
Komori

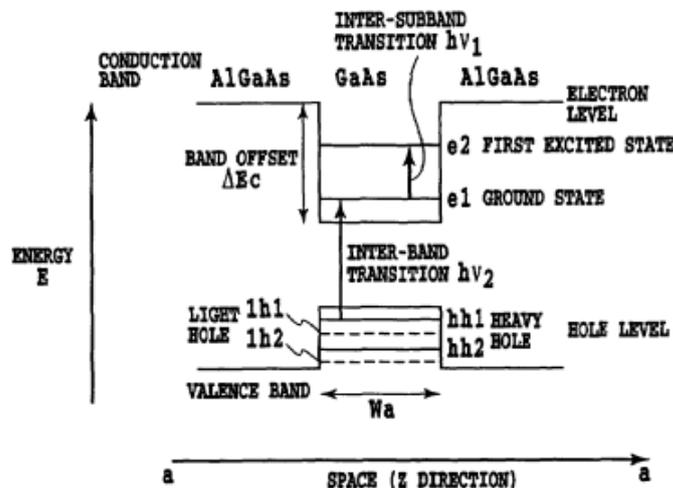
6,974,967
December 13, 2005

Quantum logic gate and quantum logic operation method using exciton

Abstract

A quantum logic gate utilizes an inter-polarization (dipole—dipole) interaction between excitons having polarization in semiconductor quantum well structures, or a spin exchange interaction between spin polarized excitons in the semiconductor quantum well structures. Problems associated with conventional semiconductor quantum well structures are solved in that a phase relaxation time is very short because of using inter-subband electrons, and that there is no usable ultrashort optical pulse laser technology because a subband transition wavelength is in a far-infrared region and hence ultra fast control is impossible.

Inventors: **Komori; Kazuhiro** (Ibaraki, JP)



Aside from its potential importance to the computing world, we were also guided in our choice by a desire to test the bounds of the TRIZ method: do tools like the Contradiction Matrix exhibit any kind of relevance when we zoom in to the nano- size scale and femtosecond time scale? is the question under consideration here.

The invention disclosure reports the tackling of a number of problems that have previously prevented the physical realization of quantum logic gates. Without wishing to get too deep into quantum mechanics, the following extract from the invention disclosure provides a useful summary of the current problems in realizing quantum logic gates:

Since the quantum computation carries out the computation utilizing a "superposition state" in which the phase relationships between the quantum states have the quantum mechanical correlation, it must hold the "superposition state" during the computation. In an actual physical system, however, the superposition state is corrupted by decoherence factor (relaxation phenomenon) that disturbs the phase relationships (coherence). The relaxation phenomenon includes the phase relaxation (lateral relaxation) that disturbs the momentum of the system, and the energy relaxation (longitudinal relaxation) that disturbs the energy of the system. Among the two types of the relaxation, the phase relaxation occurs first, followed by the energy relaxation. In the system where the energy relaxation occurs very rapidly, the phase relaxation period becomes nearly equal to the energy relaxation period. The decoherence factor in a solid is mainly governed by the phase relaxation. Consequently, it is necessary to select a system with sufficiently long phase relaxation time, and to carry out the quantum computation in a much shorter time period than the phase relaxation time.

For this reason, to implement the quantum logic gates, the following conditions must be met: First, a system which has a long decoherence time, the time the coherence term takes to decay by a factor of e (the base of the natural logarithms), must be selected, and in which system the decoherence time (phase relaxation time) is much longer than the quantum operation time (basic gate time×the number of computations); and second, the elements essential for the quantum operation, that is, a one-quantum logic gate "phase shifter" and a two-quantum logic gate "controlled Not" must be constructed.

Trying to implement such logic gates using actual physical systems in turn involves the following problem:

... the transition wavelength (the wavelength of the inter-subband transition) from the first excited state to the ground state in the subband is determined by the depths of the quantum wells in the conduction band (energy discontinuous value ΔE_c in the conduction band between the two semiconductors). The wavelength falls in about a far-infrared region (ultra-long wavelength of about 10 μm) when the semiconductors such as GaAs and InP are used. In this case, it is difficult to carry out the ultra-fast excitation control because of the lack of femtosecond laser technology operating at a speed of less than 100 femtoseconds.

We can then see that in order to conduct the desired quantum computations in a given time period, we need a system with 'sufficiently long phase relaxation time'. What stops us achieving this is system 'decoherence time' and excitation control issues. We can map this problem onto the Contradiction Matrix as follows:

Improving Factor	Worsening Factor	Principles				
Loss of Time (26)	Duration of Action of Stationary Object (13)	5	28	24	7	16
in order to achieve adequate 'phase relaxation time' we need a system with a long decoherence time						
Loss of Time (26)	Control Complexity (46)	10	37	4	5	2
in order to achieve adequate 'phase relaxation time' we need to improve excitation control		3	19			

So then how did the inventors solve the problem? Alas, again the explanation is not a particularly straightforward one. Here is what we can see from the invention disclosure:

...using the interband excitons in the quantum well structure instead of using the electrons between the subband levels enables the phase relaxation time to be prolonged by a factor of 10-100

...Moreover, using the phase relaxation time of the quantum dot of the order of 100 picoseconds in combination with the laser technology with the pulse width of 5-100 femtoseconds, it is expected

that the maximum step number N_s of the quantum computation in a range of 1000-10000 will be possible

And then from Claim 1:

1. A quantum logic gate utilizing an electronic state of a semiconductor quantum structure comprising:

a first semiconductor quantum well structure as a control quantum bit;

a second semiconductor quantum well structure as a target quantum bit having width which differs from width of the first semiconductor quantum well structure;

a means for generating one exciton having an up spin or a down spin in the each first and second semiconductor quantum well structures; and

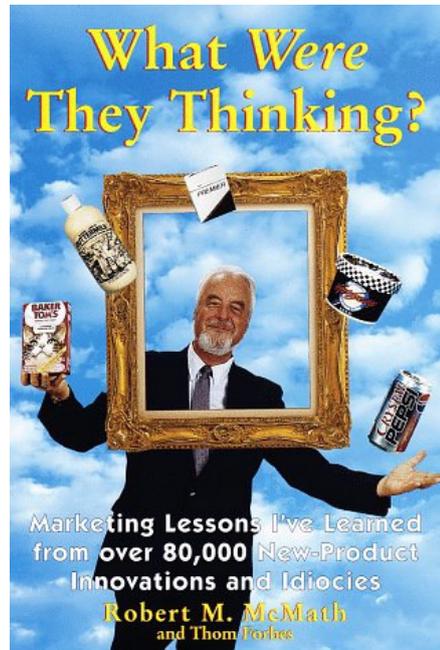
a means for inverting the target quantum bit from $|1\rangle$ state to $|0\rangle$ state or from $|0\rangle$ state to $|1\rangle$ state only when the control quantum bit is in the $|1\rangle$ state by irradiating an electromagnetic wave corresponding to an shifted energy difference to the second semiconductor quantum well structure,

where the $|0\rangle$ state in which the exciton is not excited and the $|1\rangle$ state is a state in which the exciton is excited for the each first and second semiconductor quantum well structures, wherein the shifted energy difference is shifted by an amount of a spin exchange interaction between the excitons undergone spin selective excitation, which occurs only when the exciton is generated simultaneously one by one both in the first and second semiconductor quantum well structures, from an energy difference between the $|0\rangle$ state and the $|1\rangle$ state without the spin exchange interaction.

Hopefully we can see here the use of strategies consistent with Principle 5, Merging, Principle 19, Periodic Action and in particular, Principle 3, Local Quality, and Principle 37 in its 'Relative Change' interpretation (*a second semiconductor quantum well structure as a target quantum bit having width which differs from width of the first semiconductor quantum well structure*). More specifically we cannot see anything in what the inventor has done that fits into other Inventive Principles. The fact that all of the Principles present in the invention are also present in the Matrix is a pleasant surprise given the relatively small number of other patents in the quantum field against which the Matrix could be validated. One swallow does not make a summer of course, but it is a start.

Best of the Month – What Were They Thinking?

It is often said that we learn more from our failures than from our successes. ‘What Were They Thinking?’ by Robert McMath is a highly entertaining look at some of the great marketing and new product failures from the last few decades. While the focus is primarily on the fast moving consumer goods sector, the book contains a number of lessons that appear to have relevance across just about every industry.



As ever, our eye is biased in a TRIZ-ward direction, firstly testing the bounds of the TRIZ knowledge framework, and then secondly looking for examples and case studies that might provide content to populate the framework. Regarding the first aspect of the analysis, it is fair to say that all of the failures described by McMath are entirely consistent with the pillars of TRIZ. And so, (surprise, surprise) failure to think about function (tangible and, in marketing, especially intangible), failure to deliver a solution that gives the customer a more ideal solution, and delivering solutions where one trade-off is exchanged with another, all end up in products destined to fail on the market.

Some of our favourite examples from the plethora outlined in the book include:

- The failure of Jergens ‘Body Shampoo’ for women. With its implication that women have body hair, this product was very unlikely to succeed. Ditto Gillette’s ‘For Oily Hair Only’ brand shampoo, with its implied message that having really oily hair is something to be proud about.
- The failure of Gablingers beer in the US in 1967. Gablingers could have been the success that Miller Lite later turned out to be, except that it was advertised as a ‘diet beer’. Miller later succeeded with the advertising ‘less filling’; a subtle but profound difference in terms of marketing perception since the subtle message sent by the former advertising was ‘inferior to normal beer’, while the latter sent out the much more appealing (to drinkers anyway) idea that it was possible to consume more.
- In a similar vein is R.J.Reynolds’ Premier brand ‘smokeless cigarette’ – great news for everyone except the person going to make the purchase – the smoker tends to not mind the smoke!

- 'I hate peas' brand peas – formed to look like french-fries no less – as a golden example of the perils of trying to advertise based on a negative. Looking like a French-fry is little good if the taste (i.e. the main function) still says 'pea'.
- From a packaging perspective, putting children's toothpaste in an aerosol spray, also turns out to be a pretty bad idea – great for the kids perhaps; somewhat less so for the parent in the supermarket contemplating clearing up the mess from the inevitable paste-fights at bedtime.
- ScotTowels Junior – an attempt by Scott Paper Company to counter the attack on their normal paper towel products by cheap generics, which alas fell foul of the fact that reducing the length of the towel roll by three inches meant that it no longer fitted onto the Scott paper towel dispensers owned by the company's existing customers.

The book is a pretty light read, and a couple of hours should allow a fairly good scan through the whole thing. All in all really nice way of getting people in a product development team to give their project a final sanity check; someone, somewhere thought all of McMath's FMCG failure 80,000+ examples were worthy of launching onto the market. Set in the context of an overall statistic, the chances of getting it right is historically something less than 1 in 600. Now there's a scary thought.

McMath's approach offers a relatively pain-free (even perhaps enjoyable) way to conduct an analysis of your latest product or advertising 'winner', and as such is highly complementary to a TRIZ/systematic innovation 'red-team' analysis session.

Conference Report – TRIZ Future Conference, Graz

The second European TRIZ conference of the year was held in Graz between 16 and 18 November. Interested readers can find Ellen Domb's review of the conference in the December issue of TRIZ Journal. Ellen's review focuses on the facts and figures of the event. My review here will focus on some of my own personal reflections on the conference. If everything runs to form, then a more detailed analysis of the various papers at the conference will shortly feature in Toru Nakagawa's excellent TRIZ Home Page In Japan.

In the fewest words, then, the over-riding feelings left in my mind in the days following the event distilled down to quality, hypocrisy and naivety. Let's have a look at each one in turn in a little more detail:

Quality

As is the case at any conference, some papers will be better than others. Hopefully everyone gets at least one or two nuggets to take away. For me, only the Uhrner case study paper on the first day of the conference fell into this category. Perhaps because it was the only paper that appeared to be based on any kind of research evidence. This paper is well worth looking out for, offering some tangible evidence on the beneficial effects of TRIZ on individuals working in organizations. At the other end of the spectrum was the paper from Professor Tiet Tildemann from Estonia. I was in the fortunate (or, as it turned out unfortunate) position of chairing the session featuring this paper. The presentation finished after about 12 minutes of the available 30 minutes with a request from the Professor for questions. Tumbleweeds rolled across the stage. No-one had a question. So the chairman had to think of one. Err. 'Professor Tildemann, please could you explain how your expert system for calculating the volume of a mass dropped into a bathtub helped you to invent your wind-turbine?' Answer: they have nothing to do with each other. Err. 'Professor Tildemann, please could you explain what elements of TRIZ are present in your expert system?' Answer: there is none. This kind of paper does TRIZ absolutely no favours and it is difficult if not impossible to see how it could possibly have passed any kind of refereeing process. There is a problem that needs to be addressed here I think.

Anyway, without wishing to dwell on this paper for too long (!), the other papers at the conference alas tended towards the Tildemann as opposed to the Uhrner end of the quality spectrum. Notable mentions to ACC, Litvin (his full as opposed to keynote paper) and Ikoenko for veering to the Uhrner end of the quality scale – these are the papers to look out for if you are thinking of acquiring the conference proceedings. Total learning points for this author from the whole programme was around two, which is not the best of statistics. This was not always due to just the overall quality of what was on offer:

Hypocrisy

One of the main guiding principles of ETRIA is that the papers presented at the conference should be non-commercial. The Association President appeared to have generated more subtle ways around this rule when he nominated a paper from France as the first keynote address. What was supposed to be a description of TRIZ success stories in the French Electricity research establishment turned out to be nothing more than an advertisement for INSA in Strasbourg. Fortunately, due to the total lack of content, the plan hopefully back-fired to the extent that everyone was left wondering whether INSA delivered any tangible benefit to the paper's author at all.

If this paper was bad, it was but nothing to the contribution from Ideation. In theory this was a paper about evolution of software systems. In practice it was nothing more or less

than an advertisement for Ideation's new website and old software products. Thanks. For nothing. Any other speaker offering this kind of blatant advertising would have been stopped after five minutes; just because an author has a big reputation should not mean they can abuse their standing in the community.

Naivety

Does anyone remember the TRIZ idea that someone, somewhere might have solved your problem? Precious few of the authors at the conference apparently did. Several papers thus featured pieces of 'research', the output of which was the re-invention of something that had already been done by someone, somewhere already. Special mention here to Val Souchkov who's 'Root Conflict Analysis' (hmm, where did that name come from I wonder?) paper managed to re-invent the Current Reality Tree from the Theory of Constraints. Is that one decade or two after the event? Congratulations in either event for not bothering to do a literature search. Hey, why bother? Far better to spend a few weeks writing a paper than spending a few minutes on Google.

Fans of Invention Machine's excellent Goldfire software will no doubt be pleased to read that a number of ex-Invention Machine employees were presenting papers relating to a tool called 'Functionally Oriented Search'. No need for \$50k worth of software anymore apparently, all we need to do is enter an appropriate search string into the USPTO database and all the information we'll ever need will appear magically before our eyes. I'm not sure how to respond sensibly to this one. On the one hand I agree that this strategy represents 'a start', on the other, it is something we've been doing in our company (and presenting on workshops) for about five years now.

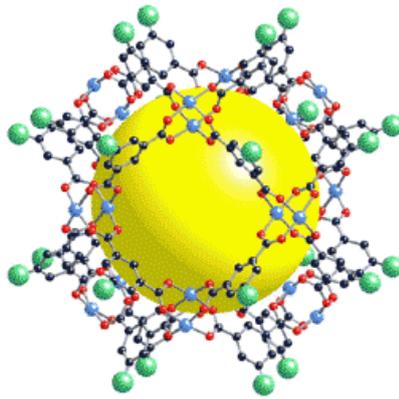
So, if this isn't bad enough, we also have the recurring TRIZ conference no-show phenomenon to contend with. It is reaching the point where as soon as we see the words 'Iran', 'China', 'Ireland' or 'Livotov' featured on the programme, we know we're about to have another impromptu panel discussion to fill in the inevitable gap in the programme. Coupled with the issues described above, this is becoming a problem that is affecting the credibility not just of the conference but the whole subject.

If this all sounds like a very negative view of the conference, please be assured that I would be far, far happier writing a positive review. Of course, it is always great to speak and meet with everyone at the conferences, and Graz was no exception. But if we ever want to meet a few *new* people at future events, then the community seriously needs to rethink a few things. This is a very precarious time in the evolution of TRIZ. It could very easily tip in the wrong direction if we are not careful.

Investments – Crystal Sponges

As more and more people begin to accept the contribution of mankind to global warming (and even to accept that global warming is a real phenomenon in some cases!), much research has gone into alternatives to burning fossil fuels. Few if any have so far offered the prospect of a total solution. Coupled with the increasing rate of usage of fossil fuels, there is likely to be a need for a significant interim technical solution to help bridge the gap that will occur between the demise of fossil fuels and the full-scale deployment of its replacement. One of the main transition technology possibilities involves removing carbon dioxide (CO₂) from the flue exhaust of power plants, using porous materials that take up the gas as it travels up the flue.

A new class of materials known colloquially as 'crystal sponges' (great name!) invented and developed by Omar Yaghi at the University of Michigan can store vast amounts of carbon dioxide. And one member of the class has the highest carbon dioxide capacity of any porous material, Yaghi and co-worker Andrew Millward report in a paper published online in the December issue of the Journal of the American Chemical Society.



The materials, more properly called metal-organic frameworks (MOFs), have previously been shown to have great potential for storing hydrogen and methane and have been proposed for various fuel cell applications (see for example Yaghi's patent US6,929,679 granted earlier this year). On the molecular level, MOFs are scaffolds made up of metal hubs linked together with struts of organic compounds, a structure designed to maximize surface area.

Just one gram of a MOF can have the surface area of a football field. By modifying the struts in various ways, Yaghi and his team have been able to increase the material's storage capacity, making it possible to stuff more gas molecules into a small area without resorting to high pressure or low temperature.

Yaghi compares the principle by which MOFs store CO₂ to placing a honeycomb in a room full of bees. "All the bees will come to the honeycomb, so you're able to contain a large number of bees in a small volume. What we've created is a material that acts like a honeycomb for adsorbing carbon dioxide."

The star performer in Yaghi's cast of MOFs is one which sops up 140 percent of its weight in CO₂ at room temperature and reasonable pressure (32 bar).

Put another way, "if you have a tank filled with MOFs, you can store in that tank as much carbon dioxide as would be stored in nine tanks that do not contain MOFs," Yaghi said. By comparison, a tank filled with porous carbon---one of the current state-of-the-art materials

for capturing CO₂ in power plant flues---would hold only four tanks worth of CO₂.

MOFs can be made in large quantities from low-cost ingredients, such as zinc oxide---a common component of sunblock---and terephthalate, which is used in plastic soda bottles (see Yaghi's latest patent – US6,930,193). With both technical capability and low cost viability questions seemingly resolved, the only remaining risk issues would appear to be route to market and finding economic ways of keeping the sequestered carbon out of the atmosphere. In regards to the first issue, it is difficult to see the MOF technology having any vested interests likely to prevent its emergence. In the second case, there are several existing candidate possibilities (several of which have the possibility for new IP when combined with Yaghi's solution).

Professor Yaghi is the Robert W. Parry Collegiate Professor of Chemistry at U-M. The research was funded by the U.S. Department of Energy and the National Science Foundation and was done in cooperation with U-M assistant professor of chemistry Adam Matzger and Universal Oil Products of Des Plaines, Illinois.

For more information, visit: <http://www.umich.edu/%7Emichchem/faculty/yaghi/>

(Original source for some of the text featured here: NEWSWISE/Science News)

Biology – Mudskippers

Mudskippers are exceptional among fishes in their amphibious behaviour. As reported in Nature (Volume 391, January 1998), Mudskipper fishes get the oxygen they need mainly from breathing air. On the other hand, for the purposes of habitat and breeding, Mudskippers create mudflat burrows. These burrows are often filled with oxygen-depleted water, and their eggs, deposited in the burrows, have to develop under severely hypoxic conditions. How they cope with such conditions has been unclear. According to the Nature article, *Periophthalmodon schlosseri* (Figure 1) solves the problem by accumulating air in its burrows. This behaviour seems to be an adaptation to provide oxygen for burrow dwelling fish and for embryos developing in the burrows.



Figure 1: *Periophthalmodon schlosseri* resting in the surface water pool of a burrow.

Periophthalmodon schlosseri, one of the largest mudskippers in the world, inhabits intertidal mudflats in Southeast Asia. Field studies in Malaysia have shown that the burrows of this Mudskipper occur in the high intertidal zone and consist of a largely vertical shaft about 8 cm in diameter which connects to one or more horizontal tunnels (Figure 2). The maximum burrow depth recorded was 125 cm. The burrows were always filled with water and the water level was unaffected by tidal oscillation. The dissolved oxygen concentration of burrow water varied from almost none to more than 80% of that of air-equilibrated water at the surface. It declined sharply with depth, becoming less than 3% below 50 cm.

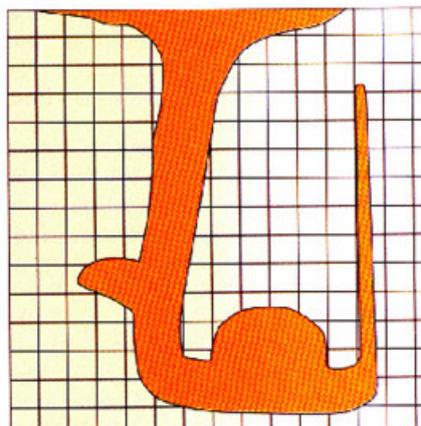


Figure 2: Mudskipper Burrow Characteristics - Architecture of the *Periophthalmodon schlosseri* burrow. The drawing is based on a cast from the Burung River, Penang, Malaysia. (Scale grid: 30cm)

Field observations confirmed that *Periophthalmodon schlosseri* transports air into its burrows. Immediately before entering a burrow, the fish inflated its buccopharyngeal cavity with air. This cavity was deflated when the fish emerged. The fish would immediately take another gulp, and often re-enter the burrow. The duration of the burrow sojourns varied, some lasting longer than 30 minutes. Laboratory studies demonstrated that, irrespective of aquatic oxygen level, *Periophthalmodon schlosseri* regularly inflates its buccopharyngeal cavity with air and, as long as air is accessible, rarely uses aquatic gill ventilation

The paper also reports observations of *Periophthalmodon schlosseri* indicating that the behavioural accumulation of air in the burrows provides a significant oxygen reservoir for burrow-dwelling fish and for developing embryos. Mudskippers commonly deposit their eggs on the ceiling of their burrows and some species make a specialized spawning chamber for this purpose.

From a TRIZ perspective, the Mudskipper has a conflict to solve. We can express it, based on the preceding discussion as the desire to increase the amount of oxygen in its burrow being prevented by the depth of the burrow. This conflict pair can be mapped onto the Contradiction Matrix as illustrated in Figure 3:

Improving Factor	Worsening Factor	Principles				
Amount of Substance (10)	Length/Angle of Stationary Object (4)	35	31	3	17	14
Mudskipper desires to increase amount of oxygen in its burrow, but depth makes it difficult to achieve		2	40			

Figure 3: Periophthalmodon schlosseri Burrow Mapped Onto Contradiction Matrix

Examination of Figure 2 reveals use of both Principle's 3 (Local Quality) and 17 (Another Dimension), both of which correlate very nicely with the recommendations from the Matrix. Another nice example, we think, of the large amount of common ground between the best practices of nature and the best practices of human problem solvers.

Short Thort

Function Analysis is so named because its primary use is analysing and modelling what already exists. The technique, however, can equally be well used as a synthesis method for designing new systems. Starting from a blank piece of paper (or screen), first define the desired outputs/products, then the functions needed to create them, then the components or elements in turn needed to deliver those functions. This way, we will tend to only allow onto the model those elements that are absolutely necessary to create the desired outcome.

News

2006 Programmes

Keep an eye out on the 'Experiences' page of our website for our whereabouts in the first third of 2006. Darrell managed to break the million-kilometre barrier again in 2005, and with trips to Austria, US, Ireland, Malaysia, India, China, Australia and Mexico already committed, it looks like next year will be no different. The trick to using time (and jetlag) efficiently seems to be to try and do several things during each trip. So, if you see us visiting somewhere near you, and you want us to visit, please don't hesitate to get in touch.

2006 Papers

We are happy to have had papers accepted for 4 conferences already next year – one each in the fields of knowledge management, architecture, artificial intelligence in music (!) and innovation management. We expect to match our usual annual target of 12-14 conferences next year, and so if anyone has any suggestions for other conferences, or wants some cheap TRIZ support in exchange for letting us publish results, please get in touch with Darrell.

Auxetic Materials

Anyone who has done pretty much anything with us will have heard us talking about auxetic (i.e. negative Poisson Ratio) materials. We will be attending a one day conference on the subject to be held in Bolton, UK during January. Expect to see a report in next month's e-zine.

Fujitsu-Siemens

For the second time this year your slightly late copy of the e-zine is brought to you despite the best efforts of Fujitsu-Siemens laptop computers. Our third hardware fault of the year, coupled with some very unsympathetic service, means the only present they will be receiving from us this year is a hefty discount on our 'product reliability for dummies' and 'why it is a good idea to re-connect the cooling fan after replacing the motherboard' training.

Happy Holidays!

We wish all of our readers a restful and enjoyable time over the coming holiday period, and a prosperous 2006. Thanks to all for their support during this year. Quite simply, we couldn't do it without you.