Systematic Innovation

e-zine

Issue 106, January 2011

In this month's issue:

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

(Meta)^4

There's nothing quite like a metaphor to spur new ways of thinking at the beginning of innovation projects. Who could see Sarah Palin quite the same again after the 'pitbull in lipstick' expression? Irrespective of whether you were for her or against her, the image was extremely evocative… probably even today, three years later. A metaphor is a figure of speech in which an expression is used to refer to something that it does not literally denote in order to suggest a similarity. A good metaphor opens up multiple useful connections to the original. Its place in creativity is well established. But probably only insofar as being a theoretical means of getting people to think 'out of the box' about their target problem. One of our long-time collaborators, Jonathan Hey, recently completed his 'Effective Framing In Design' PhD thesis at Berkeley (Reference 1), and in so doing spent a lot of time exploring the power of metaphor, and techniques for formulating the 'right' metaphor to help project teams gain new insights. His literature search revealed a significant hole in the academic community's collective understanding of metaphor. While the theory of *using* metaphor appeared sound, structured techniques for *generating* useful metaphors were, he reported, to all intents and purposes non-existent.

In his thesis he tried to right the situation by first creating a series of simple templates to help users connect metaphors to problems, and second by creating a metaphor generating tool (www.meta4acle.com for anyone interested).

This article is about integrating the concept of metaphor generation with the Systematic Innovation tools in order to build a process capable of delivering more and richer insights. Following a series of experiments, we have found that one of the best places to start is the outcome map placed right at the beginning of the (TrenDNA) opportunity finding process – Figure 1.

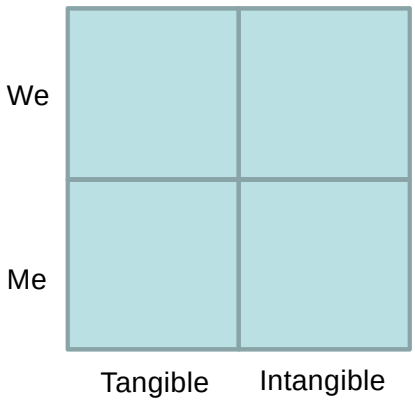


Figure 1: Outcome Map

This 2x2 matrix makes a good start point since failing to get this part of the innovation story right effectively makes everything that happens downstream irrelevant. Whatever the target domain, the fact that customers buy outcomes is undisputable, and one of the two possible ways of innovating involves finding new outcomes (the other being 'solve a contradiction').

In order to make our metaphor-building story less abstract, at this point we will introduce a specific case study in order to better describe the model we've homed in on. The case involves the creation of a new recorded music company. All instincts right now suggest

that the advent of MP3 downloads has in effect killed the record industry, so a sensible person would perhaps look to invest their money elsewhere. Never being ones to walk away from an impossible challenge, we thought at the very least exploring opportunities in this dying domain would be interesting.

Having decided upon the focus area, the next job is to explore some of the outcomes that we would like our new record company to deliver to customers. Under normal circumstances, we would map the existing and prospective new outcomes comprehensively onto the Figure 1 map. In our new 'metaphor-driven' experiment, the outcome finding burden is reduced to finding a single 'most important' outcome in each of the four quadrants. Figure 2 represents the result of our doing that job:

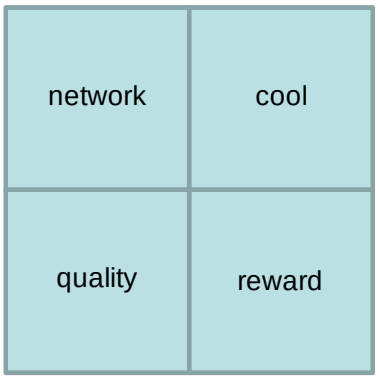


Figure 2: Key Desired Outcomes For New Record Company

Next up comes the task of defining a useful metaphor for each of the four quadrants of the map. We used the simple template illustrated in Figure 3 to do this job:

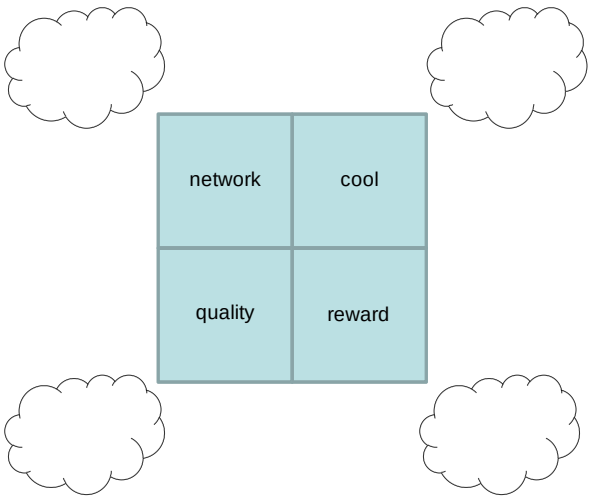


Figure 3: Meta^4 Outcome-Metaphor-Making Template

The trick at this point is to identify 'appropriate' metaphors that can be used to generate new insights into the record company design challenge. The aforementioned meta4acle software attempts the feat by requesting the user to think about adjectives relevant to the subject at hand. Figure 4 represents the output received after supplying the software with adjectives like 'rare', 'tiny' and 'resonant'. The software effectively triggered these words by providing a check-list of adjective clusters. So that, for example, 'rare' came from exploration of the options in the 'quantity' adjective cluster.

The middle column of the Figure 4 screenshot shows the metaphors suggested by the algorithm contained within the meta4acle software. The right hand column then provides a set of further clarifying connections to potentially related domains:

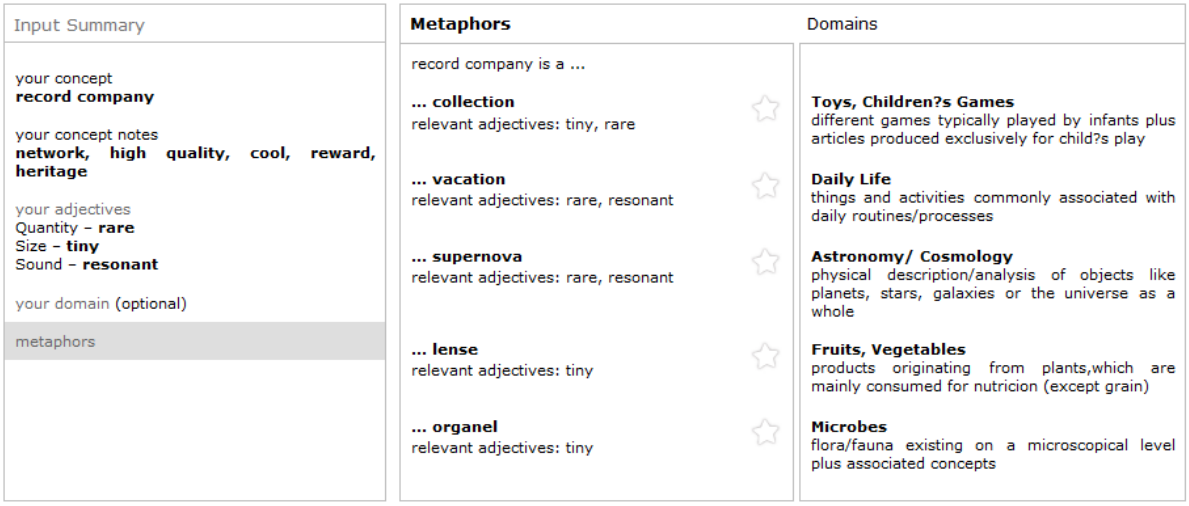


Figure 4: Typical Meta4acle Software Output – Record Company Example

Although some of the suggested metaphors appeared 'intriguing' (a record company is a supernova in that…?), the size of jump between record company and metaphor appeared both large and a tad too random for this author. Some ideas appeared once we forced ourselves to make connections… a 'vacation record company' would take us to places we've never been before; give us a multi-sensual experience; leave us with a photographic record of the experience; etc… but nothing we came up with made it feel like we'd hit upon a reproducible process.

What we then tried to do was look for metaphors that were more evocative and easier to make connections to. Following a little experimentation, it came to something as simple as looking at each of the key outcome words and finding an organization or entity from other domains that were associated with those outcomes. Figure 5 reproduces the actual connections we made after forcing ourselves to write something inside each metaphor cloud within 90 seconds of thinking about the outcome word. (By the way, don't ask me why I connected 'cool' to 'ice-hotel' – it was just the coolest (both ways!) thing I could think of in the time allowed. It just happened!)

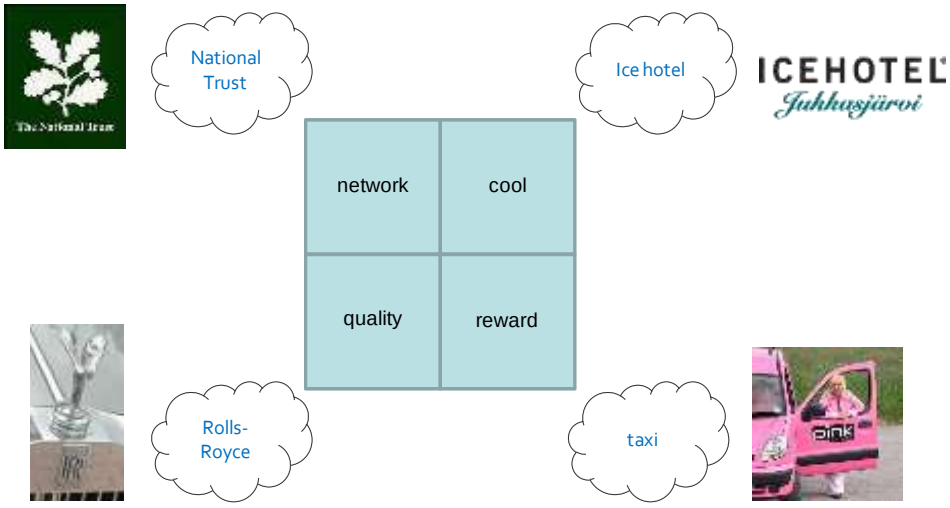


Figure 5: Completed Meta[4] Outcome-Metaphor-Making Template For Record Company Example

Having made the metaphor connections, the next job was to make links between each one and the target record company. We found the best way to do this was to think about positive attributes of the metaphor and then think about why such positives might be suitable for the record company.

So, for the ice-hotel metaphor, we came up with the connections illustrated in Figure 6:

Figure 6: Ice-Hotel Attributes Potentially Suitable For Record Company

Now, it seemed, we had something interesting and new. I say this because this is a problem we've dabbled with for a number of years now, so coming up with anything we hadn't thought of before was unlikely. Especially given the fact that we made the connections shown in the figure in less than five minutes. We did the same thing using the other three metaphors and obtained a similarly rich set of new directions to explore – Figure 7:

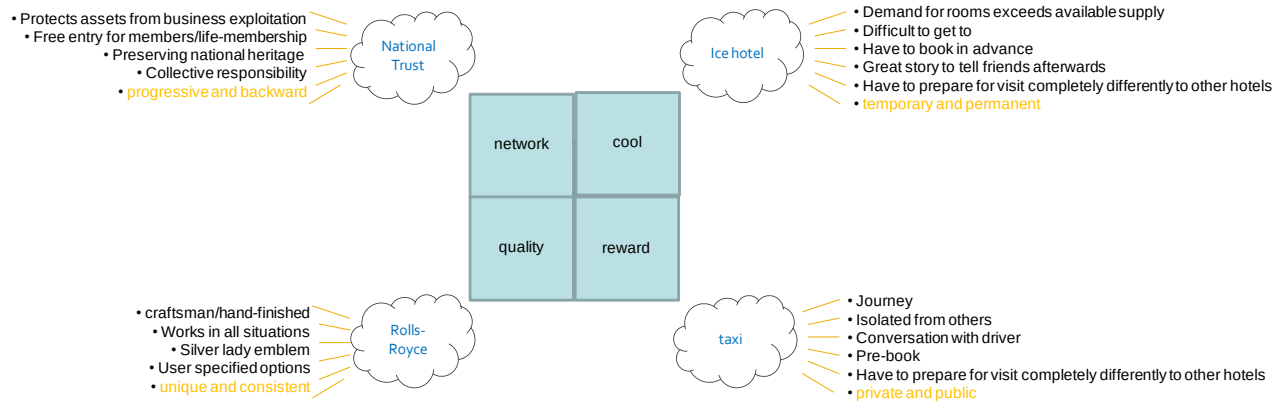


Figure 7: Meta[4] Attributes Potentially Suitable For Record Company

As it turned out, the contradictions identified for each of the four metaphors turned out to deliver some of the richest insight. Forcing ourselves to think about how a record company could be both temporary and permanent, or 'private and public' delivered some ideas that not only made the heart skip, but also offered the potential to resolve one of the biggest problems of any new venture in the recording industry – how to make money when the audience increasingly expects music to be 'free'. In retrospect, this learning shouldn't have been such a big surprise since in many ways insight is contradiction... call it one of those 'blinding flash of the obvious' moments. And it only took us 16 years to get there!

Now, no matter what we tell you about how this process worked for us, you're very unlikely to believe us. Far better, then, is that you have a go at the process yourself for a problem you're working on right now. We make this recommendation safe in the knowledge that, at

the very least, it will only take you a few minutes to go through the steps because the sequence is very simple:

1) Construct an outcome map for your target domain, defining a key outcome in each of the four quadrants
2) Identify a metaphor for each of the four quadrants – making connections between the outcome words and an organization or product/service that typifies that outcome
3) Identify positive attributes and contradictions relating to the metaphors and make connections between them and your target domain.

Give it a shot. We think you'll be pleasantly surprised by what you uncover.

References

1) Hey, J.H.G., 'Effective Framing In Design', University of California, Berkeley, PhD thesis, Spring 2008.

Does The Lone Inventor Have A Role Anymore?

(Or: The Real Fourth Quadrant)

The last couple of years have seen the publication of a strong surge of books on 'where innovations come from'. One of the more interesting of the cluster was 'Where Good Ideas Come From' by prolific US innovation author, Steven Johnson (Reference 1). In essence, the thesis of Where Good Ideas Come from was that networks were the most important source of innovation. In more specific terms, the book gave the clear hint that Open Innovation was the most likely way for organizations to create new products and services.

One of the things we liked best about the book was the way in which Johnson set about analyzing a host of world-changing innovations through the last 600 years of history and classifying them into a simple 2x2 matrix. That matrix divided the world of innovation into four quadrants as detailed in Figure 1:

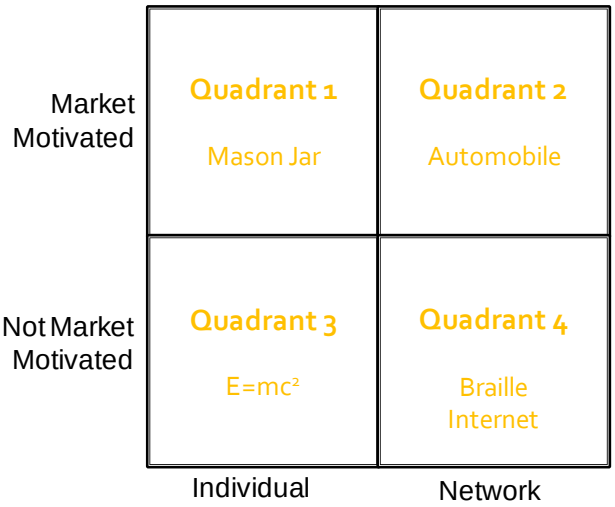


Figure 1: The Four-Quadrant World Of Innovation

Essentially what Johnson was interested in was whether innovations tended to come from individuals or networks, and whether they came from people focusing on a market need (i.e. the classic 'necessity is the mother of invention') or from people working in a non-market focused manner – i.e. people like Einstein 'doing science' for the love of it.

Figure 2 shows a summary of how the innovations Johnson looked at sat within each of the four quadrants, at the three different times in history he studied:

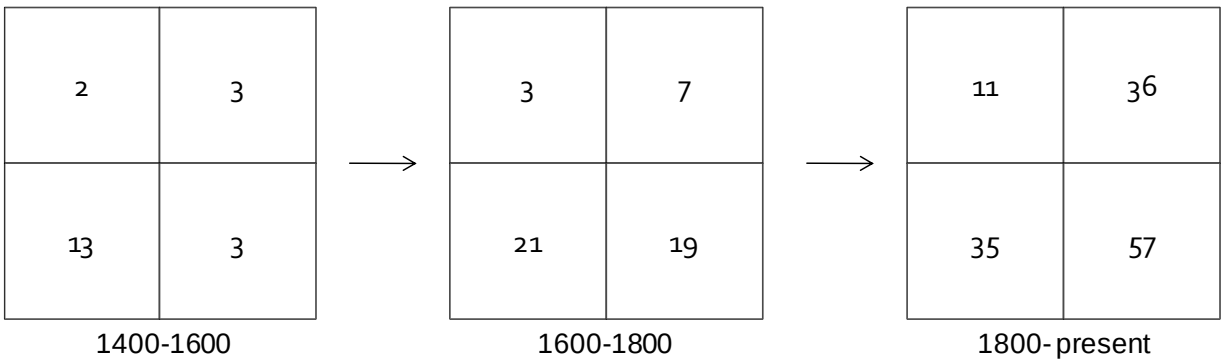


Figure 2: Innovation Sources

Back in the 1400s, Johnson's analysis reveals, the lone-scientist dabbling in the laboratory was the dominant source of innovation. But then, over time, although that type of person continues to be an important source of innovation, the dominant innovation source has shifted significantly away from the individual and towards the network.

The concluding chapter in Johnson's book is about the 'Fourth Quadrant' – the overall dominant source of innovation according to his research over the course of the last 200 years. This is the quadrant relating to networks of individuals working on non-market-focused research. Tim Berners-Lee and his fellow Internet-creating workers being the iconic illustration of what the quadrant is all about. Berners-Lee might have taken the credit (the media needs a hero!), but quite simply, he couldn't have created the Internet without the input of many other people. The fact that this network was trying to solve a specific internal communications problem rather than anything with any commercial, 'let's-sell-this', motivation is also a significant feature of the Fourth Quadrant innovation story according to Johnson's thesis: most innovations come from networks of non-monetarily motivated people.

Well, aside from liking the way Johnson writes and the thoroughness of his historical analysis, 'Where Good Ideas Come From' didn't make it into our Best of the Month slot. The main reason for that being our feeling that W. Brian Arthur's book 'The Nature Of Technology' (Reference 2) was the best of the 'where innovations come from' surge. What Arthur picked up that Johnson didn't was the fact that there are two very distinct types on innovation:

- Discoveries – things that were always there, but we didn't know about (e.g. the Earth spins around the Sun, or magnetic fields.)
- Combinations – innovations that came about through the combination of two or more known things.

It seemed like a good idea to set about re-classifying Johnson's analysis to take into account these two very different innovation start-points. Figure 3 presents the results of that analysis:

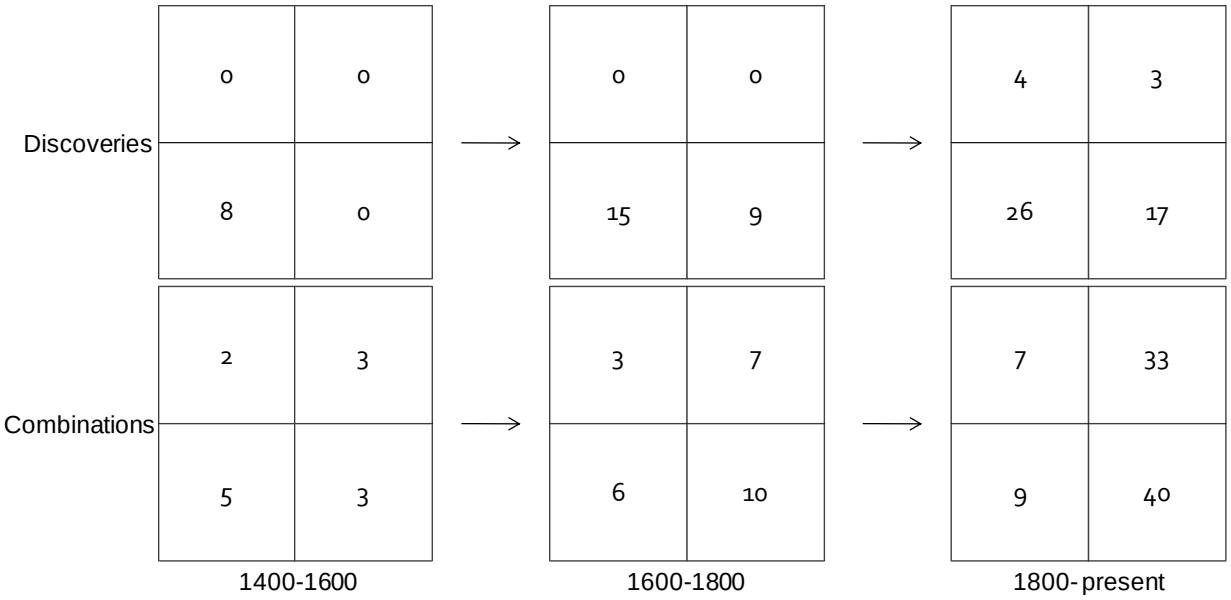


Figure 3: Innovation Sources – Separating Discoveries & Combinations

The results of this study highlight what we think are important caveats on Johnson's suggested significance of the 4th Quadrant. Namely:

1) The large majority of Discoveries come from non-market focused activities
2) Networks are the dominant source of combination innovations
3) The Individual inventor continues to be the major Discoverer of new things.

Which, reading between the lines with an Open Innovation focus, seems to suggest that organizations that come to rely heavily on 'the crowd' to answer their innovation needs will be highly likely to compromise their ability to generate Discovery innovations. Either that, or Open Innovation needs to start addressing the potentially dangerous hole in its overall philosophy. Meanwhile, the lone-dabbler, tinkering in his (or her) garden shed can take comfort from the fact 'we still need you'.

References

1) Johnson, S., 'Where Good Ideas Come From: The Natural History Of Innovation', Allen Lane, Penguin, 2010.
2) Arthur, W.B., 'The Nature Of Technology: What It Is And How It Evolves', Allen Lane, Penguin, 2009.

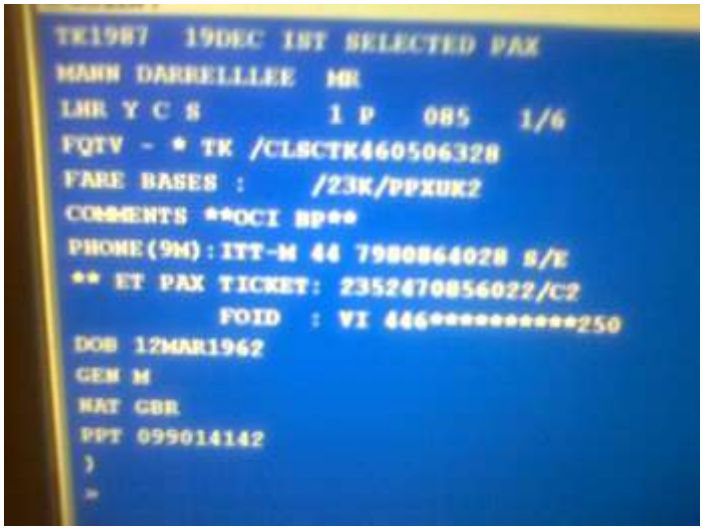
Worst Of 2010 Awards

A shrill cry of 'who let the dogs out', a quick check through our cupboard to make sure all evidence of our failings has been expunged from the records, and grasping the sturdy SI clapometer in our sleazy mitts, we arrive nervously at our 2010 awards section. Thinking, maybe we need a name for these things… the Nobels have the Ignobels; the Oscars has its evil-twin equivalent in the Razzies and the Golden Turkey Awards, what about the world of innovation? Why do we get left behind? Where are our awards? 'The Segways'? The C5s? The Farmvilles? (Only joking, Farmville fans.) Hey ho, either way, someone somewhere needs to get a grip and give people a reason to get out of bed in the morning and aspire to be something truly un-wonderful.

Joint 'It-Can't-Be-KLM-Again Suck'y-Airline Of The Year' and 'All-Conversations-May-Be-Recorded-For-Training-Purposes Customer Service' Awards - well, inevitably it was going to have to be an airline that was going to win this one, given that we spend 75% of our lives on aeroplanes, or mumbling obscenities trying to get through airport Security in a bid to get onto an aeroplane. Little did we know, though, that this year's winner wasn't even going to be in the slightest bit connected to KLM, AirFrance or Delta (the SkyTeam axis of evil). Stand up and take a bow Turkish Airlines, because you win by a furlong this year. Not that you managed to win without some help from the incompetence at Heathrow airport in London, but that minor detail aside, your complete inability to deal with a plane load of people who's flight had just been cancelled was truly awe-inspiring in its ineptitude. Essentially, here was a group of people who, at 10pm on a Saturday night, had many better things to do than watch a squadron of angry passengers sputtering out their frustrations:

- Why had the departures board being saying 'on time' for the last 2 hours?
- Why did the flight then just disappear without so much as a 'poof' from the board?
- Why was there no-one at the Gate to let people know what to do?
- Why did no-one keep the queue at the Transfer Desk from descending into anarchy (being a fairly seasoned traveler, I managed to get to the desk among the first five other stranded passengers, and yet somehow 50 people pushed in front of me by (and I still can't believe this happened) forming an alternative queue starting *behind* the Transfer desk… yes, staff found themselves with glowering passengers standing behind them, refusing to go away until something had happened
- Why were we offered hotel accommodation at 2am, only to be told we had to be back at check-in at 5am?
- Why couldn't they print out new boarding passes (answer: the computer system collapsed… me: 'well how do I get through Immigration without a boarding pass' them: 'it will be fine'. (10 minutes later after leaving the queue, failing as expected to get through Immigration and then re-joining the queue.) Me: 'now can I have a boarding pass please?' Them: 'the system is down. I can show it on the screen, but we can't print it.' Me: 'so what am I supposed to do?' Them: 'do you have a camera?' Me (puzzled): 'on my phone, yes.' They gestured for me to hand them my phone, then took the photo shown on the next page. Me (looking perplexed at the image): 'this will get me through Immigration?' They nodded.

  Amazingly enough it did.
  My only concern at that point was whether this arrangement was a major breach in International travel safety protocols. Honestly, I'm not sure I want to go back to find out.



Screenshots: the new passport control

The Depeche Mode Everything-Counts-In-Large-Amounts Literature Award – during what has to be described as a fairly average year in the world of business literature, there was neither much that counted as life-changing, nor anything that dipped far enough below the rank of 'dull' to merit winning an award for naff'ness (not like last year's veritable cornucopia of crap). Hence, we only have two candidates (let's save time and call them 'joint winners') for this year's award.

We dislike these books for two quite different reasons. The esteemed Mr Peters is probably the bigger (easier?) target. 'The Little Big Thing's' is a blatant attempt to demonstrate the fact that the sound-bite culture has now hit its nadir. If I'd needed to here Mr Peters telling me 'Show up (it's a start)' in the belief that he was sharing some kind of insight with me (as opposed to throat-clutchingly clichéd piece of fluff), I would've logged onto his Twitter feed rather than spending ten pounds on what it turns out is slightly more useful as a doorstop than a piece of management literature. Actually, if it were possible to re-direct the Award to Twitter, then he would've won the prize no contest – if you want to catch a flavor of just how low the mighty fall once their brain becomes overly-addled with monetary success you really should take a look at his profile. At least I think it's his. It's definitely got his picture on it. The words, though, seem to be coming from the mouth of a senile humourless bigot with absolutely nothing to say any more. How the mighty fall.

SYSTEM·ATIC INNOVAT·ION

Stefan Lindegaard on the other hand, gives no indication in his also humourless and slightly bigoted tome 'Open Innovation Revolution' that he ever had anything useful to say. To place this book in the category marked 'blatant bandwagon jumping' is an insult to all the other blatant bandwagon jumpers in and around the Open Innovation world right now. Like them, Lindegaard makes the cardinal mistake of assuming that someone, somewhere solving someone somewhere-else's problem is 'innovation'. Unlike them, Lindegaard takes matters a lot further by not even wanting to contemplate that anything is other than rosy in the OI garden. Talk about rose-tinted spectacles, anyone would've thought the book was written by the President of the Henry Chesborough fanclub. Oh, wait a minute…

The Necessity-Is-Not-Always-The-Mother Invention Award – the global financial crisis has, meanwhile, seemingly had little or no impact on the inventors of the world. If anything, the lone-inventor-in-garden-shed had a bumper year in 2010. We particularly enjoyed these offerings:

First up, pet-lover Rachel Addelman from Houston,Texas. Rachel has been concerned about other cats stealing food from her precious pet. Here's the answer:

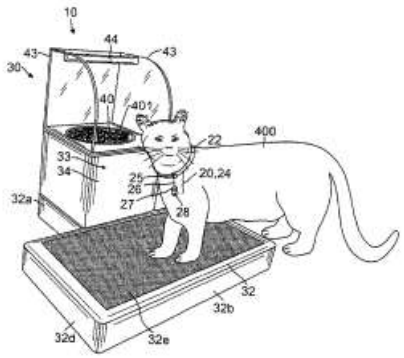
United States Patent **7,827,935**
Addleman **November 9, 2010**

Restricted access animal feeder utilizing vibratory means to deter access to food

Abstract

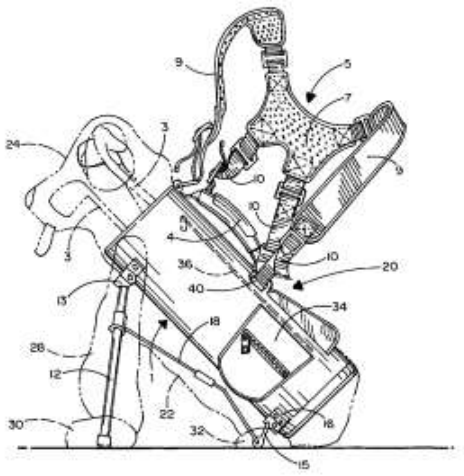
A restricted animal access feeder which includes the concept of having vibratory means and noise emitting means which will scare an animal away from eating food in a desired dish. The vibratory means and noise emitting means are generated by closing of a magnetic circuit so that the vibratory mechanism and noise activating mechanism is activated. An animal who is desired not to eat from a specific food dish will wear a specific magnetic collar that will close the activation circuit. An animal that does not have such collar will not close the activation circuit and therefore, will have access to the food. The invention also includes means to enable the magnet to detach from a magnetic object so that the animal will not be permanently attached to a magnetic object such as a refrigerator.

We granted extra points for the last sentence of the abstract, which perhaps drops the first hint that here is an idea that hasn't quite been thought all the way through yet. The second hint comes from the main picture:



How much are you willing to wager that the moggy in the picture is hers? As a fellow cat-lover, I sincerely hope the poor beast wasn't too traumatized after spending the day stuck to the refrigerator after trialling the first prototype.

Like pet-care, golf is always another rich hunting ground for inventing nutters. Although I'm not quite sure we were expecting this bizarre merging into the pet world:



In case you haven't quite understood the inventive step, you need to be looking at the object labeled '24'. Or maybe the text will help:

United States Patent **7,743,916**
Roberts, II **June 29, 2010**

Ornamental golf bag cover

Abstract

A removable golf bag cover having an ornamentally-pleasing shape (e.g., that of a dog or other animal) to surround a conventional golf bag without affecting the normal use of the bag during play. The golf bag cover includes legs extending from an elongated body of the cover which surround corresponding outstretched folding legs of the golf bag. A hollow head of the golf bag cover is pivotally coupled to the elongated body of the cover by a piece of flexible material that is adapted to stretch. The hollow head is rotatable from a closed position seated on top of the golf bag, at which to surround an protect the golf clubs carried within the bag, and an open position off the bag, at which to enable a golfer to gain access to his clubs. At least one golf club carried in the bag is received inwardly of and holds the hollow head in a generally erect condition relative to the elongated body of the cover.

Thanks, Peter Roberts of Los Angeles for that one. Not sure it has solved my father's 2011 Christmas present problem, but a valiant attempt nevertheless. Our 'Get Well Soon' card is in the post.

The One-Big-Happy-Family Generations Award – with close to 25% unemployment of people under the age of 25 in the UK, it isn't quite so easy to be critical of Generation Y this year. We almost had to give the award to the Baby Boomers. Mainly the ones working as attendants on US Airways. Or that's what we thought until we came across 26 year old 'personal branding guru', Dan Schwabel and his book: 'Me 2.0'. A veritable gospel of the completely-bleeding-obvious ('if you're unsure about your future, weigh all the factors that

matter to you and find the career path that fits best'. Thanks for that, Dan.) You just know you can rely on Generation Y to come up with the goods sooner or later. Here's hoping that Dan Schwabel 3.0 works out better.

The Slow-Fast-Moving-Consumer-Goods Design Excellence Award – unlike inventions, the GFC has had a somewhat stronger impact on new crappy products allowed to make it all the way to the shops. Slim pickings, then, in 2010. Top marks, however, have to be given to the following valiant attempts to create a non-Japanese version of Chindogu.

First up, the Krave 'e-Cigarette'. Even the girl in the poster doesn't seem to be sure what she's supposed to do with it. Just so long as you don't put it in your mouth.

Next up, the 'Phubby':

It's a phone caddy you know. Not sure why having my phone on my wrist is a good idea. Better than my ankle I suppose, but perhaps not as good as, say, my shirt pocket? Anyway, extra bonus points for welcoming wholesale enquiries. Hope everyone is forming an orderly queue…

..maybe the same queue that failed to form for the worst surprise you're ever going to get in a Dunkin' Donuts store. Here's the un-cunningly titled sausage pancake bite. Not so bad if you don't open it up to take a peek inside before you ingest. Very bad indeed if you do.

‘Sausage’ it turns out is another word for ‘spongy-week-old-horse-poop’. We’re lovin’ it…. Err, wasn’t that another chain? Apparently DD’s is ‘It’s worth the trip’. All we need to do now is work out whether that is more a reference to the drugs the DD chefs are quite evidently taking than to their customers.

Patent of the Month – Electrochemical Actuators

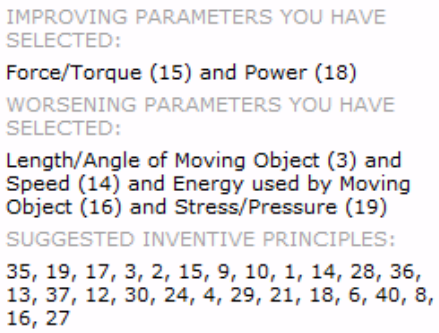
Our patent of the month this month goes to a trio of inventors at MIT for their work on electrochemical actuators, as described in US7,872,396, as granted on 18 January.

The background description of the invention gives a very succinct summary of the problem the inventors have been addressing:

"Actuation generally refers to a mechanism by which an object, or portion of an object, can be adjusted or moved by converting energy (e.g., electric energy, chemical energy, etc.) into mechanical energy. Actuators may be categorized by the manner in which energy is converted. For example, electrostatic actuators convert electrostatic forces into mechanical forces. Piezoelectric actuation provides high bandwidth and actuation authority but low strain (much less than 1% typically), and requires high actuation voltages. Shape memory alloys (SMAs), magnetostrictors, and the newly developed ferromagnetic shape-memory alloys (FSMAs) are capable of larger strain but produce slower responses, limiting their applicability. Actuation mechanisms that are based on field-induced domain motion (piezos, FSMAs) also tend to have low blocked stress. The above actuation methods are based on the use of active materials of high density (lead-based oxides, metal alloys), which negatively impacts weight-based figures of merit. Thus, there is a need for a technology capable of providing high actuation energy density, high actuation authority (stress), large free strain, and useful bandwidth.

Certain methods of actuation using electrochemistry have previously been described, wherein the load-bearing actuation materials are in gaseous or liquid phase and may be expected to have low elastic modulus and consequently low actuation energy density and actuation stress, compared to the approach of the present invention. Despite the observation of displacement, mechanical work has not been demonstrated. Accordingly, improved methods and devices are needed.

Put another way, different types of actuators give rise to different trade-offs – more of one attribute typically giving rise to less of another. Here's what some of the main trade-offs look like when mapped onto the Contradiction Matrix using 'mechanical work' as the main improving parameter – since, as the inventors describe, previous attempts at electrochemistry actuators have not achieved useful solutions in this area:



Well, with large numbers of conflicting attributes, it shouldn't be too big a surprise to learn that the Matrix presents many different possible solution directions. Here's what the inventors have actually done:

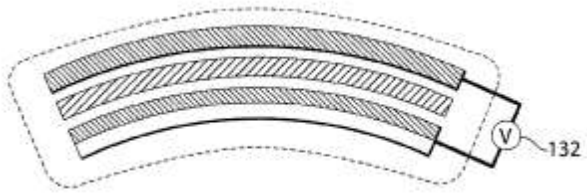
The present invention also relates to actuator systems constructed and arranged to be displaced from a first orientation to a second orientation comprising at least one electrochemical cell comprising a negative electrode and a positive electrode, wherein one or both of the negative and positive electrodes is an actuator, and comprises a first portion and a second portion, and wherein upon charge and/or discharge, a species is intercalated, de-intercalated, or alloys with the first portion to a different extent than the second portion, and experiences a resulting dimensional

change relative to the second portion, thereby imparting to the actuator a differential strain between the first and second portions causing a displacement of at least a portion of the actuator, which actuator displacement does mechanical work without the need to be coupled to a structure which does said work.

And here's one of the main intended applications for the invention:

The present invention also relates to infusion pumps comprising at least one electrochemical cell comprising a negative electrode, a positive electrode, and an intercalation species, wherein the negative and/or positive electrode undergoes a dimensional change upon charge and/or discharge so as to cause infusion of a fluid into a body.

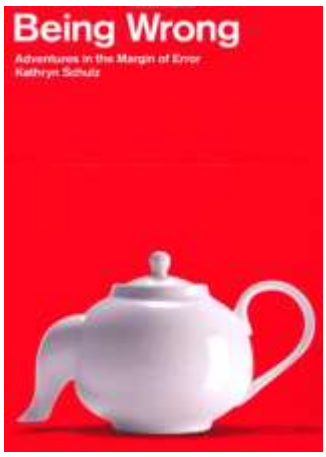
The present invention also relates to actuators constructed and arranged to be used in a physiological setting, the actuators comprising a first portion adjacent a second portion, wherein the first portion undergoes a dimensional change upon exposure to a bodily fluid comprising a species, and wherein resulting electrochemical intercalation of the species into the first portion, de-intercalation of the species from the first portion, or oxidation/reduction of the first portion as a result of contact with the species, imparts a dimensional change of the actuator.



Which, altogether, looks a lot like Principles 1 Segmentation; 37 Relative Change, 28 Mechanics Substitution, and 29 Fluidity from where I sit. Although, in these kinds of 'first of its kind' solutions – i.e. no-one has done an electrochemical actuator before – it is often not so much the resolution of a contradiction as the discovery of a new way of achieving the desired function that the invention rests upon. Either way, this very elegant solution seems to open up the potential for a host of other applications particularly in and around the medical devices sector.

Best of the Month – Being Wrong

Running to 339 pages of content and another 50 of notes at the end, the only real problem with our reading recommendation this month is its length. Not that you should let that put you off getting hold of a copy of Kathryn Schulz's extremely useful book, Being Wrong.

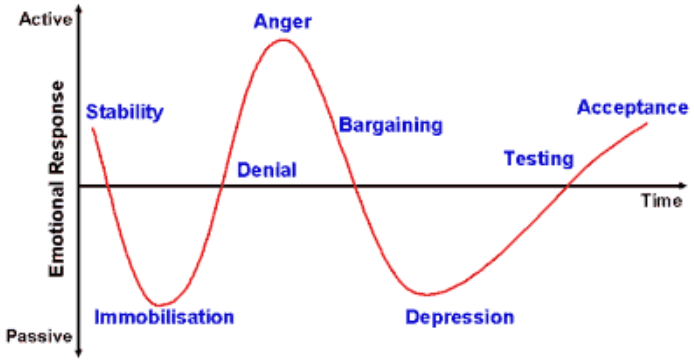


The primary hypothesis of the book is that Being Wrong is an inescapable part of being alive. And yet, we go through life tacitly assuming (or loudly insisting) that we are right about nearly everything - from our political beliefs to our private memories, from our grasp of scientific fact to the merits of our favourite team (not, of course, if like me, you support Bradford City). Being Wrong looks at why this conviction has such a powerful grip on us, what happens when this conviction is shaken, and how we interpret the moral, political and psychological significance of being wrong. Drawing on philosophies old and new and cutting-edge neuroscience, Kathryn Schulz offers an eloquent exploration of the allure of certainty and the necessity of fallibility in four main areas: in religion (when the end of the world fails to be nigh); in politics (where were those WMD?); in memory (where did I leave my keys?); and in love (when Mr or Miss Right becomes Mr or Miss Wrong).

The best reason for acquiring a copy of the book, however, is because of its links to creativity and the whole 'why is innovation so difficult' story: Both require us to challenge what we and others 'know' to be true, and therefore no wonder that there is a tendency for people to reject new ideas. For me, one of the most profound insights contained in the book is the connection between our emotional response to being wrong and the Kübler-Ross grief cycle.

Elizabeth Kübler-Ross was a doctor in Switzerland who, for many years, studied people with terminal illnesses and how they were often viewed as an embarrassment for doctors. Someone who could not be cured was evidence of the doctors' fallibility, and as a result the doctors regularly shunned the dying with the excuse that there was nothing more that could be done (and that there was plenty of other demand on the doctors' time). Kübler-Ross railed against this unkindness and spent a lot of time with dying people, both comforting and studying them. She wrote a book, called 'On Death and Dying' which included a cycle of emotional states that is often referred to (but not exclusively called) the Grief Cycle:

In later years, it has been observed that this emotional cycle was not exclusive just to the terminally ill, but also other people who were affected by bad news, such as losing their jobs or otherwise being negatively affected by change. The important factor is not that the change is good or bad, but that they *perceive* it as a significantly negative event.

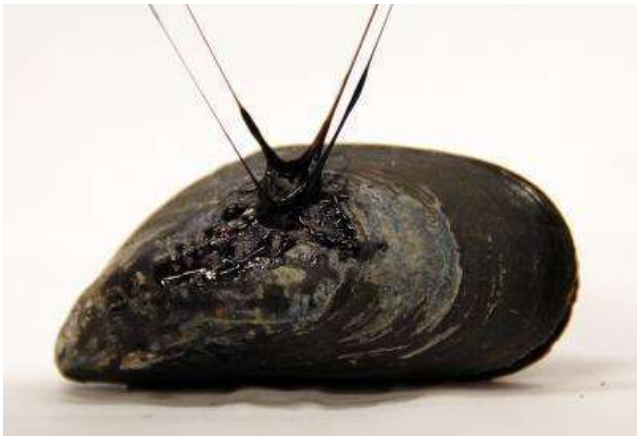


Schulz's insight is that we experience a very similar version of the Grief Cycle even for something as apparently trivial as getting a general knowledge question wrong when we're watching quiz shows on TV and *sure* we're right. The key learning here is that convincing anyone about your new idea is inevitably going to put them through one of these cycles. And, that being the case, there are certain things you should prepare for in order to smooth the road as much as possible.

Most people, Schulz convincingly argues, are of the belief that being wrong is a really bad (shameful, embarrassing, etc) thing to be avoided at all costs. Rather we love and crave for what she calls 'the allure of certainty'. The most creative individuals, on the other hand, are the ones that are successfully able to realise that accepting our wrong-ness about something is pretty fundamental to our ability to make progress.

All in all, then, I humbly suggest this is a really important book well worth your close attention. As in most books these days, many of the individual elements and thoughts it contains can be found elsewhere. We shouldn't let that detract from Kathryn Schulz's efforts though since, according to me, this is a book that manages to present a coherent big-picture view of the subject for the first time. A definite must-read for anyone that has any kind of responsibility or interest in convincing others about the merits of their breakthrough new ideas.

Investments – Self-Healing Gels



Scientists can now manufacture a synthetic version of the self-healing sticky substance that mussels use to anchor themselves to rocks in pounding ocean surf and surging tidal basins. A patent is pending on the substance, whose potential applications include use as an adhesive or coating for underwater machinery or in biomedical settings as a surgical adhesive or bonding agent for implants.

Inspiring the invention were the hair-thin holdfast fibers that mussels secrete to stick against rocks in lakes, rivers and oceans. "Everything amazingly just self-assembles underwater in a matter of minutes, which is a process that's still not understood that well," said Niels Holten-Andersen, a postdoctoral scholar with chemistry professor Ka Yee Lee at the University of Chicago.

Holten-Andersen, Lee and an international team of colleagues recently published the details of their invention in the *Proceedings of the National Academy of Sciences*. Holten-Andersen views the evolution of life on Earth as a " beautiful, amazingly huge experiment" in which natural selection has enabled organisms to evolve an optimal use of materials over many millions of years.

"The mussels that live right on the coast where the waves really come crashing in have had to adapt to that environment and build their materials accordingly," he said.
Many existing synthetic coatings involve a compromise between strength and brittleness. Those coatings rely on permanent covalent bonds, a common type of chemical bond that is held together by two atoms that share two or more electrons. The bonds of the mussel-inspired material, however, are linked via metals and exhibit both strength and reversibility.

"These metal bonds are stable, yet if they break, they automatically self-heal without adding any extra energy to the system," Holten-Andersen said.

A key ingredient of the material is a polymer, which consists of long chains of molecules, synthesized by co-author Phillip Messersmith of Northwestern University. When mixed with metal salts at low pH, the polymer appears as a green solution. But the solution immediately transforms into a gel when mixed with sodium hydroxide to change the pH from high acidity to high alkalinity.

"Instead of it being this green solution, it turned into this red, self-healing sticky gel that you can play with, kind of like Silly Putty," he said. Holten-Andersen and his colleagues found that the gel could repair tears within minutes.

"You can change the property of the system by dialing in a pH," said Ka Yee Lee, a professor in chemistry at UChicago and co-author of the paper. The type of metal ion (an electrically charged atom of, for example. iron, titanium or aluminum) added to the mix provides yet another knob for tuning the material's properties, even at the same pH. "You can tune the stiffness, the strength of the material, by now having two knobs. The question is, what other knobs are out there?" Lee said.

The study reports the most recent in a series of advances related to sticky mussel fibers that various research collaborations have posted in recent years. A 2006 *PNAS* paper by Haeshin Lee, now of the Korea Advanced Institute of Technology, Northwestern's Phillip Messersmith and UChicago's Norbert Scherer demonstrated an elusive but previously suspected fact. Using atomic-force microscopy, they established that an unusual amino acid called "dopa" was indeed the key ingredient in the adhesive protein mussels use to adhere to rocky surfaces.

Last year in the journal *Science*, scientists at Germany's Max Planck Institute documented still more details about mussel-fiber chemical bonds. The Max Planck collaboration included Holten-Andersen and Herbert Waite of the University of California, Santa Barbara. Holten-Andersen began researching the hardness and composition of mussel coatings as a graduate student in Waite's laboratory.

"Our aspiration is to learn some new design principles from nature that we haven't yet actually been using in man-made materials that we can then apply to make man-made materials even better," he said.

Being able to manufacture green materials is another advantage of drawing inspiration from nature. "A lot of our traditional materials are hard to get rid of once we're done with them, whereas nature's materials are obviously made in a way that's environmentally friendly," Holten-Andersen said.

Citation: "pH-induced metal-ligand cross-links inspired by mussel yield self-healing polymer networks with near-covalent elastic moduli," by Niels Holten-Andersen, Matthew J. Harrington, Henrik Birkedal, Bruce P. Lee, Phillip B. Messersmith, Ka Yee C. Lee, and J. Herbert Waite, *Proceedings of the National Academy of Sciences* Early Edition, Jan. 24, 2011.

Generational Cycles – Ear Plugs

A fairly rare occurrence for me, but a pretty, smiling, (semi-drunk), Generation Y female sidled up to me at a recent gig. Very nice it was too. Until she started berating me for not wearing earplugs. Didn't I know how dangerous it was, she said, didn't I know how loud the music was going to be? (Yes – it was The Cult!)

Purely in the interests of scientific research, I have found myself, since the incident, subtly peering into people's ears at gigs in order to see if there are any ear-plug related patterns. Well, half a dozen gigs later, I am happy to report my findings. And they are as follows: Generation Y concert-goers are approximately 4 times more likely to be wearing ear plugs than members of Generation X. Not that I go to many gigs where there are lots of Boomers in attendance, but where they too have been present, Boomers are approximately 2 times more likely to be wearing plugs than Generation X.

So what is this trying to tell us?
First up, the high proportion of Generation Y ear-plug wearers was somewhat surprising. Here is a generation currently (certainly when it comes to those old enough to attend gigs) in the 'heroic' stage of their lives. Somehow the words 'heroic' and 'earplugs' don't seem desperately connected to one another – surely a heroic gig go-er would be the one sticking their heads in the bass bins at a Motorhead concert?

Except, no, because here is a generation that has most likely been told by their protective parents that loud music is dangerous and to be avoided at all costs if you want to live a long, sound-filled, life. Or maybe it's just that they notice their parent increasingly asking them 'sorry, could you say that again only a bit louder?' For their parents were the Alienated youth who were never informed by their (narcissistic, self-absorbed) parents that listening to loud music was a bad thing. And even if they were, being Alienated you tended to ignore any such parental advice in any event. 'Don't stick your head in Lemmy's bass-bin' being a sure-fire way of getting everyone you knew to stick their heads in the great man's speaker stack. And keep it there.

Now largely evolved from Alienated to Pragmatic, Generation X'ers still going to gigs (a large number given that, generally speaking, many of us never really grew up) tend to think that, 'well if I've been going to gigs for the last 20 years with no problems, I don't think there's any point starting to wear ear plugs now'. And even if they do have problems (pardon?), it's just not in the spirit of things to withhold from the pleasures of 130dB of Rickenbacker bass noise whistling past your head.

SYSTEM·ATIC INNOVAT·ION

So much for explaining the Generation X versus Y ear plug mis-match, what about the Boomers being twice as likely as X'ers to wear the stupid sound blockers? Surely they've been to as many gigs? Hell, they even invented loud music at gigs. Nope, the problem for the Boomers right now is their desire to be Immortal. Sure their health is fading, but sure too they are still going to head to even the skuzziest venue to see a cool gig if they get a chance. Immortality means preserving what few faculties you still have working. They may not be as deaf as Pete Townshend (he has the excuse of standing in front of Keith Moon's drum-kit for nearly 20 years), but no way they're potentially going to risk a problem anytime in their no-doubt, next 40 years of gig-going either.

And so everything becomes crystal clear:

Generation Y wear ear-plugs because their protective parents told them to.
Generation X don't wear ear-plugs because only wimp-y Boomers and even wimpier Generation Y wear ear-plugs.
Boomers wear ear-plugs because they didn't die before they got old, per Pete Townshend's 1964 plea.

Simple when you know how.
Hello? Hello? Is anybody there?

Biology – Pistol Shrimp

Pistol shrimps (*Alpheus heterochaelis*) normally live in the sub-tropics. Thanks to global warming, they are increasingly being found – or should that be 'heard' in British waters. 'Heard' because the creatures can emit an astonishing 218 decibels – louder than a gunshot. The feat is made even more impressive by the fact that the shrimp is less than an inch long. The incredible noise, which is created by snapping their claws together, is used to stun their prey. The sound stunning small fish and crabs, allowing the shrimp to move in for the kill.

The creatures, also known as snapping shrimps, are native to the warmer waters of the Mediterranean and have only been found swimming off the coast of Britain a handful of times this century. A pair were discovered in 2008 near the mouth of the Helford River in Cornwall. They were brought to the Blue Reef Aquarium in Newquay, where staff were forced to separate them to stop them stunning each other. Curator Matt Slater, who collected the creatures from Mr Bailey, said: 'Only a handful of this type of shrimp have ever been recorded in UK waters, although their numbers do appear to be on the rise. 'I started to think they were something special while I was driving back from Falmouth. 'I kept on hearing this cracking. It wasn't until we unloaded the bucket that I realised the sound was coming from the shrimps snapping their claws together.'

'The noise is very instantaneous. It's not like a shotgun blast. It lasts literally a fraction of a second, but it's enough to stun the prey they're after.' Douglas Herdson, the information officer at the National Marine Aquarium in Plymouth, said that the creatures are so loud that they can be heard by sailors: 'I have heard of yachtsmen being moored in a bay and not being able to sleep because of the noise these shrimps make,' he said.

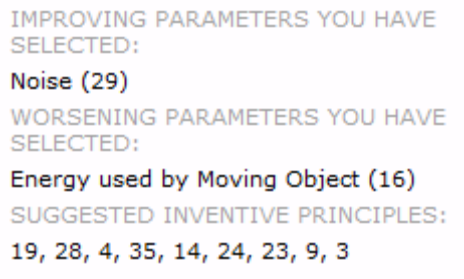
There are around 600 species of pistol shrimp worldwide. Most dig burrows and feed off small crabs and fish.

The pistol shrimp produces its loud snapping sound by an extremely rapid closure of its snapper claw. It was commonly believed that the sound is generated when the two claw surfaces hit each other. In fact the sound originates from the collapse of a cavitation bubble. During the rapid snapper claw closure a high-velocity water jet is emitted from the claw with a speed exceeding cavitation conditions. Hydrophone measurements in conjunction with time-controlled high-speed imaging of claw closure demonstrate that the sound is emitted at the cavitation bubble collapse. A model for the bubble dynamics based

on a Rayleigh-Plesset type equation quantitatively accounts for the time dependence of the bubble radius and for the emitted sound. Interested readers can find out more in the 22 September 2000 issue of Science.

Close inspection further reveals that a short, intense flash of light is emitted as the bubble collapses, indicating that extreme pressures and temperatures of at least 5,000K must exist inside the bubble at the point of collapse. We have dubbed this phenomenon 'shrimpo-luminescence' — the first observation, to our knowledge, of this mode of light production in any animal — because of its apparent similarity to sono-luminescence, the light emission from a bubble periodically driven by ultrasound. Interested readers can find out more about this phenomenon in the 4 October 2001 issue of Nature.

From a contradiction perspective, the pistol shrimp challenge is to make its suitably shocking noise with the minimum use of energy. Here's how human engineers have typically sought to resolve similar conflicts:



Both of the two most likely Principles used by humans appear to connect strongly with the shrimp's strategy:

1) Use a high-velocity impulse (19 – Periodic Action), and even better,
2) Don't use the mechanical snapping of claws, but rather introduce a field… in this case a collapsing cavitation bubble….

…all in all a really rather remarkable use of existing resources. For human engineers, cavitation is often viewed as a harmful thing. A bit like resonance. What the pistol shrimp reminds us is that 'even the bad stuff is good stuff'. Cavitation can do bad things, but it can also help catch lunch.

Short Thort

"Any discrimination,
like sharp turns in a road,
becomes critical because of the tremendous speed
at which we are traveling into the high-tech world
of a service economy."
Clarence Thomas

News

TrenDNA China
The Chinese edition of the TrenDNA book is approaching completion and is expected to be published in time for the Systematic Innovation conference in Shanghai at the end of May.

Public Workshops
Thanks to a recent upsurge in demand, starting from April we will be running monthly public SI, Bullet-Proof Patents and Whispered Voices workshops in different parts of the UK. See the Experience page on the website for details.

TRIZCON
Assuming we can make the dates work (the conference is 'in April' but we still don't know precisely when), we will be presenting the TRIZ/FDM paper we didn't get to present at last year's US TRIZCON event. What we know so far is that the conference will take place in Houston, and we have a pair of client engagements also happening at around the same time. Fingers-crossed… a) that we can go, b) that anyone else is able to turn up, given that April is now less than 8 weeks away.

TRIZCON India
Somewhat more reliable (well, they've only done one so far), the second TRIZCON in India will be taking place in Bangalore at the end of July. We missed it last year; hopefully this year we'll manage to turn up in person and present something.

New PhD

We are looking to set up a new PhD programme with our friends at Plymouth University. This time the focus will be on music composition and specifically determining whether it is possible to create anything other than muzak by instructing a computer to compose. Our musician friends are already horrified that we might be 'taking the magic out of making music'; close relatives are hoping that it will mean Darrell stops playing guitar (badly); likely participants are hoping that rather than removing the magic, we merely reveal the next level of magic beyond the current layer of mystery. Oh, and maybe re-invent the somewhat embittered music industry in the process. Aim high, right? Anyone who might potentially be interested in joining the research team is invited to get in touch with Darrell in the first instance.

New Projects

This month's new projects from around the Network:

FMCG – Eyes on the World Study
Medical devices – NPD definition study & consumer insight
Entertainment – Invent-to-order software solution
Automotive – Next generation product development opportunity finding workshops
Financial Services – Consumer insight/product concept design
Consumer electronics – ApolloSigma IP analysis
Mining – Innovation dashboard
Government – innovation strategy workshops