Systematic Innovation

e-zine

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In this month's issue:

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

A Real-World Market Opportunity Landscape

In recent times we've had occasion to work with a number of clients that, independently, had done some work with Outcome Driven Innovation (ODI). Sad to say, in each case, the outcome of the activities didn't really result in any innovation. Especially sad in that in each case the level of investment required in order to work through the ODI process was quite significant. Something that is pretty much inevitable when a process that demands lots of customer interview time is taking place.

We decided to explore why so much investment of time and money had resulted in so little tangible outcome. And, from there, what we might do to rectify the situation.

One of the first and most obvious clues is the fact that ODI requires going to talk to customers. And we know that in the vast majority of cases, when we ask customers we tend to come back to the office with the wrong answers: customers predominantly can't describe step-change needs; they tend to gift or game the interviewer (i.e. either give them what they think they want to hear, or deliberately set out to distort the answer); or, worst of all, they are very reluctant to share the 'real' reasons why the do or don't like the thing you're trying to get them to evaluate.

One of the main outputs of an ODI customer interview process is what they call a market opportunity landscape – Figure 1. Essentially what that landscape is intended to describe is the level of satisfaction and importance of different attributes of whatever is being evaluated.

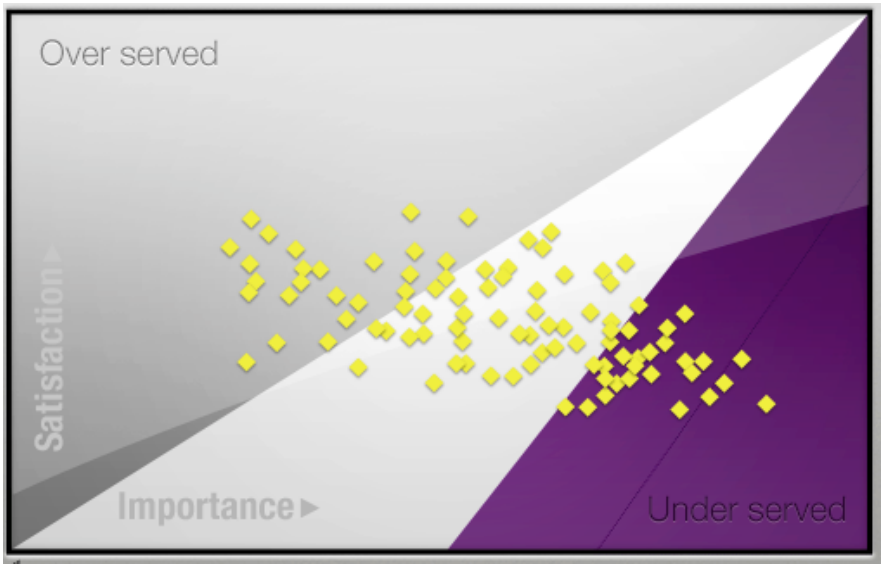


Figure 1: ODI Market Opportunity Landscape

The snapshot-view aim of the completed picture is to provide a perspective on whether something is under- or over-serving customer needs. In the Figure 1 picture, for example, the large cluster of highly important, but low satisfaction ranked attributes tells us that this market is generally underserved… the remedy for which would involve taking some of the most important, least satisfied points on the map and putting in place projects to derive potential solutions.

Now, again in theory, there is no reason why the yellow dots can't include intangible attributes of a system as well as the more obvious tangible ones. We could, should we so choose, ask customers about how cool they think our product or service is, or how much peace of mind it delivers to them, but the likelihood that we'll come back with anything meaningful from such an interview is quite another matter.

That's why we built the Outcome Map tool (Figure 2) and offer clients the suggestion that you don't actually need to go and talk directly to any customer in order to be able to fill out the 4 segments of the template.

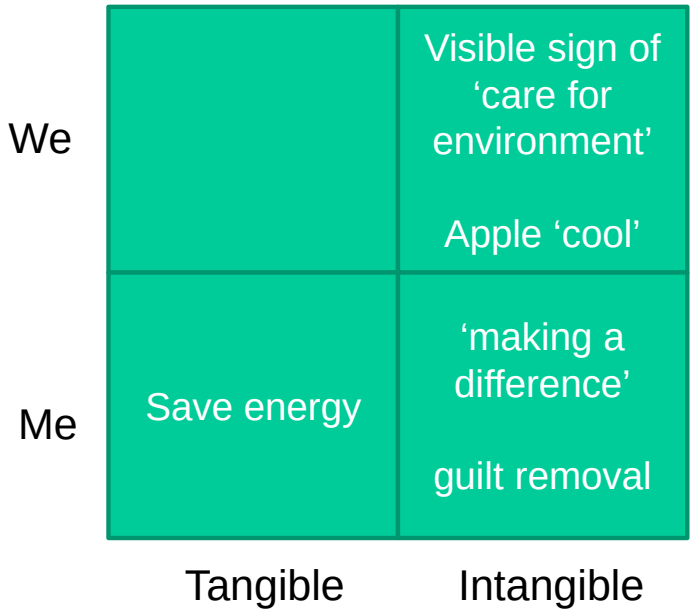


Figure 2: Outcome Map Template

A completed version of this template – plotting what outcomes customers already receive and which ones we think are 'missing' – represents what we consider to be a pretty good start in terms of knowing what the innovation opportunities in a given domain are. The main thing we don't know at this stage in fact is the relative importance of the various things we've written into each of the boxes.

One of the things we can do to rectify this shortcoming in a meaningful sense is to run a PanSensic analysis of customer narrative. What PanSensic is trying to do is 'read between the lines' and allow us to capture the 'real', behavior-drivers to a level that then allows us to rank the various tangible and intangible outcome needs.

However, before we get to that stage, we believe it's possible to apply the same basic logic that allows us to complete the Outcome Map without ever directly asking customers. The very fact that we've been able to identify 'currently missing' outcomes should give us a clue: Humans are, deep down, driven by some fairly limited universal needs after all. By definition any of these missing outcomes are 'under-served' in ODI terms. So maybe, we can also start to think about the outcomes that *are* already present and think about the over-served/under-served question in relation to each of them. In other words, if we set about thinking about each attribute and ask the question 'do we think we are under- or over-serving the customers for this attribute, generally speaking we can empathise sufficiently with our customers to be able to make some kind of estimate.

We can make the job somewhat easier for ourselves if we find a better way of drawing the market opportunity landscape. We suggest that such a way is illustrated in Figure 3:

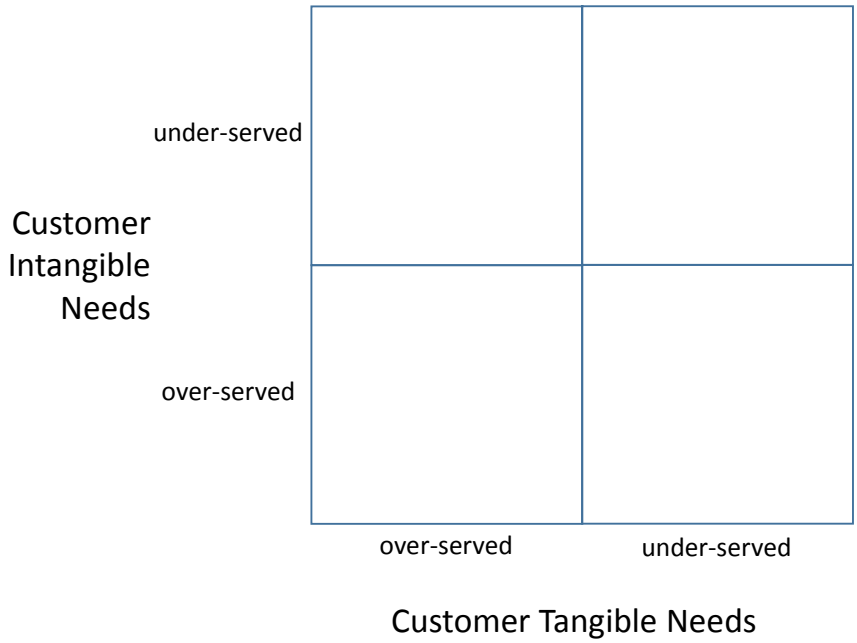


Figure 3: Real Market Opportunity Landscape

We've kept the basic concept of a 2x2 matrix here to emphasise that we don't really need to be accurate to several decimal places when we try and populate the Landscape. What's important is knowing which segment we're in. The general idea being that, per standard 2x2 Matrix convention, knowing which box we're in gives us a pretty good indication of what type of strategy is required in order to innovate from where we are today. Figure 4 illustrates the strategies suggested by each of the four segments:

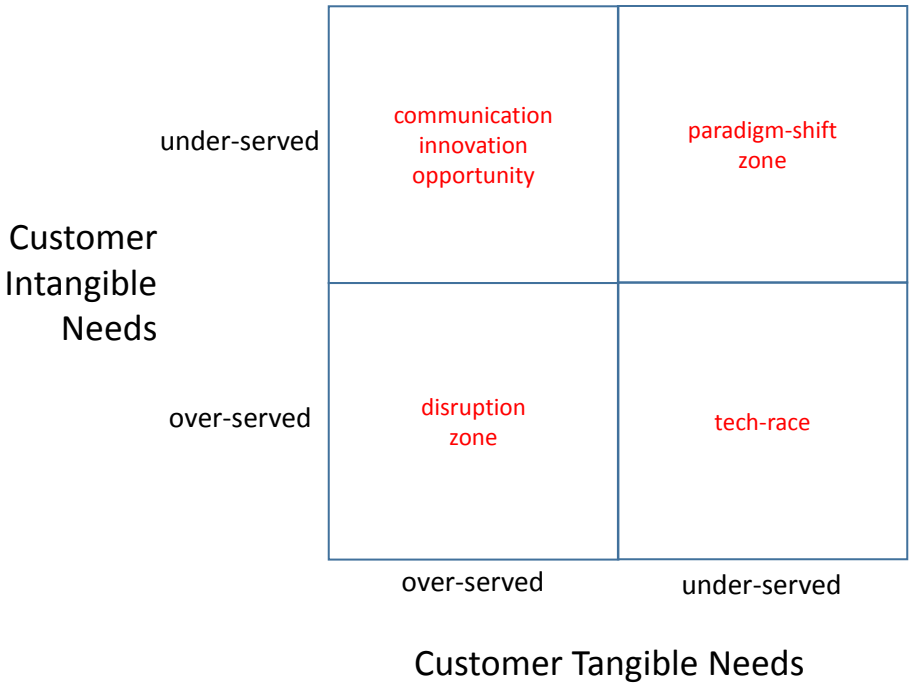


Figure 4: Real Market Opportunity Landscape Innovation Strategy Domains

Thus, taking each segment in turn:
If customer tangible and intangible needs are both over-served (bottom left segment), the most likely innovation opportunity is one of disruption. That's 'disruption' in the sense of the word used by Clayton Christensen and his work in the 'Innovator's Dilemma': what the

market is looking for in this scenario is a cheaper, simpler ‘inferior’ alternative. An enterprise that finds themselves sitting in this box, thus needs to keep a very clear eye on outsiders with the wherewithal to start chipping away at their low-end customers. Or, if they’re really smart, start to think about disrupting themselves.

If the tangible needs of the customer are over-served, but the intangible needs are under-served, the real innovation opportunity is about tapping in to some of those intangibles. This may well mean that the innovation needs to be about the way in which the product or service is presented to the customer rather than any kind of actual change to the thing itself. As such, one of the nice things about finding yourself in this top left segment of the Landscape is that the cost of innovating can be very low. The challenge that goes with that – one that is currently troubling a lot of organisations – is that mere mention of the work ‘intangibles’ tends to provoke worries about being un-scientific, unmanageable and generally fuzzy. i.e. it tends to be organisations that have very scientifically understood and captured all of the *tangible* needs of their customers. Usually in a highly quantifiable manner. Suddenly starting to talk about capturing customer narrative and qualitative research to organisations in this segment can, from personal experience, create a frightening culture shock.

A slightly more comfortable place for these types of organisation to be is the bottom right segment of the Landscape, the place where intangible needs have been over-served, but tangible needs are still largely underserved. This is what we call the ‘tech race’ segment: the innovation opportunity here is all about better serving all those clear, quantifiable and very tangible needs that haven’t yet been mastered.

Finally, there is the top right segment of the picture, the place where both tangible and intangible needs are presently being under-served. We’ve labelled this the ‘paradigm-shift zone’ because the fact that the customer is ‘unhappy’ on both tangible and intangible grounds most likely means the organisation (or industry) has chosen a means of meeting the basic outcome needs of the customer that is not the right one. The vulnerability here is not so much from a ‘disruptor’ in the Christensen sense, but rather the pioneer that comes along with a far more effective way of doing things.

So much for the basic model. Let’s now start populating it with one or two examples of organisations and industries in order to explore what it might mean in terms of where we might best look to innovate in those industries in the coming months and years. Figure 5 plots a few examples representing each of the four different segments. Rather than try to accurately position any individual company along each of the two axes, we’ve merely tried to judge them relative to one another. More formally, we’ve more recently been using the automotive industry as one that sits fairly close to the cross-hairs at the middle of the picture – i.e. an industry that, in the West at least, has reached a point where the tangible and intangible needs of their end consumer are both at some kind of threshold level. This position might change in the future (indeed, if we considered just Generation Y car consumers, we might shift the position of the industry across a little bit into the ‘Tech Race’ category in light of their IT communication demands and how they’re generally not yet met within the four walls of today’s cars).

(Note: this should also remind us that the Real Market Landscape template should also be something we can use to plot shifts over time. Apple, for example, if we average out all of the attributes of all of its products to produce a single point on the Landscape, we think currently sits in the Disruption Zone. Five years ago, the markets they were serving sat largely in the 'Communication Innovation Opportunity’ zone – i.e. a large part of the past

success of Apple was that they were the first to really tap into the intangibles in their target markets. What happens now they've started to over-serve both tangible and intangible needs will be interesting to watch. Particularly from the perspective of disruptive innovators. See, for example, how recent Samsung advertisements have started to literally mock the ridiculousness of some of the emotional drivers being pushed by Apple.)

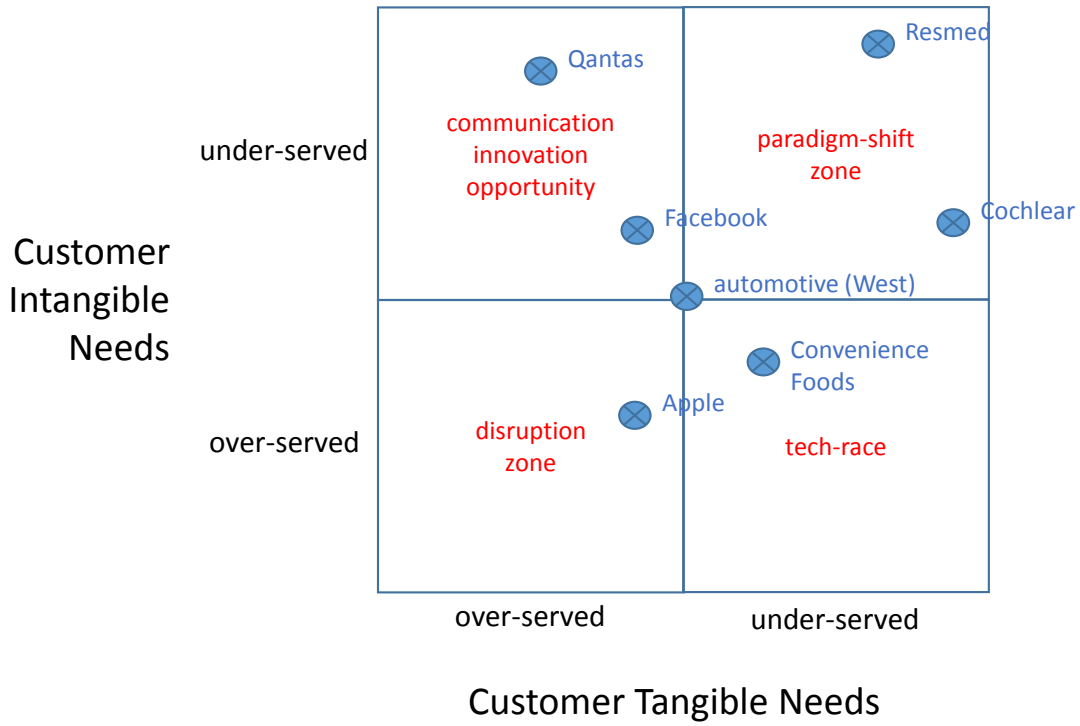


Figure 5: Populated Real Market Opportunity Landscape

Let's have a look at some of the other segments:

Convenience foods – for a long time now the primary focus of many parts of the FMCG sector appears to have been on tapping in to the unmet emotional needs of the consumer. To a large extent, we think many of these needs are now being over-served. Adding an egg to a cake-mix has fooled us into thinking we're contributing to the baking process, but the cake still tastes pretty artificial. In other words, some of the tangible needs have been left under-served. As such the innovation opportunity – as may be seen in the emergence of 'real-food', no-sugar and organic food innovations – is to better meet the tangible needs of the human digestive system.

Up in the top left corner, we've put Qantas. We could pretty much have put any airline in about the same place: the commercial airline sector generally speaking does a pretty good job of meeting our tangible traveler needs (ultra-safe, on-time, low-cost), but an awful job of meeting our emotional needs. If you ever want to go and surround yourself with grumpy, stressed and officious people, simply take a trip to your local airport. About a decade ago, a consultant to British Airways suggested renaming their Business Class service as 'Bitter Class'. Nothing has become any better since that suggestion.

We've also put Facebook (we could have widened it to most social media services in fairness to Mr Zuckerberg) in this category. We think again there is a significant innovation opportunity for social media services that better serve the intangible needs of users. Most likely in relation to the dawning of just how much privacy is being taken from us without our tacit agreement.

Finally, in the top right segment we've placed a pair of Australian medical-device producers. Again, in fairness to both Resmed and Cochlear, we could have broadened the description to cover most parts of the healthcare industry. An industry that, in no small part due to increased patient expectations, manages to under-serve patients in both tangible and intangible needs. We've picked out Resmed and Cochlear because they sit in different parts of the segment: Cochlear, for those that don't know, are the global pioneers of cochlear implants, an amazing technology that helps to provide hearing to the profoundly deaf. The main problem with the cochlear implant industry right now is that because the technology is expensive and requires a lot of skilled audiologists to help recipients learn how to use the system, only a tiny, tiny proportion of deaf people on the planet have access to the solution. Hence we place the sector far to the right of the Landscape.

Resmed, on the other hand, and again in fairness to them, we could also have drawn the dot where we did for any other player in the business of providing solutions to the sleep apnea condition, we think sits right at the top of the Landscape – i.e. the idea of solving apnea by making people sleep for the rest of their lives with a pressurized mask and a pump by the side of their bed is both a crude tangible solution, but also massively misses the emotional needs of the patient. When you read on public patient forums that users of the mask decide, after persevering for several months, that they'd rather die than continue using the mask, you know there is something not right with the industry.

Both Resmed and Cochlear – and nearly all other medical device providers – we think are very vulnerable to paradigm-shifting solutions to the problems they offer to patients. Traditionally, part of the challenge here has been the conservatism and high degree of regulation of the medical devices industry. The reason for mentioning that fact is that the 'paradigm shift' that eventually does allow patient needs to be properly served could be a technological one, but it could also be a regulatory one.

Details of the specific examples aside, hopefully what the new Landscape model allows us to do for the first time is to start to put a language and therefore a capability to provide meaningful advice to organisations that might find themselves in any of the possible under/over served tangible/intangible scenarios. At this point in time the Landscape is a crude 2x2 matrix, but already we can see that it will eventually be coupled with other tools and protocols to add whatever sophistication (PanSensics, time trends, a third dimension looking at other parameters, etc) users might come to demand. In the meantime, being strong believers in the Pareto Principle and '80% of the benefit for 20% of the effort', we hope that readers will think about taking a few moments to plot their own organisations and industries onto the landscape. We'll be returning to the Landscape picture again in a future article examining its impact on Enterprise Resilience and resilience-building strategies.

The Sick Switch

There's an old cartoon image, several years old now, that purports to describe the differences between men and women.

Figure 1: Men & Women

Although undoubtedly accurate on a number of different levels (☺), the picture tends to underplay the number of toggle switches present on both the top and bottom parts of the picture. We all have a bunch of dials – things that enable us to control different levels of our physiological and emotions incrementally so that we can, for example, increase heart rate, decrease frustration, etc. The difference between a dial and a toggle switch is that the dial allows us to make smooth, continuous transitions, whereas a toggle switch creates a discontinuous, step-change shift once flicked. It is these toggle switches that are the most significant when it comes to understanding how people behave, because they create corresponding discontinuous changes in our perceptions and behaviours. And, in TRIZ/SI-land, 'discontinuities' equates to 'contradictions'. Which in turn equates to innovation opportunities.

The easiest way to imagine what these toggle switches feel like, think back to the last time you had flu or a cold. Or rather, think back to the time, you first started to experience the early-warning sign symptoms; the tickle at the back of the throat, the start of a headache. You're not sure whether you've got a cold, and maybe – maybe – if you're lucky your body will do what it's supposed to do and fight off the germs. But the symptoms get a little bit worse, and then worse again. Until – ping – there is a moment, often quite literally a moment, where you realize, damnit, I've got a cold. That's the moment you flicked your brain's 'sick switch'.

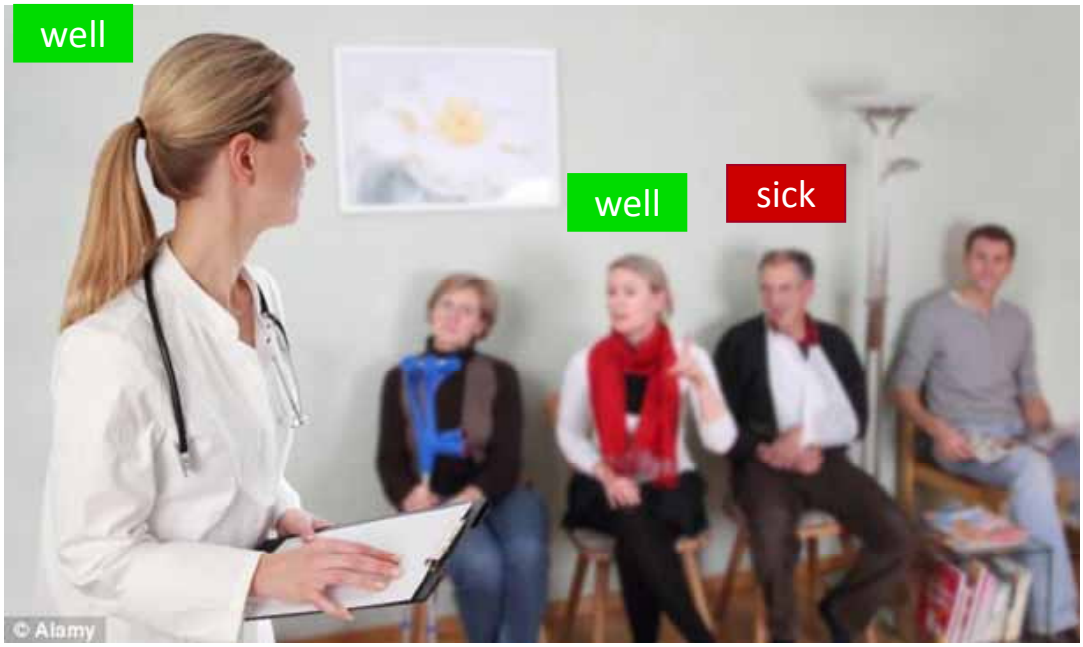
A discontinuous mental shift just took place: a second ago you were ‘well’ and fighting off the emerging symptoms; now you know you’ve lost the battle and the cold has arrived.

Take the scenario a step or two further now and think about what happens now that sick switch has been flicked. Your world is discontinuously different to what it was a few moments ago. Suddenly you are allowed to ignore your long list of things to do, you don’t have to stay dressed, you don’t have to be polite to people, you’re allowed to disappear off and curl up by yourself in a darkened room, you don’t have to answer the phone or check your emails. Your number one job now is to let the cold takes its course and get the switch flicked back to ‘well’ again… a moment, usually 2 or 3 days later, which also feels like a discontinuous shift again: one moment you were ill; now you’re well again.

If nothing else, what that toggled ‘sick switch’ has done is shifted you several gears down the Spiral Dynamic scale. Your pain-avoiding and pleasure-seeking motivations have shifted, and quite literally you’re a different person, with a whole different set of motivations to the ‘real’ you.

In contradiction terms, our ‘sick switch’ creates a whole series of innovation opportunities: how best to advertise cold cures to someone who has flicked their switch versus someone who has not? How to design a medical advice website for a person that is ‘sick’ and the person who’s looking after them who is ‘well’? Or how about this one. We were recently doing some work for the Accident and Emergency ward of a UK hospital that was experiencing a very high number of complaints, and were asked to help them design solutions to the problem. Right at the heart of the problem as it turned out was the finding that complaints generally arrived in to the hospital from one of two sources:

1) The patient writing up their complaint after they had flicked their ‘sick switch’ back to ‘well’ again, or
2) A ‘well’ person accompanying the ‘sick’ person into A&E:



How to deal with this situation? Paradoxically, the main answer appears to be to design the appearance, reception and waiting areas of A&E with ‘well’ people in mind, rather than ‘sick’ people. Because the complaints come from ‘well’ people.

The overall point here is that our sick/well toggle switch is just one of a whole series of discontinuous-shift triggering switches in our brains – Figure 2 highlights a few of the more common ones – each one of which has the potential to generate a series of contradictions and therefore an equivalent series of wonderful innovation opportunities.

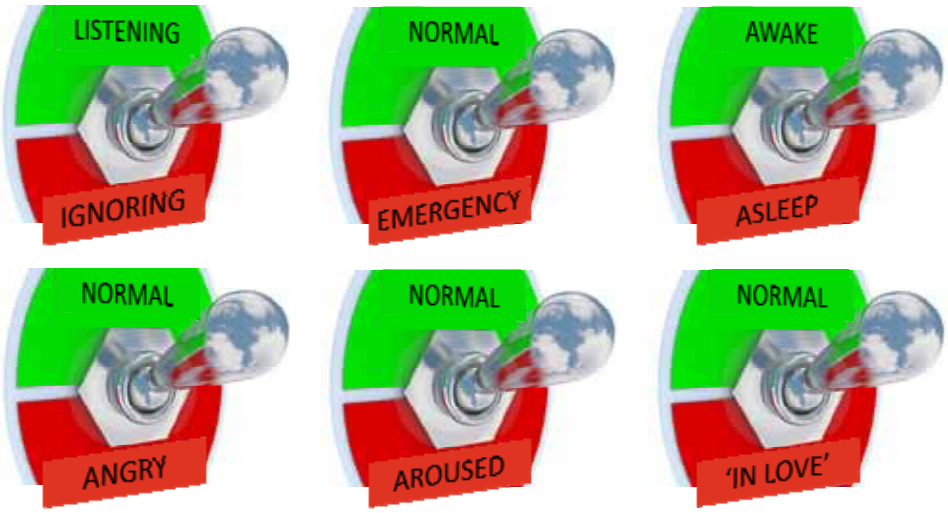


Figure 2: A Selection Of Human Emotion Toggle Switches

Consider the challenge switch flicked….

Not So Funny – Pet Contradictions

Problem: I'm bored with my pet.
What stops me solving this problem: the stupid animal only plays with rubbish toys
How have others solved this problem?

IMPROVING PARAMETERS YOU HAVE SELECTED:

Negative Intangibles (48)

WORSENING PARAMETERS YOU HAVE SELECTED:

Trainability/Operability/Controllability (34)

SUGGESTED INVENTIVE PRINCIPLES:

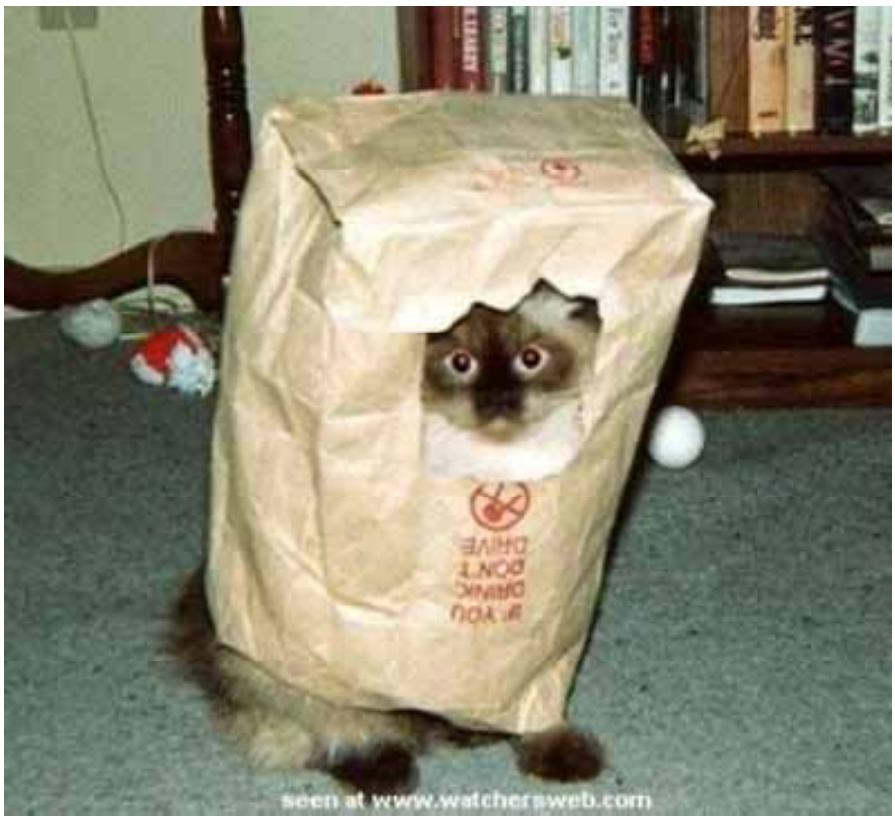
10, 26, 15, 13, 37, 23

Solutions:

SYSTEM ·ATIC INNOVAT· ION

Of course the ultimate answer, as any cat owner will tell you comes from Principle 30. Which isn't even recommended by the Matrix. Now who's the smart one?

Insert gratuitous cute cat in paper bag picture here.



Patent of the Month – Acoustic Deterrence

Patent of the month this month takes us to the University of St Andrews in Scotland. US8,665,670 was granted to a pair of inventors at the University on the 4th of March. Here's what the background description to the invention tells us:

This application relates to acoustic deterrence and, in particular, to an acoustic deterrent device and methods for deterring mammals, most particularly but not exclusively marine mammals.

Worldwide, farming of marine and diadromous finfish species has experienced tremendous growth rates, showing a ten fold increase over the last three decades. This increase in potential food resources presented in a marine environment has brought about increased interactions with predatory species. One common group of predators is marine mammals who exploit food resources depending on their profitability and potential costs, which include dive depths as a major factor. The shallow depth of fish farms thus makes them particularly attractive to predators.

In particular, predatory behaviour of pinnipeds is a major concern, causing a variety of economical and market related risks for the fish farm owner. Accordingly, there is much interest in developing anti-predator control methods.

These methods include net modifications, lethal or non-lethal removals, population control and aversive conditioning. However, each of these methods has their own drawbacks. For example, the addition of a second net can cause tangling of predators and non-predatory species; and lethal removals as well as population control may have an impact on populations and raise ethical concerns over the treatment of the animals. Culling of higher order predators can also have negative impact on predation rates by other predators, for example, pinnipeds forage on predatory fish species around the net pen which in turn potentially feed on aquaculturally important species. Also, emetic aversion conditioning requires that individuals learn to associate treated fish with sickness, and this can be hard to achieve when predator numbers are high.

One anti-predator control method that avoids these pitfalls is the use of acoustic deterrent devices (ADDs). These have traditionally been considered to be a benign solution. However, they do present certain problems with respect to the effects they have on other marine wildlife and with habituation, where a target species motivated by a food source ceases to be deterred by the acoustic signals.

If the source level of an ADD is sufficiently high it can cause temporary or permanent hearing damage both to the targeted species and to other wildlife, and the noise pollution is in general an environmental hazard. Further, both targeted and non-targeted species can be excluded from their natural habitat within a wide radius of the fish farms. These concerns have led some governments to restrict or even ban the use of ADDs.

A further problem is the habituation of the target species to the sound. In extreme cases, the sound which is intended to be aversive acts as a "dinner bell" and actually serves to attract predators, rather than deter them. Also, if predator sounds are used as an aversive noise, habituation is dangerous for the target species once they had returned to their normal habitat.

Also, existing power levels and signal cycles impose heavy duty cycles on the batteries used as power sources in the transducer units.

Accordingly, it would be desirable to provide an acoustic deterrent device that is highly effective, but does not damage the environment, is species specific and avoids habituation.

So, several contradictions that exist in relation to existing solutions – they cause damaging side-effects, they use too much power and predators become habituated to them. Here's how we can best map the various challenges onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Safety/Vulnerability (38)

WORSENING PARAMETERS YOU HAVE SELECTED:

Duration of Action of Moving Object (12) and Power (18) and Noise (29) and Other Harmful Effects Generated by System (31)

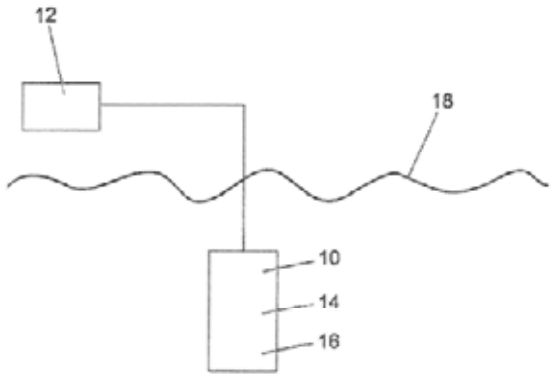
SUGGESTED INVENTIVE PRINCIPLES:

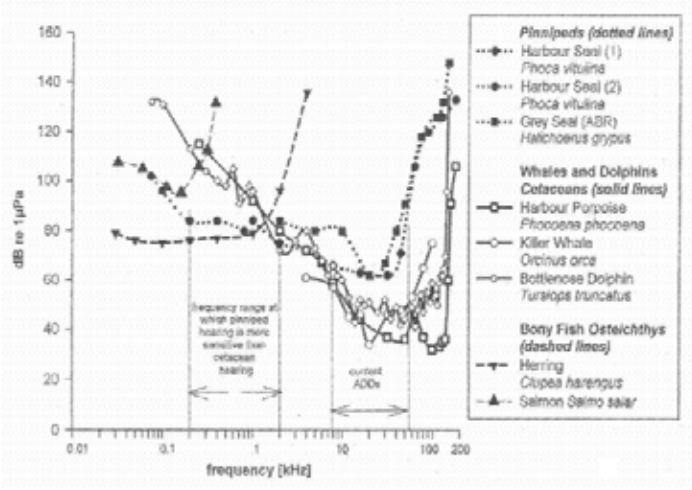
19, 1, 13, 24, 10, 35, 2, 11, 28, 31, 5, 34, 15, 33, 39, 16, 21, 23

And here's how the inventors have solved the problem:

A method of deterring mammals comprising configuring an acoustic deterrent system to emit an acoustic signal having characteristics which cause said mammals to be repelled from an area by eliciting a sound-specific [Principle 1] oligo-synaptic reflex [Principle 35] in said mammals, the acoustic signal being specific to mammals and having characteristics which sensitize said mammals such that repeated exposure to the signal reinforces [Principle 13] the sound-specific oligo-synaptic reflex, thereby increasing aversive responses in the mammals over time…

…A method as claimed in claim 1 wherein said acoustic signal comprises isolated acoustic pulses [Principle 19], the method further comprising repeatedly exposing the mammals to said isolated acoustic pulses so as to sensitize said mammals and increase aversive responses in the mammals over time.

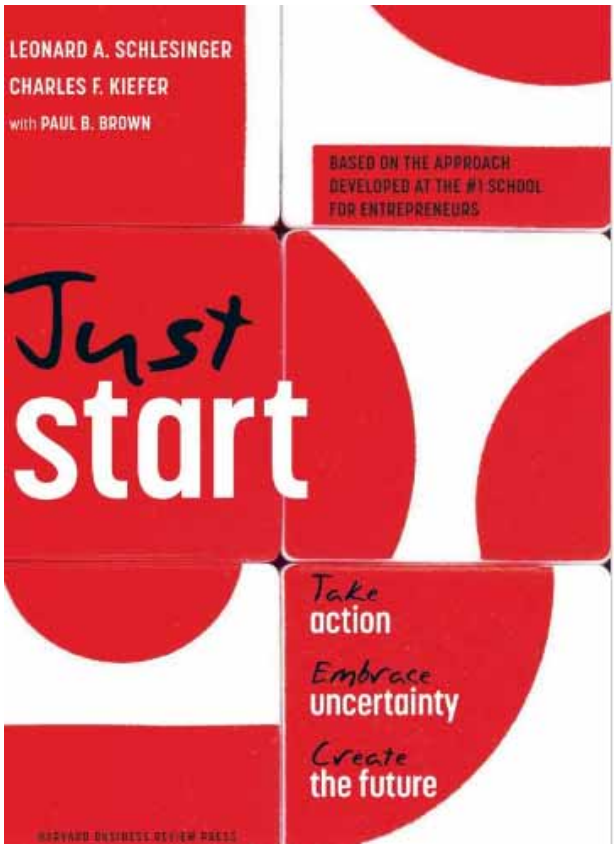




All in all a very elegant and simple ('obvious'?) solution. It's also a beautiful example of what we think is a very generalizable strategy for deploying Inventive Principle 19: All the Principle can really tell us is to turn a continuous thing into a pulsing thing. It can't really tell us anything about the best frequencies of pulsation. In order to answer that question, what we need to do is tap in to a pulsing resource. Asking the question, 'what is there that already pulses in the system that we haven't made use of?'

Admittedly, connecting this question to the oligo-synaptic reflex of predators requires a deal of domain knowledge about the specific problem at hand. Or, now we can all see this resource, adding it to some kind of check-list. There must be other untapped uses, all we need to do is find them. Meanwhile, I'm thinking of attaching a version to my local cake shop; see if that will help cure my sugar addiction!

Best of the Month – Just Start



Oh boy, the trouble we've had this month trying to find something to recommend. The number of seemingly promising titles we've picked up only to find the content behind the tag-line is either content-less or simply wrong-headed. The side of my bed is now littered with books with one of my makeshift bookmarks resolutely stuck somewhere in the first 40 pages:

'Overcoming Innovation Fatigue' – made great play about identifying 'all' the factors that cause innovation initiatives to fail, and then made another great play on the use of (trade-marked!) metaphors that would help resolve the problems. Innovation funnels are bad; far better to think about The Horn Of Innovation™. Innovation is an immigrant in a foreign land. Err. No it's not.
'Rapt' – well written review of what the world knows about 'attention', but almost completely free of any kind of insight that hasn't already been identified by a host of other authors.
'The 10x Rule' – 'set bigger goals' claptrap from an author that, if I read the first chapters correctly has failed in his career because he failed to apply the 10x rule he now knows to be right. Only problem is that he doesn't offer even a shred of evidence to suggest that the now discovered 'rule' is anything other than his next delusion.
'Leading With Cultural Intelligence' – oh dear.
'The Fortune Cookie Principle' – not quite sure what I was thinking when I ordered this one from Amazon. Seriously contemplated sending it back after I realized the basic premise, which – I'm para-phrasing here – seems to work something along the line of a 20-step journey to brand happiness. It's actually a 'fill in this half-baked template' book, albeit you have to buy the companion book to see what the template looks like.

I could go on.

Fortunately, however, a semi-planned trip to my favourite bookshop (take a bow Hay Cinema Bookshop!) finally allowed me to find something worthy of your valuable time and energy. Enter ‘Just Start’:

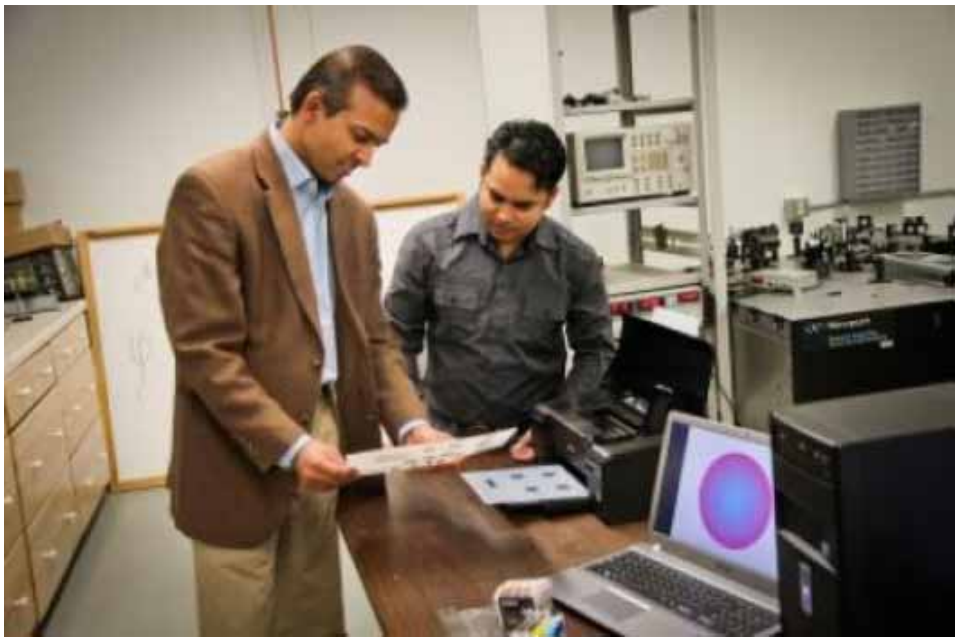
Babson College president provides a simple, systematic, and research-based method - identical to the one taught at Babson (widely recognized as the world's leading educational institution for Entrepreneurship) - for achieving success in an uncertain world. In a world where you can no longer plan or predict your way to success, what is the best way to achieve your goals? It's a daunting question, but today - when change seems to be the only constant - it's one that everyone, from entrepreneurs and managers to newly minted grads, must resolve. The simple answer, say the authors of "Just Start": you must act. And then go from there. Written by a trio of seasoned business leaders - Babson College President Leonard Schlesinger, organization learning expert Charles Kiefer, and veteran journalist and author Paul B. Brown - "Just Start" draws both from academic research and proven practices in organizations to lay out a simple yet reliable method for moving forward on anything when you are faced with volatility. The key, say the authors, is not only to think differently (much like an entrepreneur would), but to then put that thinking into immediate action to see if you are right. They also explain how "smart steps" can help move you forward on your path of acting, learning from that action, and building off that learning to create a productive cycle of iteration.

As well as being an eminently readable book, Just Start starts from a very TRIZ-like ‘someone, somewhere already solved your problem’ premise – i.e. let’s learn from how serial entrepreneurs achieve their consistent successes – and expands it into a series of usable insights. Also encouraging is the authors’ understanding of the need to avoid either/or recommendations. So, to take a good example, the ‘Ready Fire Aim’ implication of ‘just start’ is not about dismissing the importance of prediction, it’s about knowing what the limits of prediction are and then ‘starting’ to answer the unknowns through doing something.

Anyone that’s heard me quoting von Clausewitz in recent times (‘critical mass at the critical point’, blah blah), this book might just be the thing that transforms Clausewitz’s big idea into an actionable set of strategies, tools and methods. For that reason alone, I’d say it has to be worth your money.

Mainly, though, I’m reminded of the occasions when people approach me with variations on the theme, ‘I’ve read all the TRIZ books now, when do you think I’ll be ready to start working on some problems?’ Quite honestly, these are the kinds of question that make me want to weep. Now I don’t have to anymore. I simply have to point people in the direction of this book. Just Start (dummy).

Investments – ‘Squeezing Light Into Metals’



Using an inexpensive inkjet printer, University of Utah electrical engineers recently announced they have been able to produce microscopic structures that use light in metals to carry information. This new technique, which controls electrical conductivity within such microstructures, could be used to rapidly fabricate superfast components in electronic devices, make wireless technology faster or print magnetic materials.

High-speed Internet and other data-transfer techniques rely on light transported through optical fibers with very high bandwidth, which is a measure of how fast data can be transferred. Shrinking these fibers allows more data to be packed into less space, but there's a catch: optical fibers hit a limit on how much data they can carry as light is squeezed into smaller and smaller spaces.

In contrast, electronic circuits can be fashioned at much smaller sizes on silicon wafers. However, electronic data transfer operates at frequencies with much lower bandwidth, reducing the amount of data that can be carried.

A recently discovered technology called plasmonics marries the best aspects of optical and electronic data transfer. By crowding light into metal structures with dimensions far smaller than its wavelength, data can be transmitted at much higher frequencies such as terahertz frequencies, which lie between microwaves and infrared light on the spectrum of electromagnetic radiation that also includes everything from X-rays to visible light to gamma rays. Metals such as silver and gold are particularly promising plasmonic materials because they enhance this crowding effect. "Very little well-developed technology exists to create terahertz plasmonic devices, which have the potential to make wireless devices such as Bluetooth -- which operates at 2.4 gigahertz frequency -- 1,000 times faster than they are today," says Ajay Nahata, a University of Utah professor of electrical and computer engineering and senior author of the new study.

Using a commercially available inkjet printer and two different color cartridges filled with silver and carbon ink, Nahata and his colleagues printed 10 different plasmonic structures with a periodic array of 2,500 holes with different sizes and spacing on a 2.5-inch-by-2.5 inch plastic sheet.

The four arrays tested had holes 450 microns in diameter -- about four times the width of a human hair -- and spaced one-25th of an inch apart. Depending on the relative amounts of silver and carbon ink used, the researchers could control the plasmonic array's electrical conductivity, or how efficient it was in carrying an electrical current.

"Using a $60 inkjet printer, we have developed a low-cost, widely applicable way to make plasmonic materials," Nahata says. "Because we can draw and print these structures exactly as we want them, our technique lets you make rapid changes to the plasmonic properties of the metal, without the million-dollar instrumentation typically used to fabricate these structures."

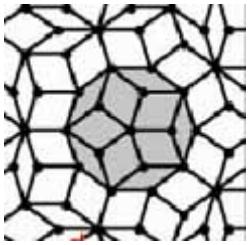
Plasmonic arrays are currently made using microfabrication techniques that require expensive equipment and manufacture only one array at a time. Until now, controlling conductivity in these arrays has proven extremely difficult for researchers.
Nahata and his co-workers at the University of Utah's College of Engineering used terahertz imaging to measure the effect of printed plasmonic arrays on a beam of light. When light with terahertz frequency is directed at a periodic array of holes in a metal layer, it can result in resonance, a fundamental property best illustrated by a champagne flute shattering when it encounters a musical tone of the right pitch.

Terahertz imaging is useful for nondestructive testing, such as detection of anthrax bacterial weapons in packaging or examination of insulation in spacecraft. By studying how terahertz light transmits through their printed array, the Utah team showed that simply changing the amount of carbon and silver ink used to print the array could be used to vary transmission through this structure.

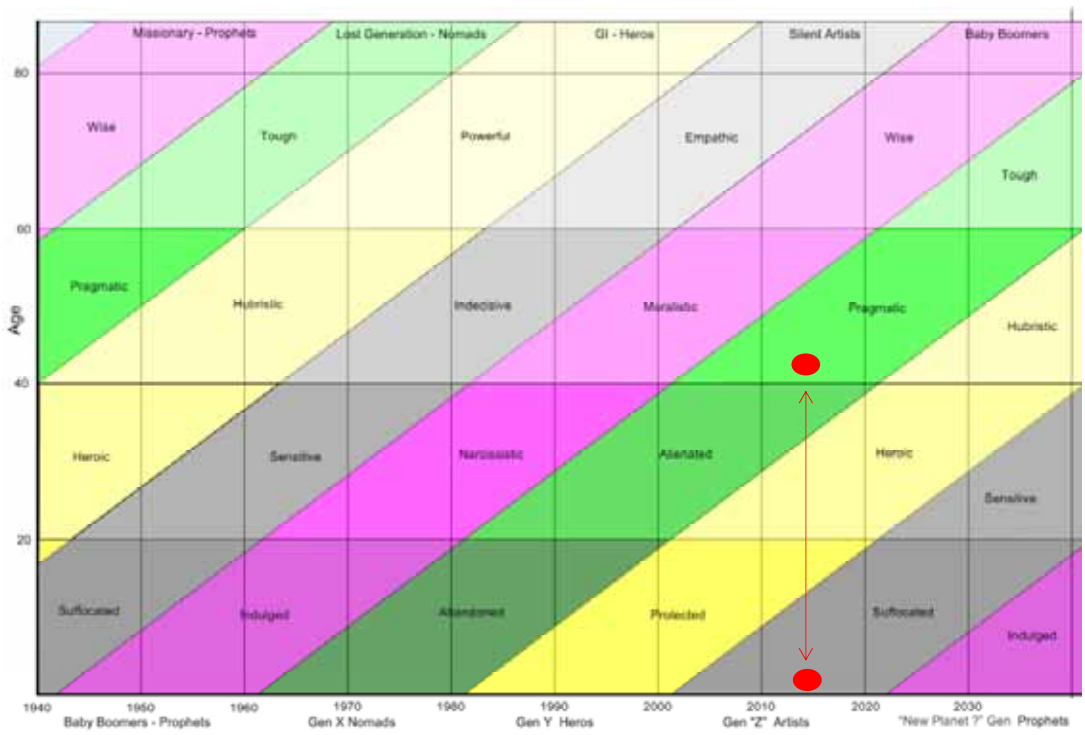
With this new printing technique, Nahata says, "we have an extra level of control over both the transmission of light and electrical conductivity in these devices -- you can now design structures with as many different variations as the printer can produce."
Nahata says these faster plasmonic arrays eventually could prove useful for: Wireless devices, because the arrays allow data to be transmitted much more quickly; Printing magnetic materials for greater functionality (lower conductivity, more compact) in different devices. This technology is more than five years away, Nahata says.

Although the Utah team used two different kinds of ink, up to four different inks in a four-color inkjet printer could be used, depending on the application.

More details:
Barun Gupta, Shashank Pandey, Sivaraman Guruswamy, Ajay Nahata. **Terahertz Plasmonic Structures Based on Spatially Varying Conductivities**. *Advanced Optical Materials*, 2014; DOI: 10.1002/adom.201400018



Generational Cycles – Exceptions Proving Rules: Pragmatic Mother In Trouble



One of the most frequent challenges we hear about the Strauss & Howe Generations model relates to parent-child relationships where there are two generations between parent and child. The challenge most often comes from Nomads (naturally!), perhaps because this is the generation cohort that tends to have babies later than the other three. But also because the main tenet of the Strauss & Howe model is that the pattern of generation archetypes is driven by the transfer of influence from parent to child. Heroic parents might suffocate their Artist children, but surely, the two-generation gap argument goes, a late Pragmatic Nomad parent wouldn't suffocate their child, would they?

The Strauss & Howe argument against this two-generation gap between parent and child is that parents that have their offspring late in life are the exception rather than the rule, and therefore what they do doesn't affect the overall pattern.

If that's true, is there any evidence to suggest that the exception might also turn out to prove the rule. To be honest, I've never really understood the phrase 'the exception proves the rule' in general, never mind in relation to the specifics of the Generations model. A news article published recently in the UK has finally helped me to understand what it all means.

Picture the scene. 43 year old mother of three, Paula Andrews was walking her nine-month old youngest, Maddy, along the seafront in northern UK coastal town, Scarborough. Not many babies are walking by the time they're nine months old, but Maddy had already proved herself to be advanced for her age, and loved her new found mobility. She was dressed in woolly tights, leggings, an all-in-one vest and fleecy top. She seemed well wrapped up for weather. Which was later recorded at 7 degrees Centrigrade. Mother and daughter are having fun, when suddenly a police car pulls up next to Paula and two policemen get out. They tell Paula that they had received an anonymous phone-call from a

member of the public telling them that a small child had been observed wearing insufficient clothing. Paula and Maddy had been on the seafront for approximately ten minutes when the police arrived.

Nutrutionist, Paula, who has two other children aged 12 and 14 picks up the story:

‘I explained that she was fine and Maddy certainly looked fine. I told them that we came out to the prom all the time to play. I am not convinced police should be harassing mums playing with their babies.’

Mrs Andrew then said one of the policemen told her it was their duty to ‘keep an eye on these things’.

‘Where do you draw the line? Do you police children wearing too many clothes on the beach in summer? Can people dial 999 if they suspect a parent hasn’t put enough sun cream on a youngster? They’d be better off policing McDonald’s and checking that children are not eating too much in there.’

Mrs Andrew was on the promenade with Maddy while her financier husband Mike, 49, was surfing off the beach.

She added: ‘It can take more than an hour for police to turn up if I call in complaining about yobs at the back of my house and sometimes they don’t attend at all, but an anonymous call can send them racing to the promenade.’

When one of the policemen asked Mrs Andrew her name, she responded: ‘This is ridiculous.’

After refusing to reveal who she was, Mrs Andrew, from Scarborough, was asked: ‘So you don’t want to co-operate?’ She said: ‘I told them that it was a mother’s right to play with her daughter and it wasn’t a co-operation thing.

‘I added that they’d be taking her to the social workers next if I gave them my details. I wasn’t doing anything wrong, so I walked off.’

A North Yorkshire Police spokesman said yesterday : ‘All reports concerning the safety of children are taken very seriously by North Yorkshire Police and must be properly checked out.’

While the incident – and its sensationalised coverage in national TV, radio and newspapers – might just turn out to be one of those incidents that helps the parental suffocation trend to reach the end of its travel (see also our ‘flapjack’ story from last year), and in many ways reveals typical Generation X, Nomad behaviour from Mrs Andrews, it also serves as an exception that we can already see is proving the rule.

Mrs Andrews behaviour might well have represented an archetypal Pragmatic attitude to parenting her (non-Suffocated) Artist child. But it also subsequently presented her with a difficult Pragmatic decision. The arrival of the police and the subsequent media exposure of the story essentially sent out a clear message: behave Pragmatically as a parent at your peril. In other words, much as Mrs Andrews (and the rest of the Nomad cohort) might think the incident is ridiculous, there are just too many other battles to fight in life to risk this type of thing happening again. Or, put another way, much as Mrs Andrews might believe exposing her child to a bit of cold weather is a good thing, society has sent her a clear message that it is not. She – and other Nomad mums – will no doubt think twice

before they leave the house ever again with a child that other (Hero) parents might perceive to be inadequate for the prevailing conditions.

It's difficult to swim against society's tide. Fighting norms is hard work, and because the amount of energy minority groups possess is inherently limited, society as a whole tends to self-correct to the norm. There's no absolute rule that says today's parents have to Suffocate their precious offspring, but, boy, is it difficult to not do it right now.

Mrs Paula Andrews and her 'underdressed' daughter, Maddy

Biology – Mimosa

By using the same experimental framework normally applied to test learnt behavioral responses in animals, biologists from Australia and Italy have successfully demonstrated that *Mimosa pudica* – an exotic herb native to South America and Central America – can learn and remember just as well as it would be expected of animals.

Mimosa pudica is known as the Sensitive plant or a touch-me-not. Dr Monica Gagliano from the University of Western Australia and her colleagues designed their experiments as if *Mimosa* was indeed an animal.

They trained *Mimosa*'s short- and long-term memories under both high and low-light environments by repeatedly dropping water on them using a custom-designed apparatus. The scientists show how *Mimosa* plants stopped closing their leaves when they learnt that the repeated disturbance had no real damaging consequence.

The plants were able to acquire the learnt behavior in a matter of seconds and as in animals, learning was faster in less favorable environment.

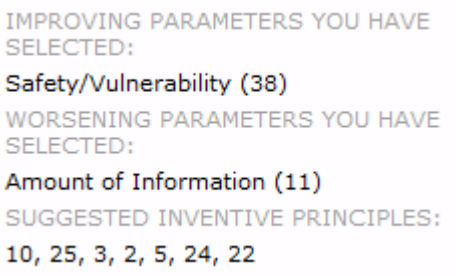
Most remarkably, these plants were able to remember what had been learned for several weeks, even after environmental conditions had changed.

"Astonishingly, *Mimosa* can display the learned response even when left undisturbed in a more favorable environment for a month. This relatively long-lasting learned behavioral change as a result of previous experience matches the persistence of habituation effects observed in many animals," the biologists wrote in a paper published online in the journal *Oecologia*.

"Plants may lack brains and neural tissues but they do possess a sophisticated calcium-based signaling network in their cells similar to animals' memory processes," they explained.

The biologists concede that they do not yet understand the biological basis for this learning mechanism, nevertheless their set of experiments has major implications – not least, it radically changes the way we perceive plants and the boundaries between plants and animals, including our definition of learning as a property special to organisms with a nervous system.

What we can understand is that evolution has allowed the Mimosa to resolve a contradiction: they need to protect their leaves from potential damage, but they don't know when or what the incoming threats might be. Here's how we might map that problem on to the Contradiction Matrix:



The emergence of a 'memory' of previous events represents a pretty good illustration of Principle 10, Prior Action in operation: learn from one event to inform the next. The fact that 'calcium based signaling networks' are used to transmit the memory information would also appear to indicate a Principle 25 solution… or Principle 24 if the calcium has been co-opted into the plants physiology specifically for the memory job. Either way, one suspects that the Australian discovery has to change our perception of plant life at least a little bit.

Short Thort

"*We know that attention acts as a lightning rod.*
Merely by concentrating on something
one causes endless analogies to collect around it,
even penetrate the boundaries of the subject itself:
an experience that we call coincidence, serendipity – the terminology is extensive.
My experience has been that in these circular travels
what is really significant surrounds a central absence,
an absence that, paradoxically, is the text being written or to be written."
Julio Cortázar, Around the Day in Eighty Worlds

"We are drowning in information, while starving for wisdom.
The world henceforth will be run by synthesizers,
people able to put together the right information at the right time,
think critically about it, and make important choices wisely."
E. O. Wilson

News

IRDG, Dublin
We are very happy to learn that our one-day workshop with IRDG, the premier R&D networking group in Ireland, is now sold out. The Systematic Innovation Introduction session will take place in Dublin on April 15. For anyone interested, the IRDG website is allowing anyone wanting to attend to join a reserve list: http://www.irdg.ie/systematicinnovation/.

TRIZ For Finance, Tehran
This prestigious event, mentioned in previous e-zines has now been shifted to August 14-15. The session will be co-facilitated by Darrell Mann and Yekta Özözer. More details on the (imminent… he said) new SI website.

HongKong/China
We're still working out the fine details, but it looks like we'll be conducting a week of public workshops in HongKong and mainland China during the first week of June. There will definitely be at least one day covering SI For IT, another on TrenDNA and understanding customers, and, with a following wind, hopefully one or two completely new sessions.

Hargraves Institute Bootcamps
Due to unfortunate calendar clashes, we will not be able to attend the Hargraves Institute annual conference in Sydney at the end of March. Fortunately, it has been possible to re-schedule the planned 'Step-Change Commercialisation' bootcamp day… to the extent that it will now be two days – the first in Sydney on April 9; the second in Melbourne on the 10th. Check out the Hargraves website for more details and to register for one or other of the sessions.

Marcelo Gimenes
We are very happy to welcome Marcelo to the SI team. Starting from April 14, Marcelo will be working on our government sponsored 3 year post-doctorate Generative Music project at the University of Plymouth. Brazilian-born Marcelo will spend the first year of the project based at the University, before transitioning to the new SI HQ in North Devon, and the planned new recording studio facility. Work to define the first of what we expect to be multiple patent applications has already begun.

DTU, Managing For Growth
We will be participating in the teaching of an SI module in a new 100-day action-learning education programme intended for industry-based innovation professionals. The first cohort will be enrolled for an August 2014 start. For anyone interested in joining the programme, more details can be found at: http://www.business.dtu.dk/english/MfG

New Projects
This month's new projects from around the Network:

Pharma – SI Certification programme
Industrial – Problem-Solving sessions
FMCG – PanSensic measurement study
Transport – ICMM assessment
Healthcare – PanSensic dashboard & problem solving consulting
Academia – EMBA teaching module
White Goods – 'Invent to Order' project
Aerospace – SI workshop series
Aerospace – Problem-Solving Consulting Project
Aerospace – ApolloSigma IP Quality Assessment Study
Marine – 'Invent To Order' IP generation project