

Systematic Innovation



e-zine

Issue 104, November 2010

In this month's issue:

Article – Innovation Dashboard – Putting It All Together

Article – Taking Ideation Sessions To The Next Level

Humour – The Age Of Austerity

Patent of the Month – Neuro-Mimetic Control Systems

Best of The Month – Two-Speed World/Freak Nation

Investments – Cambridge

Generational Cycles – Reactives, Boomeritis & Holarchies

Biology – Greater Roadrunner

Short Thort

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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

Innovation Dashboard – Putting It All Together

Back in September (Issue 102), we introduced a prototype innovation dashboard for use by senior managers within organizations. The focus of that article was one of the instruments in the panel, a measure of how silo'd the organization was. We also drew the resulting Silo Index framework in the context of an overall dashboard. That dashboard is reproduced here in Figure 1. The aim of this article is to set the bigger picture context regarding how this dashboard structure evolved and why we think it offers the right means of measuring innovation.

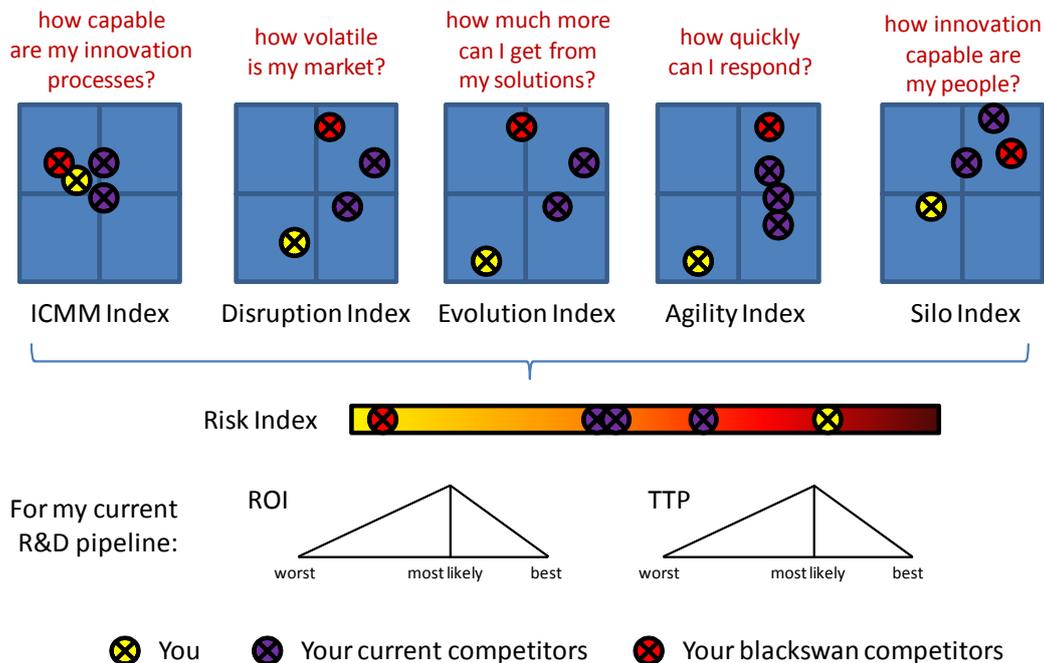


Figure 1: Prototype Innovation Dashboard

In simple terms, the architecture of the dashboard comprises five main instruments, the information from which is designed to be integrated in order to deliver high level risk and performance measures. These integrated measures are primarily there to provide strategic information to the CEO of an organization, and as such they are designed to answer three basic, high level questions:

- 1) How much relative innovation risk are we carrying in the organization right now?
- 2) What is our likely return on innovation investments?
- 3) When is our likely time to payback for our innovation investments?

This, we felt, was the basic information a CEO needs in order to make sensible, informed decisions about innovation spend. Access to timely, objective, believable information in each of these three measures should also allow the CEO to conduct scenario planning studies in order to design and manage the short, medium and long term future of the business.

There are five instruments feeding data into this high level output because five is the number of elements required in a minimum viable system – as per the Law Of System Completeness. We made this connection to the dashboard design since ‘innovation’ is a system and therefore must by definition have the requisite five elements. Figure 2

describes how we have mapped the five generic elements of the System Completeness model to such an innovation system:

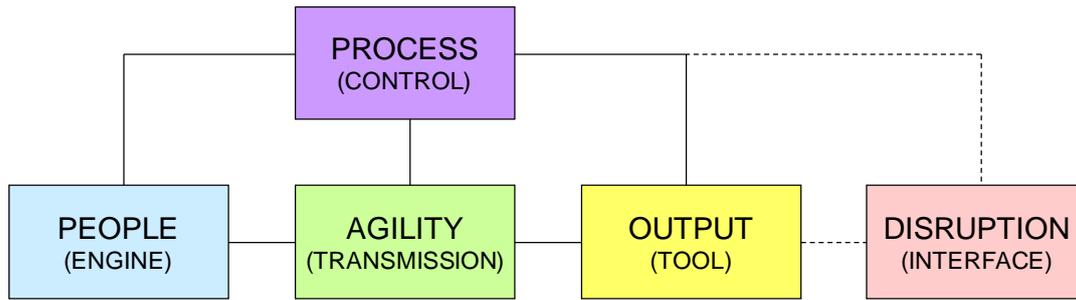


Figure 2: 'Innovation' As A Complete And Viable System

Each of the five dashboard tools, then, are designed to correspond to each of these five elements. The mapping is as follows:

- Control – how capable are my processes? (Innovation Capability Maturity Model Index)
- Engine – how innovation capable are my people (Silo Index – Issue 102)
- Transmission – how quickly can I respond? (Agility Index – Issue 101)
- Tool – How much more can I get from my solutions? (Evolution Index)
- Interface – how volatile is my market (Disruption Index)

Two of these have been discussed in detail in Issues 101 and 102. Let's have a look at the other three in a little more detail so we can see how they are made up and therefore how they contribute to the high level CEO measurement objectives:

Innovation Capability Maturity Model Index

We first introduced the subject of innovation capability maturity in Issue 96 of the e-zine, back in March of this year. The main picture we presented in that article described the five basic levels of capability we currently see in organizations around the world. The levels are reproduced in Figure 3:



Figure 3: Five Basic Stages Of Organisational Innovation Capability

In terms of our innovation dashboard, all we have really done with this picture is divided it, as we have done with all the other dashboard instruments, into technical and business dimensions. Figure 4 illustrates what this actually then looks like.

Each axis of the picture has been non-dimensionalised using the following calculation protocols:

$$\text{ICMM Technical Index (I}_T\text{)} = \frac{\text{ICMM technical score for company}}{\text{industry average technical ICMM}}$$

$$\text{ICMM Business Index (I}_B\text{)} = \frac{\text{ICMM business score for company}}{\text{industry average business ICMM}}$$

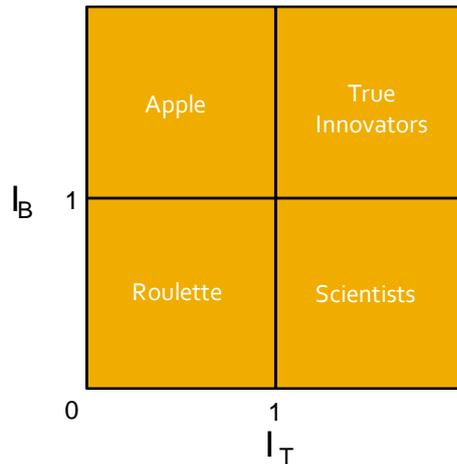


Figure 4: Innovation Capability Maturity Dashboard Instrument

Evolution Index

This one we haven't mentioned elsewhere before, but only because, of the five, this is probably the most obvious of the dashboard instruments. Because this is the instrument relating to the 'tool' and therefore the outputs produced from the innovation, very simply this measure is all about Evolution Potential and specifically the amount of untapped potential in both the business and technical aspects of the innovation opportunity space. The calculation protocol looks like this:

$$\text{Technical Evolution Index } (E_T) = \frac{\text{current technical Evolution Potential for company}}{\text{technical Evolution Potential to IFR}}$$

$$\text{Business Evolution Index } (E_B) = \frac{\text{current business Evolution Potential for company}}{\text{business Evolution Potential to IFR}}$$

And the dashboard looks like this:

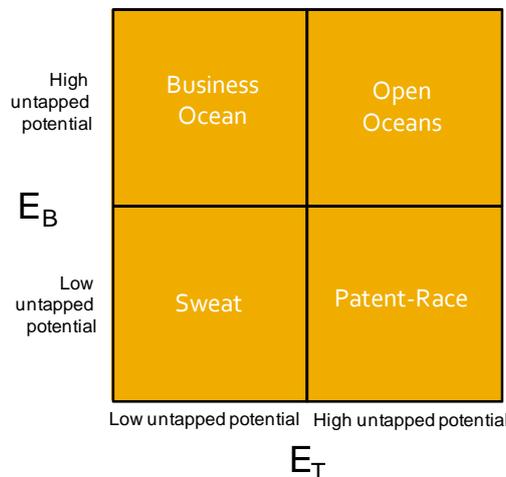


Figure 5: Evolution Index Dashboard Instrument

Disruption Index

Finally in the list of five instruments is another new one. And another fairly obvious one. This time the measure relates to the 'Interface' element of the Law of Completeness, and in the innovation context, the important focus is on the customer for the innovation and

specifically how dynamic that customer is. Figure 6 shows the constituent parts of the instrument, and the calculations used to place an organization on the map are as follows:

$$\text{Technical Disruption Index (D}_T\text{)} = \frac{\text{technology jump rate of company}}{\text{technology adoption rate of customer}}$$

$$\text{Business Disruption Index (D}_B\text{)} = \frac{\text{business jump rate of company}}{\text{business change adoption rate of customer}}$$

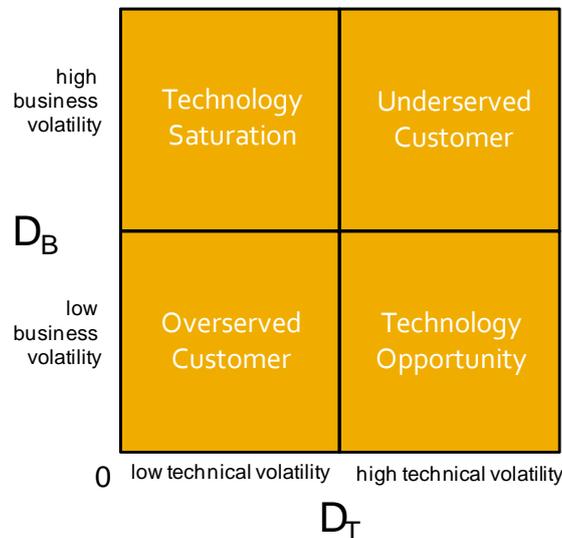


Figure 6: Disruption Index Dashboard Instrument

So, back to Figure 1, and the final bringing together of this discussion, having defined the axes of each of the five dashboard instruments, the next job is to plot relevant points onto each. What is ‘relevant’ here is defined by three main data sets:

- a) Where the organization being measured is along each of the axes
- b) Where their current competitors are relatively speaking along the same axes
- c) Where their ‘blackswan’ competitors are

These three types of data are drawn onto each plot as illustrated in Figure 7 and back in Figure 1.

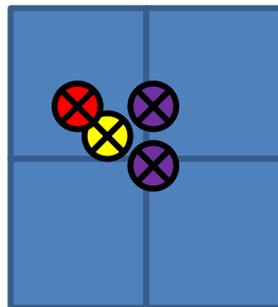


Figure 7: Plotting Different Players Onto The Dashboard Instruments

‘Blackswan’ competitors in this case are perhaps the most important element of the plots, at least in terms of the integrated risk calculation done for the CEO. The Blackswan label comes from the Nicholas Taleb book of the same name, and refers in general to the idea of an unpredictable, unforeseeable event, and specifically in our case to the unexpected competitors that might in the future threaten the livelihood of an organization. The main difference between Taleb and us, comes from our belief that the predictability of outsiders

that might threaten your industry is somewhat higher than Taleb's thesis might suggest. In our world, most Blackswans are in actual fact very predictable indeed, thanks to the fact that TRIZ/SI informs us that FUNCTION is the universal means of bridging between different disciplines, and that there are also a series of highly predictable discontinuous trend jump patterns that determine the direction of success. Thus,

- We can safely predict that a likely blackswan competitor to a paint company ('liquid') is a light (e.g. LED) company ('field') – we can say this because the TRIZ Dynamization trend tells us that field-based solutions always beat liquid-based solutions in the long run.
- We can safely predict that a self-cleaning textile is a blackswan threat to the detergent manufacturers – we can say this because both solutions deliver the same function, one doing it better than the other.

Integrating each of these individual points on each of the five dashboard instruments is all that remains to be done in order to provide the CEO with his/her risk information. In simple terms the translation from one place to the other is all about the relative position of organization versus competitors on each axis. The detail is rather more difficult to describe in the abstract. Hence, next month we'll give a specific worked example to show how we do it and what the value and strategic implications of the output might be for anyone else wishing to experiment with the capabilities we've been developing.

Taking Ideation Sessions To The Next Level

Well, first up, thanks to human behaviouralist and marketing author, Mark W Schaefer for providing the spark for this one. He wrote in his blog recently about a simple technique for improving the efficacy of brainstorming sessions. His main problem was he didn't/doesn't know anything about TRIZ, Systematic Innovation, SCAMPER, the 40 Principles, or indeed any other series of prompts to help get the creative juices connecting to useful new stuff. He did, however, have an idea that, when combined with some of these solution triggers can do an awful lot to enhance both the quantity and quality of ideas coming from a session. Here's the basic idea:

First, you need to plan a brain-storming session with at least 10 diverse people. Really shake up the diversity in every way you can. And the more people involved, the better. Schaefer claims to have used the technique successfully with a room of 75 people; we've restricted our experiments to groups of between 8 and 12 people.

Prior to the session, be sure to tell all the participants what the purpose of the meeting is, what the basic question to be answered is and that they should come prepared with at least a few initial seeds of ideas.

After setting the scene and describing the basic structure of the meeting, as quickly as possible into the start of the meeting, have each of the participants individually take a big piece of flip-chart paper and write their very best idea for the brainstorming topic at the top. Get them to make sure there is plenty of room below their idea to write additional ideas.

Now, have them go to the walls around the room, tape their idea to the wall and stand in front of it.

Have everybody slide over one space to their right so that they are standing in front of the idea next to them. Ask the participants to read the idea written at the top carefully and then add to, or improve, the original idea and write their contribution below the first entry. Allow a maximum of 2-3 minutes to do this job.

Now have everybody slide over TWO spaces. The reason for doing this is because you don't want the same person continually following the thought process of the person in front of them. You are trying to mix up the mental frameworks. To enhance this process, the key thing to also introduce at this second people move is an Inventive Principle to help with the ideation. There are various ways to do this, but based on our experiments, either giving everyone the same Principle or putting a selection of three or four onto a screen so that everyone can see them and allowing people to make their own choice from the selection seem to work the best. Ideally, the facilitator should have done some pre-work to identify, for the problem being addressed, which of the Principles are most likely to help generate solutions. Essentially, as per our experiments, this should consist of a quick look-up on the Contradiction Matrix.

Armed with the initial idea at the top of the page, a second idea below it, and now an Inventive Principle to think about, ask each person to write more ideas. Give them around 5 minutes to generate new ideas.

Next, count off three spaces (people might have gone right around the room now depending on the size of the group), put another Principle or Principles on the screen and

have everybody slide again. Get everyone to read what has been written so far and add to it or improve it once again. Another 5 minutes.

Do this one more time. Another Principle, slide over just one space this time and ask participants to come up with a better idea than what has been written so far. And another 5 minutes.

Now is time for the facilitator to start looking around the flip-charts and making a swift assessment of the quantity and quality of ideas produced.

If both look good, then it is appropriate to get delegates to begin a process of refining and down-selecting ideas – first taking the best idea from each sheet, then clustering and combining between sheets.

If things don't look so good (we've had an ~80% success rate so far), it is generally because people have remained stuck within some kind of a company or industry box. If this is the case, now is a good time to introduce a more random set of prompts. Have everybody slide over two spaces and ask them something like:

- How could this idea be illegal?
- What would happen if this idea was invisible?
- What would you do to this idea to have people pay a million dollars for it?
- What would happen if this idea was in the dark, or under water?

The reason for these strange questions is to try to get your participants to look at the idea in a totally new perspective. We've also experimented with using prompts from the TRIZ Size-Time-Interface-Cost psychological inertia tool, Oblique Strategies, the FDM idea trigger cards, and even Edward DeBono's 'random word' operator. Probably too soon and too little data to say which has worked best, so the best advice at the moment is for the facilitator to use whatever they feel the most comfortable with, bearing in mind that the aim is to get participants out of the box and productive as quickly as possible – i.e. you don't want to be spending any time explaining the triggers or where they came from.

At the end of this 5-minute exercise, then it is appropriate to get delegates into the process of refining and down-selecting ideas – first taking the best idea from each sheet, then clustering and combining between sheets.

Finally, then, have participants go back to their original idea, read the entire page and circle the best idea on the page. This is when the magic is likely to happen. The session is effectively over now, since 'best ideas' have been selected by the group. What is interesting when people are now taken back to their original idea, written at the top of their piece of flip-chart paper, about 95% of the time, the idea they circle is NOT their original idea! The message being that, in less than 20 minutes anyone can turn all of their good ideas into great, perhaps even break-through, ideas.

(Also, from the facilitator's perspective, it is useful to see how the best ideas correlate back to the triggers that were used to generate them – again, in our experience, over 80% of the time, the best solutions have emerged from the Principle-inspired ideas at the third or fourth shift around the room.)

The theory behind the technique

Our basic mental framework — how we process information — is basically complete by the time we are 15 years old. So literally, beyond this age our thinking processes are so hard-wired it is nigh on impossible for us to think “out of the box”.

For true break-through thinking to occur on a team, we must **connect** to other outside information and we must **combine** the boxes we have available. This is why the diversity of the participants is so important. You don't want to do this where everybody is a numbers-type or creative-type or even all of a certain age or culture heritage. The more boxes you can combine and complement each other, the better the results. Always!

Even if you are trying to solve a technical problem, invite people from marketing, accounting, HR ... maybe even from another division or company all together.

Finally, according to Schaefer, there is a tremendous secondary benefit to this technique. Notice we said at the beginning of the process description how it was important to run the process this at the beginning of a meeting. Typically, when people see the amazing work they've done in just 20 minutes, they are energized, engaged and confident in your process. And all set to get stuck into whatever else you'd like to cover in the meeting.

Humour – The Age Of Austerity

As the EU house of cards begins to collapse and every nation on the continent gleefully announces their own 'age of austerity', we here at SI Towers feel it is our duty to help out wherever and however we can. In true TRIZ 'someone, somewhere already solved your problem' fashion, the easiest and most effective way to do this, we think, is to show a few solutions from one part of the world in the hope that increased visibility makes it more likely they can be seen and adopted in other places.

We start with the police. It is a well known fact that as economic conditions get worse, crime increases. At the same time, the government has less money available to pay for police. Contradiction! Enter this new squad car design recently being introduced by one of the police forces in one of the UK's southern counties.



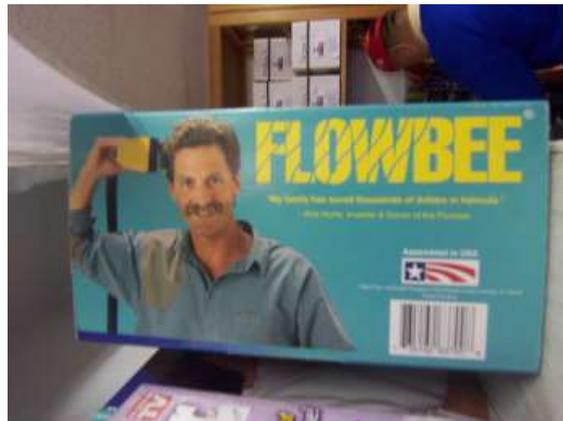
You can almost hear the prospective criminals holding up their hands in despair. 'We give up, you're too smart for us'. Genius.

Almost as good, in fact, as this terrific idea for recycling those old skis you won't be taking on the winter holiday you can't afford this year. Far better to relax in the garden and count all the money you saved in broken-limb-fixing hospital bills.



Probably very wise to stay away from public view if you also decide to adopt the next money-saving idea. Do-it-yourself hairdressing isn't a new idea of course (I still bear the

mental scars of my parents' economy measure experiments in the mid 1970s). The new angle this time around is the helpful comment, 'a perfect result every time with a bit of practice'. Practice? Expect to see a sharp rise in band-aid sales and a nation full of sobbing infants with pudding-bowl haircuts if this one takes off.



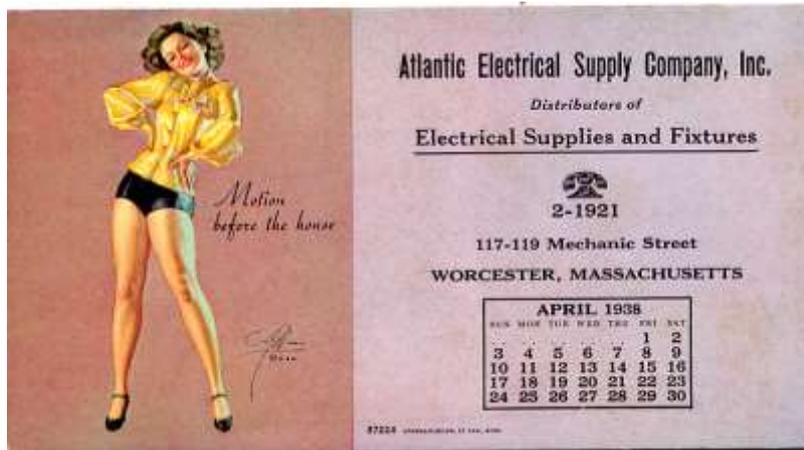
It'll be just like the 1960s again.

Which might just lead us to another good idea: recycling calendars. Because we're a really nice bunch of people, we've done the hard work for you: dig out your old calendar from 1966 and you're all set for 2011. All the days and dates match and everything...



...and quite a few useful hints in case you were thinking of downgrading to a more economical, environmentally friendly car.

Alternatively, 1938 might be more up your street...



...strange how the fashions have come full circle. Not to mention the sense of humour. 'Motion before the house'... it could've been written by Chris Rock I tell you. Whoop.

Switching to something a tad more design oriented, we've also taken quite a shine to this really neat two-for-the-price-of-one idea. Not just a great way of keeping your (soup kitchen) lunch off your shirt, but also the cheapest tie you'll find anywhere on the high street. You might say to yourself that ties are out of fashion, but don't reject the idea too quickly, you might just need this for that string of job interviews heading your way...

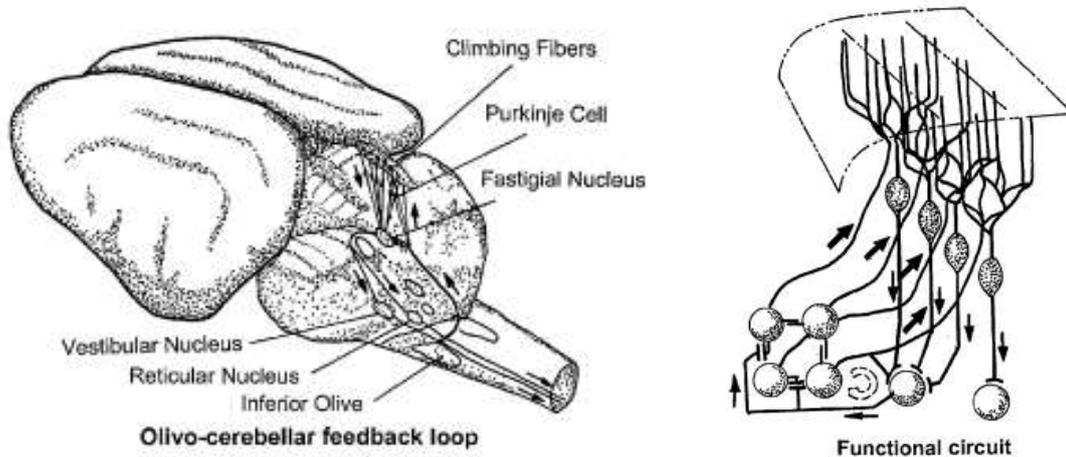


..unless you decide to do the sensible thing. Re-locate to Asia. No age of austerity there. Even the dogs are moving up in the world:



Next time I find myself having to live in a kennel, I want this one.

Patent of the Month - Neuro-mimetic control systems



Patent of the month this month is US7,822,694, granted to inventors at New York University on 26 October. In classic ‘someone, somewhere solved your problem’ fashion, the inventors have made what we think is a very elegant analogical connection between our growing understanding of how the brain works and the design of control systems for robots and other automated systems. Not that that particular idea is new by itself – indeed, given that the initial application was filed back in 2003, the Patent Office has apparently also had a lot of debate about the novelty of the design too – but rather that the inventors have made some very elegant connections at the detailed level.

We can’t profess to understand all of the ideas and concepts contained in the patent, but needless to say, the basic jump made by the invention corresponds to the following conflict, as described by the inventors in the background art description:

This system can provide simultaneous, on-line tuning of a large number of parameters (e.g., muscular parameters) with the precision required to execute the complex multi-jointed movements that characterize vertebrate motricity. For instance, a simple grasping movement of a hand involves the simultaneous activation of 50 key muscles with more than 10^{sup}.15 possible combinations of contractions. By comparison, a digital controller updating parameters every 1 ms would require a clock rate on the order of 10^{sup}.6 GHz. A digital solution would likely entail an independent processor for each muscle via a parallel digital controller. However, activation of different groups of muscles (muscle synergies) should be highly coherent and at each time step the processors would require highly precise synchronization. It is thus apparent that even simple motor tasks would result in computational overload of conventional processors.

The problem, in other words is about the need to control complex, multi-dimensional systems with limited processing power. Using the IT version of the Contradiction Matrix, here’s how that problem might be mapped:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Control Complexity (20)

WORSENING PARAMETERS YOU HAVE SELECTED:

Size (Dynamic) (2) and Speed (5)

SUGGESTED INVENTIVE PRINCIPLES:

25, 10, 2, 7, 24, 37, 35, 4, 16, 5, 19, 28

And here's how the inventors describe how they (and our brain) solve the problem (mapping to the Inventive Principles inserted by us):

By contrast, the olivo-cerebellar system operates with a drastically different strategy. First, in order to avoid the huge computational workload, the olivo-cerebellar system operates in a temporally discontinuous fashion [Principle 19]. The IO operates at approximately 10 Hz, which appears as a physiological tremor and results in the discontinuity of movement. At the same time, the low timing rate demands recurrent upgrade compensation [Principle 37] every 100 msec to smooth the movement discontinuities. As discussed, this is implemented through dynamic nucleo-cerebellar inhibitory feedback on IO oscillatory phase by changing the electrotonic coupling among IO neurons.

Movement control requires that each time step activation of different muscles or muscle synergies be highly synchronized. Accordingly, the IO neurons, which act as controller oscillators, form a set of phase clusters [Principle 5] with spatial configuration corresponding to the muscle contraction template. Thus, the space-time evolution of the clusters controls the optimal template at the next time step [Principle 37]. Note, that such an internal representation of the parameters under control brings a high degree of resilience to the system. Indeed, if one of the parameters (or a control unit) is damaged, the IO can rapidly rearrange cluster distribution [Principle 25] and execute the required action....

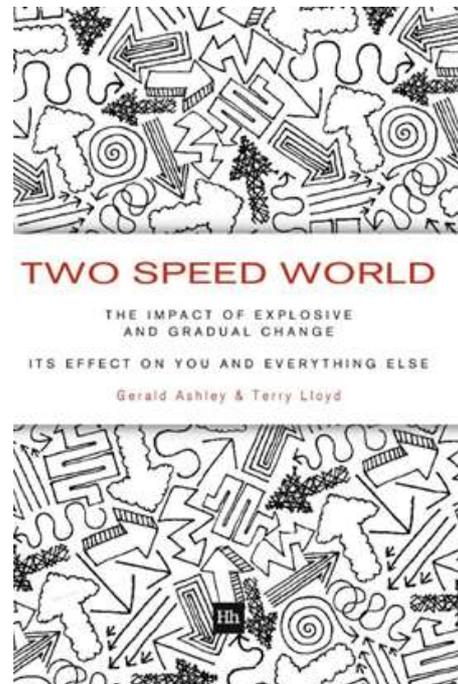
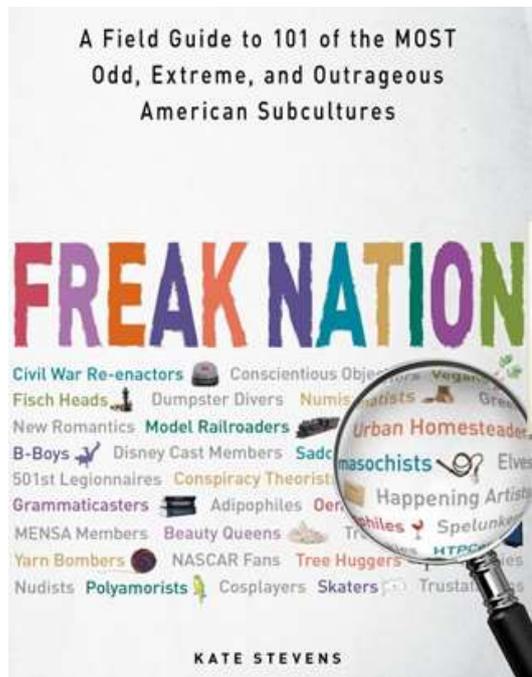
...In a first aspect of the present invention, a new model of the inferior olive neuron is provided. Based on empirically observed modes of membrane potential dynamics, the model of the present invention combines Van der Pol and FitzHugh-Nagumo (FN) dynamic systems [Principle 5] in which each oscillator property dominates one particular mode of the cell dynamics. In accordance with the present invention, a model of the IO neuron is provided which is substantially less complex than previously known models, yet which does not sacrifice accuracy in mimicking the overall dynamics of the IO neuron. This is particularly advantageous for implementing large scale networks of IO-neuron-mimicking processing units in hardware.

All in all, a pretty close match between what has been used and what the Matrix recommends. Which is not to say that the invention could easily have been made a priori from just the Matrix recommendations. In these kinds of solutions where there has been a combination of multiple inventive steps (none of which would have worked in isolation), indeed it will always be a major jump to get from Principles to solution. The only way, in fact, would have been to generate lots of ideas ('quantity not quality') using each of the Principles in turn, and then looking to make as many combinations of the individual ideas as possible. Either that or, like the New York University inventors, spend a few decades studying how the brain works. Or – hey, how about this for a thought – possibly combining both... something which wouldn't have been such a bad idea here since the patent claims seem rather weak and therefore easy to design around.

Don't let that thought detract, though, from the merits of the invention itself. Any solution delivering benefits measurable in orders of magnitude – as is the case here – cannot sensibly be ignored.

Best of the Month – Freak Nation/Two-Speed World

In the run-up to the end of the year, all the Pullitzers and other award-giving establishments of repute have made their 'best-of' decisions, and no-one wants to publish what might turn out to be a future masterpiece lest it accidentally fall between the cracks and not get noticed. Which is another way of saying we've struggled a bit this month to find something worthy of the 'best' label. Nothing we saw, indeed, seemed worthy of the title. We did, however, find a couple of semi-recommendations and figured that two halves might somehow add up to make at least some kind of a whole.

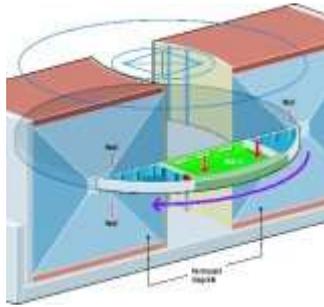


First up, Kate Stevens' newly published 'Freak Nation', a Christmas stocking-filler of a book for anyone that enjoyed Mark Penn's near classic Microtrends tome from a couple of years ago. Ms Steven's book heads a little further out along the long tail than Penn – he used a million-plus people as his criteria for inclusion in the 'trend' category. Stevens is a little less specific about her criteria for inclusion, but please don't think of that as any kind of criticism: there's plenty to enjoy in this book. It is a veritable cornucopia of marginal anthropology and as such likely to provoke a range of emotions from jaw-dropping to squint-eyed wincing at the antics that some people seem to get up to. You'll especially enjoy the book if you're the kind of person who finds themselves twiddling their thumbs over the holiday season, want to do something productive, but don't want to be accused by the family of 'working'. Plus, there's the added bonus of seeing how many of the freak categories you fit into. Turns out I'm almost in double figures. Which is more than a little bit scary now that I come to think of it.

Our second half-recommendation makes a double shift; from not-so-serious to nearly-serious, and from people-watching sociology to macro-economics. Gerald Ashley and Terry Lloyd (both Brits; one a risk manager, the other a computer-programming ex-Rolls-Royce compressor designer... hmm!) have written a very nice disposition on what is effectively the impact of s-curves on economic systems. Being written primarily for the lay-person (I think – sometimes difficult to know with these ex-RR types), the S-curve gets simplified into two distinct parts: the climbing-the-curve, optimizing, 'gradual change' part,

and the discontinuous, jumping-from-one-curve-to-the-next, 'explosive change' part. For those of us who spend our whole lives looking at the world through an s-curves-all-the-way lens, there is not an awful lot new happening in this book, but for anyone who has yet to grasp the enormous significance of s-curves, the book makes for a really good overview with more than a few nuggets of practical advice for managers and leaders... next up, all they need to do is learn a few bits of TRIZ so that they might learn that some of the 'unforeseeable events' they describe are actually really the exact opposite. Which, come to think of it, in some strange way probably takes us full circle and back to Freak Nation.

Investments – Cambridge



Refrigeration and cooling account for 15% of all the energy used around the globe, and manufacturers are under increasing pressure to build more efficient products. By 2012, the energy rating for new domestic appliances will have leapt from the current maximum of A++ to a new rating of A+++.

A Cambridge-based company believes it has a cost-effective solution that can reduce the energy consumption of fridges by up to 50%, based on the principle that metals experience temperature change when entering and leaving a magnetic field. Installing this technology in commercial beverage coolers alone could reduce UK carbon emissions by 51,000 tonnes per year by 2020. It should also make fridges easier to recycle.

Based on the long-ago discovered magneto-caloric effect, the prevailing logic clearly indicates that technological limitations make practical applications nigh on impossible. The Cambridge start-up, Camfridge (the name will probably have to go!) has recently made a significant step in the right direction with the development of a new class of materials that change their temperature when magnetised. They are currently claiming a factor of three improvement over the previous state of the art solutions, sufficient, says the company CEO, to make refrigerators based on the effect commercially viable and capable of out-performing the current ubiquitous compressor-driven refrigerators.

The material breakthrough utilises binary metal refrigerants – used in conjunction with novel nano-particle suspension heat transfer fluids. The technique could be used on a large or small scale. It has the potential to replace conventional gas compression and cycle refrigeration plants – saving energy and avoiding problems associated with leaking refrigerant gases – but could also cool electronic chips and other small scale devices.

Said the technical director, Neil Wilson, “there has been a lot of work at NASA Ames on gadolinium silicon germanium, which makes a large temperature change when it is magnetised – but also shows a large hysteresis effect.”

A magnetic field is applied to a material so that it heats up (or in some cases, cools down). After this the heat is passed to the working fluid, and the field is turned off – making the material cool as it takes in energy in order to return to its previous state. It can then absorb heat from whatever it is that needs to be cooled. As it does so, its temperature rises until it reaches that where the cycle may be repeated.

Two experimental machines have been built. The original, demonstrated to Eureka, uses a bed of gadolinium particles in a tube. Any practical machine is unlikely to be based on gadolinium – it is too expensive – but it is well understood and easy to work with, so other working parameters can be deduced from experiments and used to design more practicable machines.

Heat transfer fluid is pumped through the bed that is reciprocated by an actuator through a magnetic field produced by a permanent magnet. This machine cools fluid from 23 or 24 [degrees]C to 10 or 11 [degrees]C on a 4-second cycle time. It has a cooling power of 10W. The permanent magnet is made of neodymium iron boron, and is a Halbach magnet (see diagram) which enhances the 1.4 Tesla maximum remnant field associated with this material to 2 Tesla.

The mark II design machine has a disk of magnetic material which rotates its sectors between two pole piece pairs in a larger permanent magnet arrangement with a much shorter cycle time. The intention is for the next generation machine to be about the same size as the first, but running at 10 or more cycles per second – and with a cooling power of around 100W, using lower cost working materials.

“People naively think that what is important in a magnetocaloric material is the height of the transition [the temperature change when it is magnetised and demagnetised],” says Wilson. “But a material that has a high transition over a narrow temperature range is completely useless as a refrigerant. What we need is an expanded entropy [energy divided by temperature] range over which the material will work.”

In the original machine, the individual gadolinium particles cycle over a temperature range of about 2[degrees]C, but because the working fluid passes through a bed of particles with a hot and a cold end, the overall cooling is 15[degrees]C.

Many of the materials previously studied for this type of application undergo a change in crystalline structure when magnetised and demagnetised, but the Cambridge materials change only their electronic ground state (the way electron spins line up when in their lowest energy state). In the case of gadolinium, magnetising the material turns it from ferromagnetic (spins lined up) to paramagnetic (spins in all directions), though other transitions are possible. Materials that change their crystalline structures take too long to do so, consume too much energy to make the changes, and – if cycled a large number of times – are liable to fall apart.

The material finally chosen must be low cost, non-toxic and have high thermal conductivity. Other features include low heat capacity and preferably a high electrical resistance, to reduce eddy currents.

Following the recent successful demonstration of the new binary material structure, a bullish Wilson has suggested that the first magnetocaloric domestic refrigerator will reach the market by 2014. “By 2020,” Wilson goes on to say, “every fridge will be magnetic.” Perhaps something of an overstatement, but all of our analyses says that providing the company can get over the crucial route to market hurdle, the future looks very bright indeed. Especially when considering that the majority of the world’s magnetic materials resources are in China, and China is the place on the planet with the biggest emerging market. Are 400 million people, likely to purchase their first ever refrigerator in the next 8 years, going to buy today’s technology, or be offered tomorrows? Who knows? Cambridge maybe? Definitely one to keep an eye on.

Generational Cycles – Reactives, Boomeritis & Holarchies

We recently came across this piece in the Society for American Archeology (essential reading for all budding anthropologists and generation-ists) and thought it was so good, it was worth stealing large chunks of here... with due credit to author Lawrence E. Moore of course... to provide anew and unusually positive view of Generation X Nomads. As those of us of a certain age know, Generation X is generally perceived (by other generations at least) to be a largely 'failed' generation. This great article shows us in a more positive light, and, although the focus is archeology, has a lot to say about the Nomad role in society as a whole:

Reactive generations are the roughest in American history; they are the "bad" generations, using that word in all its variations. They generally come of age during moralistic culture wars and they suffer economic hardship most of their adult lives; many live a boom and bust life. Gen Xers have been caught in the midst of age-graded wage stagnation. Despite economic growth, the standard of living for a 30 year old in the year 2000 was much less than it was for a 30 year old in 1970 because real median income (inflation adjusted) has stagnated in the United States since the 1970s and personal savings rates have hit lows not seen since the Great Depression; meanwhile, household debt ratios have risen to new highs (Kemenetz 2006; Krugman 2007:124–152; Mooney 2008; O'Shaughnessy 2008; Strauss and Howe 1997:236). The tough economic times that Reactives live through, and the culture wars they try to avoid, casts them as survivalists, bottom-line realists, and scrappy innovators and entrepreneurs. Their values are in stark contrast to prior generations: a career is not the most important thing in their lives, they cannot imagine working for the same company or in the same line of work for their entire lives, they expect to be respected, they are reluctant to commit to much of anything, and they expect to get as much as they give.

As survivalists Xers are not beholden to any moral agenda other than individualism and eclecticism. Unattached as they are to the agendas of their next elders they are called nihilists which, of course, is inaccurate because what they are doing is not engaging in the culture wars of their elders; they are apathetic toward and tired of those crusades. The generational tiff between Boomers and Xers is real. The former look upon the latter as amoral slackers too focused on rascally fun ("These losers will run society some day? God forbid!"). Xers view Boomers as hypocritical culture warriors too incompetent to manage society ("*Will they ever shut up and stop arguing?*"). Living in the wake of the Boomers has not been pleasant; so they write about it (see Douglas Coupland) waiting for their turn at leadership. Xers have already made lasting impressions on American culture. First and foremost, they are interested in having fun. Xers are simplifying the complicated moral world of the Boomers and they are focusing on enjoyable learning experiences. Xers are also extremely physical, giving America extreme sports, bungee jumping, snow boarding, and the now popular fist pump. Within the generation there is gender parity in terms of employment. Gen Xers are also the most tattooed and pierced generation in American history. As strong romantics Gen Xers are changing popular culture toward super athletic and pleasantly plump characters because curves, firm or soft, are more appealing than rational slimness and angularity. Their hard-hitting commercialism is seen in companies like Amazon, eBay, Google, Yahoo, and Dell, all founded by Gen Xers. What the entrepreneurs of these companies did was take something that already existed for corporations and made it efficiently available to individuals because their focus is on personal satisfaction, fun, and survival. Previous reactive generations offer clues to what Gen Xers may be like in senior leadership roles. American presidents George Washington, John Adams, Grant, Hays, Garfield, Arthur, Cleveland, B. Harrison, Truman, and Eisenhower were all Reactives.

The traits that connect them are pragmatism, fiscal conservatism, and a low tolerance for risk taking while in office. They were also generally unpretentious. These presidents had had prior military service and several had been generals. They all took their leadership roles during or directly after American culture was in secular crisis (the Revolution, the Civil War, and the Depression- WW II). Since September 11, 2001, America has again been in secular crisis and the midlife reactive generation is standing up. Additionally, Reactives attaining high office fairly young may tend toward autocracy (Sarah Palin, Michelle Rhee) that likely moderates with age. The nomadic type also has its flamboyant characters such as Barack Obama, George Custer, and Sir Mortimer Wheeler. Reactives are best understood as Nomads and Commanders with keen analytical, management, and writing skills. Nomads wander geography, but also the mind, the soul, and the heart. *As they have no cultural agenda other than survival they are not wedded to any theory or methodology. Nomads will pursue concepts that are productive toward planned goals; they will even abandon useful concepts in the desire to experiment with others.* More than other generations, nomads explore all corners of life, its wonderful pleasures (Mae West) and its darkest powers (Adolf Hitler).

Reactive Mythology

Reactives live nomadic and dangerous lives while young; they may even be iconoclasts. They mature into careful, pragmatic, and conservative leaders who enable the younger civic heroes to greatness. Every generation has a sociological function, its mythic destiny, and they can succeed or fail. Heroic generations provide the critical mass that pushes a crisis-laden society to greatness; afterwards, they are the builders of a new society. Artists are the social reformers who spread elegance and grace through society; and yet they may compromise it through indecision. Prophets are culture warriors who polarize and potentially destroy society; from within their chaos comes a visionary

offering a new moral order. Reactives wander a cultural wasteland and then they redeem it, assisting its rebirth. For Generation X history has charged them with the task of demonstrating that Americans can still enjoy “life, liberty, and the pursuit of happiness” without letting the world fly to pieces, without bankrupting the nation, and without squandering scarce global resources. They get to do the dirty work, have a little fun, and help the heroic kids behind them.

The Eternal Return

America in the '00s has been a fearful place. Since 9/11 we have been afraid of terrorists, of blue and red states, of our inept leaders, and of the economy. Two Boomer presidencies (Clinton and Bush Jr.) have wracked the culture off its moorings, letting it flounder in a crisis of confidence. The economy is in systemic crisis. The collapse of the Bush administration in 2006 sent the conservative movement into shock and Boomers everywhere are anxious because the failure of one part suggests the failure of the whole generation that believed it could change the world. They are, actually, living out their destiny as culture warriors who may be destroyers. Mythology helps to sway the fears because during the apocalypse there is always a prophet giving moral courage and guidance to the younger generations. Harry, Frodo, and Luke all had steely eyed gray- haired champions to look up too (Dumbledore, Gandalf, Obi- Wan Kenobi). This gray champion has yet to emerge from the Boomer generation. History suggests that he or she will as they always have in the past (Franklin D. Roosevelt, Abraham Lincoln, and Benjamin Franklin). This secular crisis is far from over. There is time for a Boomer to stand up, deliver a vision of a new moral order, and complete a generation's destiny. Gen Xers are also doing their part; they are entering upper management positions and tenured professorships. They bring pragmatism, flexibility, fiscal conservatism, and keen analytical abilities. They are unpretentious and mostly nonideological. They are not culture warriors but are redeemers of culture.

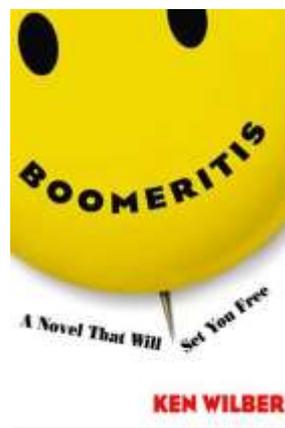
Obviously written by a glass-half-full Generation X'er, but nice to read something positive for a change. You can read the full article at:

<http://www.saa.org/Portals/0/SAA/Publications/thesaaarchrec/Nov2009.pdf>

The thought we wanted to explore here concerns the text highlighted in red:

“Will they ever shut up and stop arguing?”

There is a strong link here to Boomeritis, the love-it-or-loathe-it novel by Ken Wilber. The main premise of the book is that, in Spiral Dynamic terms, because of the way in which they have been brought up, a large proportion of Boomers get stuck at the sixth ('FS', Green, Communitarian) Level of the Spiral. This is the level at which everyone is equal and where everyone should have an equal say – hence 'will they ever shut up and stop arguing' perceptions from the GenX person brought up with a different (abandoned/ alienated/pragmatic) generational conditioning.



As they have no cultural agenda other than survival they are not wedded to any theory or methodology. Nomads will pursue concepts that are productive toward planned goals; they will even abandon useful concepts in the desire to experiment with others.

This comment, referring to GenXers, is indicative of the fact that, due to their 'abandoned' upbringing, they tend to be far more independently minded than other generational archetypes. Few if any GenXers will suffer from Wilber's Boomeritis. Rather – we think (i.e. read this as an untested hypothesis at this point in time) – Nomads are more prone to

get stuck on the Spiral at either the (Scientific) Orange or (Holarchy) Yellow levels. At this stage in their life, and because they have had to live with and through some of the Boomer 'Green', it is more likely that it is Yellow where the 'stuck'ness occurs. Yellow certainly seems consistent with the highlighted quote. Yellow is not such a bad place to be you might think, but the tendency of Yellow thinking to walk away when the going gets too difficult can be a big problem for society. Particularly if (when!) this Fourth Turning 'Crisis' period unfolds all of its horrors.

So, a final thought and pair of questions for you: what is the name we give to the Orange or Yellow 'stuckness' disease equivalent to Boomeritis that GenXers need to cure themselves of? And will any GenXer do a Ken Wilber and write the book about it?

Knowing GenX characteristics, I think we already know the answer to at least the second of these questions.

Biology – Greater Roadrunner

Life in the desert can present a host of thermal management problems for even the most adapted life-form. Reptiles tend to solve the problem by allowing their body temperature to vary with the ambient conditions. For warm-blooded creatures, on the other hand, this strategy is not possible because the body only functions if constrained to operate within a range of typically less than 10 degrees Centigrade. Contrast this with a day-night temperature range of sometimes over 40 degrees.

One of the most striking examples of a warm-blooded desert dweller is the roadrunner, and especially the Greater Roadrunner found in places like Mexico and the Arizona desert.



Here is a bird that has evolved some really rather elegant adaptations to its environment. First up, after a cold night in desert, Greater Roadrunner takes the sun, fluffing its back feathers and exposing the skin to the sun. This skin is black, to absorb solar energy. Then, when the temperature drops or the 'batteries are full' the bird resets its paler, more reflective feathers to reject further incoming energy. The same feathers then act as insulation during the night... albeit not so much that the bird hasn't also had to evolve a solution whereby its body temperature drops to hypothermia levels at night in order to conserve as much energy as possible.

Here's what the basic problem looks like when mapped onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Reliability/Robustness (35)

WORSENING PARAMETERS YOU HAVE SELECTED:

Temperature (22)

SUGGESTED INVENTIVE PRINCIPLES:

3, 35, 15, 10, 30, 37, 36, 1

All in all, a pretty close match to the roadrunner solutions. Mainly with respect to the use of Principle 15, Dynamics as the primary means of solving the problem – i.e. moving the feathers. The use of differential colour connects to either Principle 3 or Principle 37 in its 'Relative Change' form (although Principle 32D, Colour Change and the 'change emissivity' clue would have been better). No sign of a nod in the direction of the 'drop to

hypothermia temperature' solution, but in all probability this is the trade-off part of the solution – the roadrunner having 'optimised' the overall thermal management solution such that it has had to have just enough feathers/insulation to allow the bird to survive at the lowest part of the daily temperature range... adding more of either would have required a greater use of resources. No, the dark-skin/light-moving-feathers solution is definitely the one to take away as a genuine contradiction solving jump.

Short Thort

“The grace of imperfection is worth more than graceless perfection.”

Alex von Wuchenau



Grace grows from three simple realities:
nothing lasts,
nothing is finished,
and nothing is perfect.

News

myForesight

The Malaysian government has just launched this new technology foresighting magazine. The aim of the quarterly publication is to spark innovation across academia and industry in the country. We are happy to announce that we have contributed articles to both the launch issue (out now) and the next edition, scheduled for publication at the end of January.

CHAOS2011

Assuming all goes well, we will be presenting a paper at the forthcoming 4th International Conference on Chaotic Modeling, Simulation and Applications, to be held at the beginning of June. The fact that the event will take place in Crete has, of course, nothing to do with the decision to be there. At this point in time, our paper is called 'Using Complex Systems Modelling Techniques To Reveal Hidden Contradictions, Trade-Offs And Innovation Opportunities'.

Playing Cards

At long last, we are happy to announce that a new edition of the now collectors-item Inventive Principles playing cards has now gone to print. We are hoping to get the first

batch in stock in time for the Christmas holiday. Difficult to imagine a better stocking-filler for your nearest and dearest.

ApolloSigma

Beta users will be happy to learn that a new version of ApolloSigma has now been released. The new version allows users to connect directly to both US Application and all EP and WO patents.

"Generation XYZ - how well do you know tomorrow's customer?"

This new one-day workshop for marketers will see its debut in Austria in February 2011. More details on the Experience page on the website.

New Projects

This month's new projects from around the Network:

- FMCG – platform technology strategy definition sessions

- Consumer Electronics – IP generation project

- Airport Authority – Future Scenarios study & workshop

- Academia – entrepreneurship education dissemination project

- Electronics – Innovation Benchmark Scan

- O&G – workshop series

- Chemical – Future Product development ideation sessions

- Food – new product development project