Systematic Innovation

e-zine

Issue 143, February 2014

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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

Critical Mass At The Critical Point?

To try and summarise the entire body of work produced by the military strategist Carl von Clausewitz in a phrase, is probably doing him a major dis-service. That said, if you were looking for a single, powerful idea that would best help a small organization or innovation team within a large organization to generate a successful outcome from their innovation activities, it would very likely be that their need to bring to bear a critical mass of resources at a decisive, or critical, point. Easy enough to say. Easy enough, too, to comprehend intellectually. But, if we look for the examples of the aphorism being deployed effectively, you would have to conclude that it is very difficult to see evidence that people understand why it is so axiomatically important, or that they see what it really means to live the truth statement. This article represents a first attempt to make sense of the aphorism from the innovation perspective. In particular it is about trying to make sense of the 'critical point' and its relation to the 'critical mass' of resources we might have available to us. We start with a closer look at 'critical point' in the context of the different Levels of the Innovation Capability Maturity Model (ICMM).

For the most capable innovators (Level 4 or 5 enterprises), there is an understanding of their next 'critical point' that one might describe as having become innate. Their innovation instincts are well honed and they understand that the world and the markets it contains are fundamentally complex systems, and therefore there is a lot that can't be properly understood without conducting some kind of experiment or intervention to see how the system reacts. They likely also connect the concept of 'critical point' to some form of problem, anomaly or (in SI language) unsolved contradiction. The Level 4 and 5 organisations tend to start by defining their 'critical point' target because they know that to a very large extent, once they have found it, they are able to find the needed critical mass of resources to bear to ensure that they are able to win the battle to achieve a successful outcome at their target critical point. They can be confident on this matter because, a) the silo walls within their organizational boundaries are non-existent or fluid enough that they can assemble the necessary people, equipment, time and budget, and, b) if the requisite amount of any of the resources within the organizational boundary is deemed insufficient, project leaders have the skills, protocols and, usually most important, the permission, to extend their search beyond the company boundaries. Mature innovators, in other words, build projects around the critical points they identify.

For lower Level ICMM organisations, this philosophy tends not to work. The lower the Capability Level, the lower the likelihood it will work. To the extent that a Level 1 organisation (i.e. about 75% of all organisations on the planet at this point in time) has virtually zero likelihood that they will achieve a successful outcome to an innovation attempt if they start by defining their 'critical point' target. This might sound like a fairly obvious statement were it not for the fact that nearly all innovation teams in Level 1, 2 or 3 companies tend to start their projects have been given a specification and target. One

might go so far as to say that this kind of strategy represents the prevailing common-sense inside nearly all organisations: how could we possibly hope to succeed if we're not even starting with the right target in mind?

A far more sensible and effective strategy turns out to be to start the innovation activity by considering the 'critical mass' side of the aphorism first. Again, particularly so, when working in a Level 1 organisation, where there is very little confidence on the part of either members of an innovation team or the people around them that they will get to any kind of successful outcome. In such situations, the very best thing an innovation team is do is to look at their (almost inevitably) limited resources and use the 'critical mass' answer to then define the size of 'critical point' they can hope those resources can be successfully brought to bear. What this means in practice is that an innovation team may well have to turn around to their management and so 'no, we cannot take on that project'. Again an almost unheard of statement from any R&D operation in any organization. Why? Because an individual that finds themselves naturally migrating into an R&D environment is typically of the mindset that their creativity will ultimately prevail despite the size of the challenge. Indeed, in a lot of cases, the more impossible the challenge sounds, the more likely the team is to be salivating and desperate to get started. We all love David versus Goliath tales. Almost all of us tend to empathise with the David's of the world. Even though, deep down, we know that 99 times out of 100 its Goliath that prevails.

Sure, it's nice to 'have a go' sometimes, and almost every organization needs to expend some resources on the 'moonshot' type projects where the risk-reward equation looks exhilaratingly ambitious. The misconception in most peoples' minds – nearly all of us have inherently bad instincts when it comes to non-linear, step-change situations – is that those that prevailed in apparently similar against-the-odds situations as our own got there by dogged persistence alone. They didn't. Dogged persistence no doubt helped, but, as we shall see in a few moments, it was only a relatively small part of a much bigger picture.

Saying 'No'

If innovation is rightly said to require a lot of bravery, in many cases, it takes even more bravery to turn around to your boss and tell him or her that, 'no' you are unable to take on the career-making challenge that's just been thrown onto your desk. So, how do you get over that one? Not a guaranteed strategy, but at last having a few objective facts and questions on your side might help. (By the way, if you're neither brave nor willing to try the objective route, your best bet is to start a parallel exploration of your 'plausible deniability' options.)

Our start point here, as in so many things, is the Law Of System Completeness. Its relevance here is that whatever the change is that we're looking to deliver, the process of delivering necessitates the existence of a viable system. What the Law tells us is that, in order to have a realistic chance of success, our change-delivery system requires six essential elements, as shown in Figure 1.
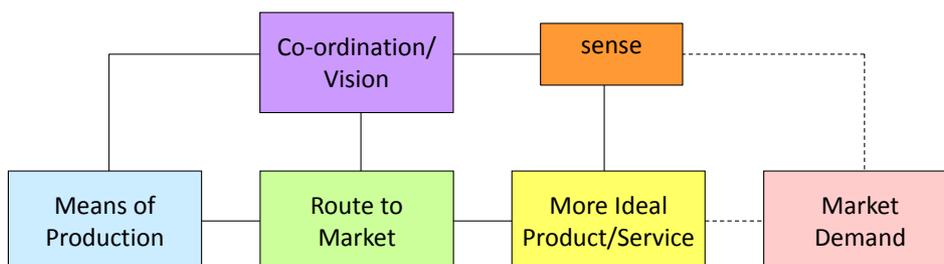

Figure 1: Six Essential Elements Of A Complete System

Each of the six elements is worth considering in a little more depth:

More Ideal Product/Service
The element that is the most readily and objectively calculable. The general rule here is that, when plotted onto an Evolution Potential plot (Figure 2 illustrates a typical plot for a technical example), there should be a net positive number of advances along the trends.
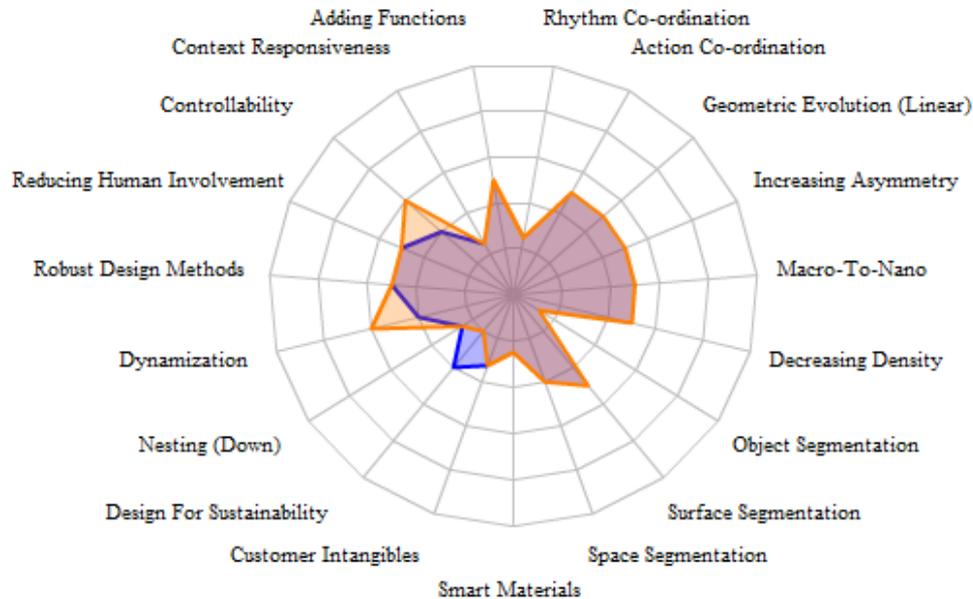

Figure 2: 'More Ideal Product/Service' And Evolution Potential

Market Demand
This, especially in the case of an ICMM Level 1 organisation, might well be a demand from an internal customer as opposed to one that exists outside the organization. The thing to be careful about regarding this element is that it is the one that is almost fundamentally 'outside' the system in the sense that the system – i.e. the innovation team – ultimately interfaces and hands something over to a customer that is outside the team. It is usually a very good idea to create an Outcome Map exploring both the tangible and intangible needs of the intended customer(s) in order to establish that both the 'good' and 'real' reasons for wanting the output from the project have been appropriately addressed.

Means Of Production
Does the innovation team possess the wherewithal to 'productionise' and roll-out their solution – i.e. turn it from prototype into something that meets the scalability needs associated with the 'finished' entity. This finished entity, especially if it is a project with an internal customer, might in itself be a single thing (e.g. a new HR succession planning procedure), in which case 'means of production' needs to be interpreted here in terms of things like is the HR department trained to execute the new procedure? Do they have the support structures in place to assist them in delivering the outcomes the procedure is intended to help deliver? Etc.

Route To Market
The usual killer for small organisations, but also potentially a very significant factor for ICMM Level 1 internal project teams: route to market is all about the means of connecting the 'more ideal product/service' to the intended customer.

Coordination
Does the team possess the vision, objectives, strategies and tactics, skills and capabilities to make sure all of the other elements are connected to one another such that everything

that is needed to happen, happens in the right places, at the right time, with the right people and for the right reasons…

Sense
…and, related to coordination, does the team possess the instruments and measures necessary to ensure that the coordination activities are being conducted appropriately?

The first key to any successful project is that the requisite amount and form of each of the six elements is present. If that 'system completeness' criterion is not met, or has the opportunity to be met within the intended duration of the project, there is very little point in allowing things to move forward. The second key to success relates to how many of the six elements are contained within the terms of responsibility of the team.

This question again takes us to the heart of ICMM, wherein the different Levels of capability in effect relate to the span of control that an innovation team possesses. Level 1 organisations, for example, will have innovation teams that are essentially seen as 'viruses' by the rest of the organization. Every time the team has to rely on inputs from other parts of the organization, their project is put in some kind of jeopardy. Level 2 organisations will tend to be able to transcend the virus/anti-body challenge, but will still contain many silos, the walls of any one of which presents the potential to be unclimbable.

Templates represent an inherently crude way of thinking about these kinds of issue. For Level 1 and 2 teams, however, they probably present more benefits than negatives. Figure 3 illustrates a typical example based on the key points being discussed here:

Element	Exists? (Y/N)	Who?	Inside/Outside Span of Control? (Y/N)	How Do They Win?	How Do They Lose?
More Ideal Product/Service					
Market Demand					
Production Means					
Route To Market					
Coordination					
Sensor					

Figure 3: Critical Mass/Critical Point Mapping Template

The ultimate point of this template filling exercise (or its tailored equivalent) is to help establish that the critical mass of available resources match the critical points. The critical points here being identified in the far right hand column of the template: what are the things that cause those elements outside the span of control of the project team to lose (or feel like they have lost). If nothing else, when we require anyone to change from what they currently do, even if what we're asking them to change to might be inherently and 'obviously' better than where they're at, just the fact that we've asked them to change is an inherent negative: 'people love change; they don't like being changed. Critical points are all about these negatives. The goal is that the stakeholders associated with each of the six essential elements is net better off than they are before the start of the project. If any one is net worse off, there is your critical point: you need to find a way in which they somehow match the negatives with sufficient positives. The critical point in any project, in other words, relates to finding resolutions to the contradictions that exist with any external stakeholder. If any of these critical points requires more resources to solve than exist within our critical mass, then our choice is very simple: we either corral more resources, or

– usually more likely – we try go back to our boss with the data to show why we perhaps ought to focus our efforts on a different challenge.

And if that doesn't work, try explaining that what we're extolling here is exactly the sort of strategy that made Napoleon successful: better to win a non-strategically important battle (the method by which he earned his reputation and rose to prominence so quickly) than fight a strategically important one without the required critical mass of resources. The only times Napoleon got this wrong – think Moscow – is the only time he forgot to apply the rule.

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PanSensics:
Forward/Backwards Ratio Measurement Tool

As the portfolio of PanSensic 'reading-between-the-lines' media scraping tools increases, we've recently begun to build a series of tools focusing on specific issues. Parameters such as anger, happiness, frustration, morale, etc offer the potential to give managers and marketers much more direct dashboard information than some of the 'bottom-up' tools like JupiterMu or MercuryPhi. It's only because we have these bottom-up tools, of course, that we're able to even contemplate outputting the sorts of measures that more directly connect to the parameters that analysts might have an interest in.

There are a host of providers of media scraping tools that purport to be able to output these kinds of direct measures, some more accurately than others. There seem to be two primary drivers of accuracy: the first relating to how well the tool is able to tap in to the behavior-driving 'thoughts' that come from our limbic brains (or, perhaps more importantly, the thoughts that come before our pre-frontal cortex (PFC) has had the opportunity to manipulate them to suit what we think others want to hear, or what we want them to hear); the second relates to contextual relevance.

The key to success in the second domain, in the case of our PanSensic capability at least, is the ability to use semantic algorithms capable of making the necessary contextual assessments. The key to success in the limbic-versus-PFC information capture story is the ability to look for things that are disguised or ambiguated in such a manner that our PFC has no idea how to manipulate what the limbic brain has 'thought'. If you're interested in whether a consumer likes your new shampoo, for example, best not to ask them about shampoos directly, rather ask them about a subject that is analogous but distant enough to prevent our PFC from trying to, or, better yet, feeling the need to make any kind of manipulation.

Reference 1 describes a very nice analysis of literature over the past century looking for the presence of, as shown in Figure 1, fear, disgust or joy/sadness related emotions. The idea here being that authors like Ernest Hemingway, Sylvia Plath, George Orwell, were writing in styles that reflected their perception of society on topics that they perceived would be appealing to readers. The in-the-moment appeal aspect of their work is the stuff that came from their PFC. The tone of what they wrote, on the other hand, was far more likely driven by much more subtle societal cues.
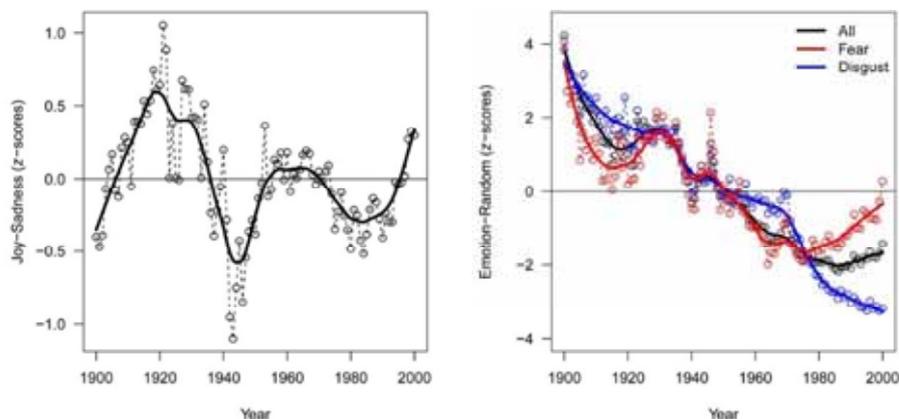

Figure 1: Analysis Of Emotions In US/UK Literature

Intriguing as these results are, the algorithm used to scrape the literature was simply using keywords and as such has the potential to bias the results. For example, when we read a book, the author has written it in such a way that we find ourselves empathizing with a hero character. Scraping the emotional tones of the hero are thus far more likely to reflect the overall tone of what a reader will take from a book than if we merely scrape all of the emotional words, which would inevitably also include those that will have come from the characters that come into conflict with our hero.

That said, I think I'd rather have the Figure 1 data, with all of the potential accuracy doubts that accompany it, than not have it at all. With any new science, the science of 'reading between the lines' is full of holes and uncertainties, that will only be repaired as we get better at interpreting information and discriminating between PFC and limbic driven content. Keyword methods aren't great, but they're certainly helped by being able to scrape very large quantities of data.

Meanwhile, one of the semantic-driven PanSensic tools we've recently been building and verifying relates to whether what someone says is looking forwards or backwards. We became intrigued about this topic as a result of doing some work with a client aimed at building their innovation capability. After reading the official communications being circulated by the leadership team relating to the imperative for 'changing the way we do things around here', and subsequently talking to people in the organisation we came away from the face-to-face discussions with the strong sense of a mismatch between what was being said and what had been written. Specifically, all the spoken language seemed to hark back to happier times, when there was still treasure to be found under the rainbow. The analogy we came up with regarding this mismatch was a very fortuitous image discovery depicting a photograph of a rainbow in someone's rearview mirror – Figure 2.

Figure 2: Looking forwards Or Backwards?

When this image seemed to get people's heads nodding inside the R&D team, we were able to make a hypothesis that even though the intention of the innovation culture building programme was to get people thinking about the future, in reality, their real attention focus was more about looking backwards. The hypothesis reminded me of a foreword I once wrote for an Indian friend that talked about Dream/Memory Ratio, and how I thought that one of the reasons for the enormous surge in the Indian economy in recent times was due to the perception I had that this Ratio was higher in India than it was anywhere else on the planet.

With that in mind, we set about building a new Dream/Memory scraping tool. Per what is now becoming an established convention, the first thing we did was to compile two sets of keywords – one collating words and phrases that were consistent with a person looking forwards and thinking about the future (explore, wish, moonshot, aspire, etc), and the other collating words and phrases that related to looking backwards (tradition, restore, commemorate, 'good old days'). Next up, having incorporated what eventually became several hundred keywords, we set about training the semantic contextual-relevance engine.

Sure enough, when we analysed verbatims and communications occurring within the client organisation, the Dream/Memory (or Forwards/Backwards as it became known) scraping tool revealed that there was an awful lot more evidence of people looking backwards than forwards. Including, most notably, the leaders that were the ones in theory tasked with taking the organisation forward into their desired new world of increased innovation capability… which resulted in a fairly simple recommendation from us about how the difficult job of building an innovation culture would be made easier: get the leaders to stop using backwards looking language if they wanted people to move forwards.

Sadly, confidentiality restrictions prevent me from sharing the actual results of the analysis with the e-zine readership. What I can do, however, is show how the Forwards/Backwards tool has subsequently been used to look at another, this time much more public and rather larger, dataset: the US media.

Figure 3 illustrates the overall findings of an exercise to scrape a variety of news and entertainment media originating in the US during the last fifty or so years. Because the task was a fairly arduous one (thanks largely to the fact we were going back through archives from a largely pre-digital age) we only looked at media in certain years, with a five year interval between one analysed year and the next:
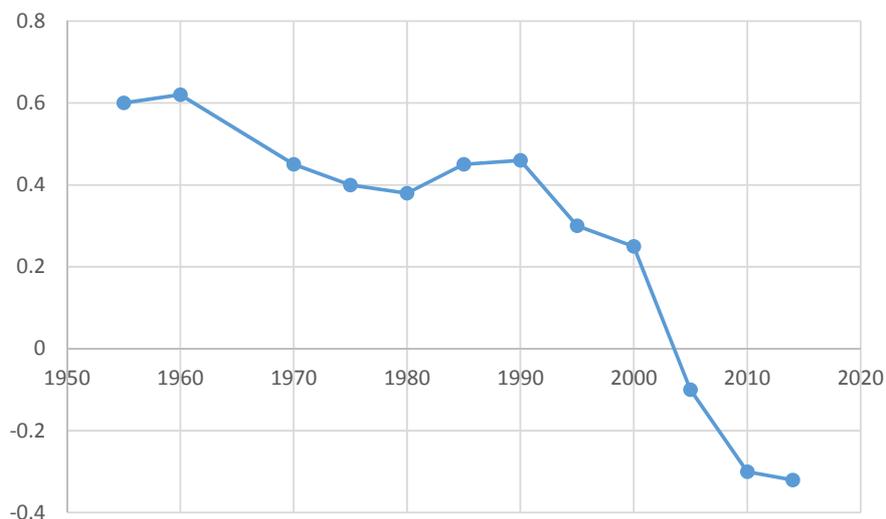
Figure 3: Forward/Backward Ratio For US Media 1950 to the Present Day

We decided to calculate the vertical axis scores in a manner that made the Forward/Backward score be positive when the 'forward' score outweighed the backward, and vice versa. In other words, if F was the total number of contextually relevant forward emotion hits from the scrape, and B was the same context-relevant total for the backward emotion hits, the graph plots (F-B)/(F+B).

The results shown appear to be indicative of a significant shift in the outlook of the US media. If the findings are in any way accurate, somehow the 'Land of Dreams' seems to have turned into the land of fond memories for better times in the past.

We probably need to dig a lot deeper to find out whether the findings are representative of American society at large. If they are, it would seem to suggest at least a partial explanation for the malaise that still exists in the US economy. It might also be suggesting that the ability of the nation to escape from it is not going to be as easy has been the case in the past when the overwhelming perspective was one of looking forwards to the future.

The emerging key challenge for the PanSensic team is connecting the various tools to appropriate data sources. Historical analyses like the one shown in Figure 3 are too time-consuming to contemplate doing as an 'interesting hobby'. Connecting the algorithms up to active and live social media sources, on the other hand, is already allowing us to analyse lots of very rich data in a manner that pretty much allows us to create interactively updated dashboards.

We're at the stage right now where we're trying to verify and validate all of our tools with as much real data as possible. Any of our readers that wants to join the programme, simply needs to do the hard work part of compiling the input data they'd like to analyse. Anyone wanting to know where there organisation stands on the Forwards/Backwards ratio scale, or how the Ratio might have changed over time, should get in touch with Darrell or Cara in the first instance. Ditto if any American readers are interested in sponsoring a deeper-dive look at the US or other nation stories ☺.

Reference

1) Cherry, B., 'Use of emotion words in books indicates trends in history and culture' http://tippingpointsproject.org/2013/03/20/use-of-emotion-words-in-books-indicates-trends-in-history-and-culture/ , March 2013.

Not So Funny – Misfortune Cookies

I love the idea of fortune cookies. This month I discovered their Principle 13, Other Way Around analogues. Which, somehow, I think I already like better. What could be better than reaching the end of a fairly mediocre meal with a group of sullen, depressing friends and experiencing the joy of opening one of these little beauties:

You have turned into your mother.

This is important! Life or death! Make sure you c

A developed country will drag you to poverty.

You will die alone and poorly dressed.

That wasn't chicken.

Shame on you for thinking a cookie is psychic.

You just ate cat.

You need a mint. Like, bad.

Rizaelnig you can raed this mepsislled fnurote wlil be the hgihgliht of yuor day.

Someone ahead of you in line will pay with a check.

Here are the winning lottery numbers for September 3, 2010: 4, 8, 15, 16, 23, 42.

Psst! They're being paid to love you.

This cookie fell on the ground.

Error 404: Fortune not found.

Pigeon poop burns the retina for 13 hours. You will learn this the hard way.

Then, just when you think life can't get any more wonderful, you realize that sometimes the single phrase doesn't do sufficient justice to what you know you deserve. Enter a

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misfortune cookie innovation that allows you to access a complete dissertation of your weaknesses and foibles.



Supposedly the QR codes are edible. Unlike this alternative, just in case your insult appetite is still not sated.

Slightly more subtle, but I think this will be the one that will take the big money in the coming months and years. Especially in the UK, where, for some bizarre reason, it has become compulsory to eat a cupcake every time you enter a cafe. Enter prophetic misfortune cupcakes…

Patent of the Month – Plasma Modification Of Polymers
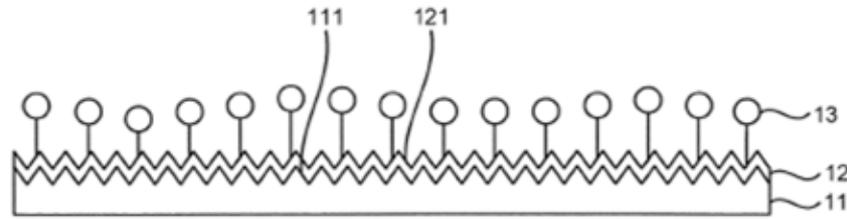
Patent of the month this month comes from a group of inventors from the Institute of Nuclear Energy Research and Atomic Energy Council in Taiwan. US8,642,133 was granted on 4 February.

In a beautifully succinct background description section, we obtain access to a history of the use of plasmas in the textile industry, and in so doing get to observe a succession of conflicts and their resolution. Here's a reproduction of the relevant section of the invention disclosure, along with our analyses of the conflicts and how they could have been mapped on to the Contradiction Matrix:

In order to enhance the wash fastness of a textile, the following chemical agents has usually been used in the conventional methods for modifying the surfaces of the textile: one is an initiator containing free radicals such as hydrogen peroxide, potassium persulfate and azo compound; and the other is a cross-linking agent consisting of low concentration of formaldehyde. However, the concentrations of these chemical agents used have been raised significantly in order to achieve better wash fastness. Thus, the environment is polluted seriously.

First contradiction:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Reliability/Robustness (35)

WORSENING PARAMETERS YOU HAVE SELECTED:

Harmful Emissions (30)

SUGGESTED INVENTIVE PRINCIPLES:

3, 24, 13, (35), 19, 31, 21, 1

Solved by…

Plasma (Principle 35a – 'change of state') *consists of a lots of active species such as electrons, ions, free radicals, and ultra violet radiations. Because these active species exist only in a reaction chamber, they do not cause any environment pollution.*

New problem: plasmas typically require processing operations to take place within a controlled vacuum facility… which is both expensive from a capital perspective and incompatible with high throughput production processes:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Speed (14)

WORSENING PARAMETERS YOU HAVE SELECTED:

Volume of Stationary Object (8) and Stress/Pressure (19)

SUGGESTED INVENTIVE PRINCIPLES:

28, 33, (18), 5, (14), 2, 6, (40), 7, 38, 9, 1, 12

Solved by:

In 1988, Kanazawa, etc. found that atmospheric pressure glow discharge plasma can be generated under the following three conditions, including a working gas of helium or its mixture (Principle 40)*, a high-voltage power supply with a frequency of 1 kHz* (Principle 18)*, and an electrode with a proper structure and a proper electrode gap* (Principle 14)*. Since the production of the atmospheric plasma does not require expensive vacuum facilities and has no limit on the size of the substrate, many technologies of atmospheric plasma applications are developed thereafter, especially those for mass production of atmospheric plasma applications used in the treatment of polymeric materials, such as roll-to-roll textiles and polymer films.*

And now the inevitable next contradiction, and subject of the current invention:

Although the atmospheric plasma is more competitive than the low-pressure plasma, its related techniques have been well developed only quite recently as compared to the matured development of low-pressure plasma in 50 years ago. However, the surface treatments for U.S. Pat. No. 6,551,950 disclosed in 2003 and U.S. Pat. No. 7,449,233 in 2008 were all processed at low pressure... Furthermore, the hydrophobic and oleophobic properties obtained from the surface modifications using ordinary perfluorocarbons and perfluoropolyether silicon compounds in the previous US patents are [unsatisfactory]… As shown in the above prior arts, there are following obstacles to the improvements of the hydrophobicity and oleophobicity of the polymeric material: too low roughness, only monomers of fluorocarbon compound grafted and no fluorocarbon functional group grafted. Hence, the prior arts do not meet all users' requirements in textile industry..

Which looks like this when mapped onto the Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Manufacturing Precision/Consistency (42)

WORSENING PARAMETERS YOU HAVE SELECTED:

Compatibility/Connectivity (33)

SUGGESTED INVENTIVE PRINCIPLES:

13, 4, 9, 28, 15, 2, 1, 24

And here, finally, is how the inventors have overcome this lack of manufacture capability due to difficulties of getting the required compounds to stick onto the fibres of the target textiles:

A method of fabricating a polymeric material comprising: roll-to-roll moving a polymeric material substrate into an atmospheric plasma area; generating an atmospheric filamentary discharge plasma with a first plasma working gas so as to irradiate a surface of the substrate and to activate and roughen the surface to create a first rough surface of the substrate; exposing the substrate to air after irradiation by the atmospheric filamentary discharge plasma so as to form active peroxide on the first rough surface of the substrate; immersing the substrate in a fluorocarbon solution so as to graft at least one of fluorocarbon monomers and fluorocarbon oligomers on the substrate to form a grafted fluorocarbon layer on the first rough surface of the substrate and define a second rough surface having the same roughness as that of the first rough surface of the substrate; generating a second plasma with a second plasma working gas so as to create a carbon tetrafluoride plasma and irradiating the carbon tetrafluoride plasma on the grafted fluorocarbon layer to form a fluorocarbon functional group layer on the grafted fluorocarbon layer; and curing and drying the substrate to generate cross-links in both the grafted fluorocarbon layer and in the grafted fluorocarbon functional group layer and between the grafted fluorocarbon layer and the grafted fluorocarbon functional group layer such that the polymeric material is hydrophobic and oleophobic.

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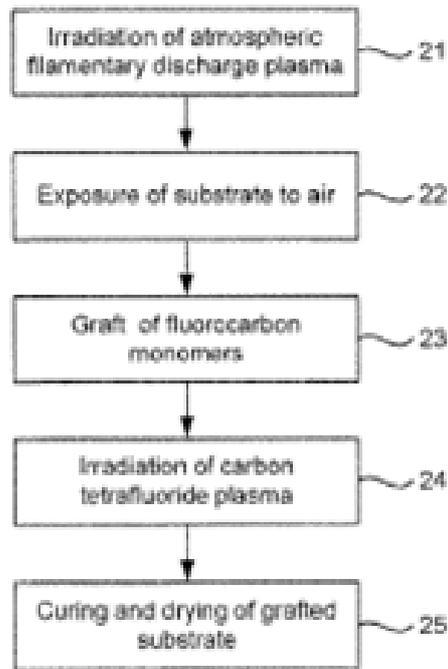
Which, looking at the Inventive Principles recommended from the Matrix look-up, offers us a clear illustration of a (Principle 1) Segmentation solution strategy – two plasmas, with a 'fluorocarbon solution' intermediary (Principle 24) between the two plasma working gases.

Simple when you know how… and, hopefully, a solution that can be allowed to transition to a production environment in fairly rapid order. Watch-out FMCG detergent manufacturers, I think the technology that will give the world self-cleaning clothes just took a major leap forward. All thanks to (predictably!) segmented plasmas.

Best of the Month – Willful Blindness

"A riveting, important book." *MACLEAN'S*

W LLFUL
BL NDNESS

Why we ignore the obvious at our peril

MARGARET HEFFERNAN

Shortlisted for the *Financial Times* / Goldman Sachs
Business Book of the Year Award

Towards the end of 2013, we used our PanSensic measurement toolkit to map the real patient experience performance of all of the UK's acute hospitals. Part of the reason for doing this was because the Government told the population of the country that current failings in patient-care were top of their change agenda. We then selected the worst sixty and sent very polite, respectful letters to the relevant Chief Executives, showing the science behind how we'd done what we'd done, and requesting an opportunity to explain our findings and, more importantly, to suggest how the hospitals in question could rectify the problems the data was highlighting. Two months later and we've received a reply from precisely one. It basically said, 'thanks, but no thanks'.

This extraordinary lack of response made us reflect back on a book we first saw when it was published in 2012. Was what we were seeing a case of willful blindness?

Troubling as this story is (as a British citizen if nothing else!), according to Margaret Heffernan's beautiful tome, we're really just scraping the surface.

So, to broaden the story to bigger and closer-to-home things, if you ever want – really want – to get to the roots of why methods like TRIZ, Taguchi, Design of Experiments, etc don't take off, even though we know how powerful they are, then this month's book recommendation is the one for you. Polymath author, Margaret Heffernan's latest manages the rare combination of deep insight and beautiful readability. In the book, she argues that the biggest threats and dangers we face are the ones we don't see – not because they're secret or invisible, but because we're willfully blind. She examines the phenomenon and traces its imprint in our private and working lives, and within governments and organizations, and asks: What makes us prefer ignorance? What are we so afraid of? Why do some people see more than others? And how can we change? Examining examples of willful blindness in the Catholic Church, the SEC, Nazi Germany,

Bernard Madoff's investors, BP's safety record, the military in Afghanistan and the dog-eat-dog world of subprime mortgage lenders, the book demonstrates how failing to see—or admit to ourselves or our colleagues—the issues and problems in plain sight can ruin private lives and bring down corporations. The book explores how willful blindness develops and then (important if you're interested in tackling the TRIZ-take-off problem) goes on to outline some of the mechanisms, structures and strategies that institutions and individuals can use to combat it.

One of the things that amazed me about the stream of increasingly horrific case studies is just how prevalent willful blindness is. It affects all of us. As such, it might just turn out to be the key (turning a harmful thing into a useful thing) resource that teams and organisations need to tap into if they intend to create any kind of change. We've often heard the expression, 'I love change, I hate being changed'. What Heffernnan's book vividly tells us is that the first half of the sentence is usually a lie. Every moment of our waking lives turns out to be a subconscious slip into self-re-enforcing status quo.

At root, the whole willful blindness problem centres around (naturally!) a paradox: we think not knowing difficult information will keep us safe, even as it puts us in danger:
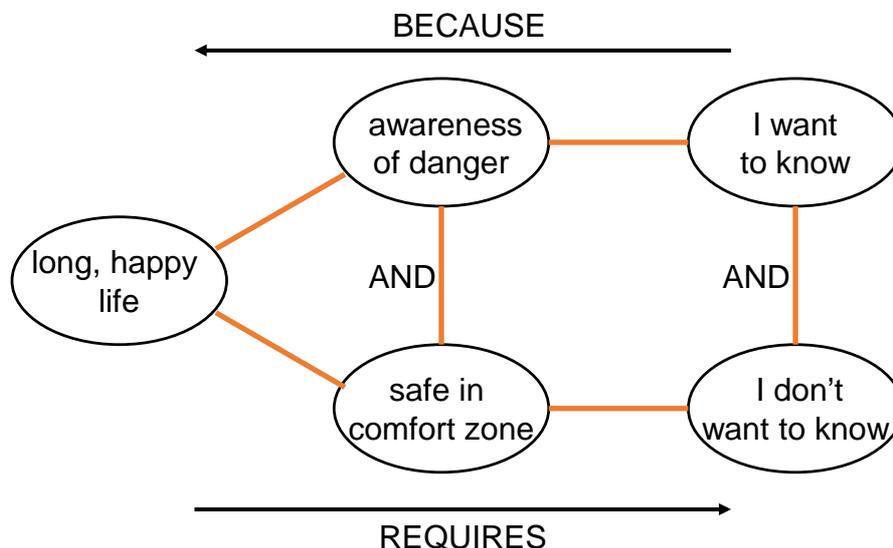
We don't think you can afford to miss this one. One might even go so far as to say that by ignoring it, you're experiencing your own case of willful blindness (wonder why the publishing company didn't use that as part of the advertising campaign ☺). Even if you don't buy it, you might like to look about the above contradiction map and spend a couple of minutes thinking about why you *don't* need to listen to what Margaret Heffernan has to say.

Investments – Catalytic Converter

A new catalytic converter that could cut fuel consumption and manufacturing costs has been designed by a scientist from Imperial College London.

Tests suggest that the new prototype could reduce fuel consumption in a standard vehicle by up to three per cent. It could also deliver environmental benefits by reducing the amount of CO_2 that each vehicle emits. The new design has half the overall volume and uses up to 80 per cent less rare metal, a development that could significantly reduce costs for vehicle manufacturers. Catalytic converters are expensive to manufacture because they use precious metals such as platinum to eliminate emissions. These metals currently account for up to 60 to 70 per cent of the cost of the component.

The prototype is also predicted to perform better than existing models because the rare metal degrades less over the lifetime of the component. Laboratory tests suggest that it deteriorates by only four per cent over a distance of 100,000 kilometres, compared to 35 per cent for a standard catalytic converter.

Lead researcher, Dr Benjamin Kingsbury says: "Catalytic converters are the most important component in a vehicle for controlling exhaust emissions. Yet their design has not changed since they were first developed in the 1940s. The prototype I have developed could make cars cheaper to run because they use less fuel. It could potentially help manufacturers to reduce their costs. Drivers could also be a major beneficiary of this device, which could save on fuel costs and ultimately lead to reduced CO_2 emissions."

A conventional catalytic converter is a ceramic block, which is honeycombed with microscopic channels that are coated in a rare metal such as platinum. Emissions travel from the engine to the exhaust system and through the channels, where the precious metal causes a chemical reaction to occur that eliminates the harmful pollutants.
The researchers have advanced an existing manufacturing process to improve the structure of the microscopic channels, increasing the surface area and enabling the rare metal in the device to be distributed more effectively so that less metal is used. The increased surface area also makes the catalytic converter's chemical reaction process more efficient.

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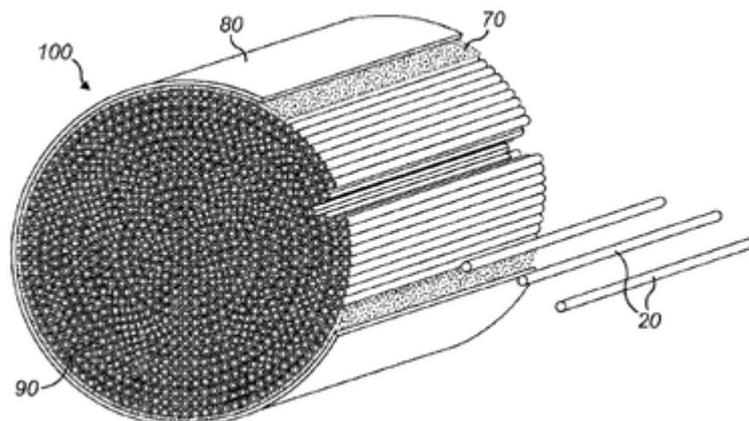
The new design of the device increases fuel efficiency because it prevents 'back pressure', the build-up of gases that can make the engine work harder, affecting its performance.

Dr Kingsbury has been awarded funding from the Royal Academy of Engineering to take his prototype to the marketplace. Dr Kingsbury and his partners worked with Imperial Innovations to fie patent applications and establish an Imperial start-up company in December 2013 to market the prototype device. A key next step is to develop a production process for mass manufacture… hopefully, the higher level shift away from internal combustion engines aside, this looks like a relatively easy one to shoehorn into the increasingly innovation-allergic automotive industry. Fingers-crossed.

PS: here's how the basic problem could have been overcome from a contradiction-resolution perspective:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Area of Stationary Object (6)

WORSENING PARAMETERS YOU HAVE SELECTED:

Manufacturability (41)

SUGGESTED INVENTIVE PRINCIPLES:

17, 40, 13, 10, 16, 5, 36, 32

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Generational Cycles – Unravelling In The Early 1980s

One of the main ideas behind the Strauss/Howe Generations model (even though they never use the words) is that society passes through an s-curve cycle every four generations. The overall cycle is typically divided into four segments: High, Awakening, Unravelling and Crisis:
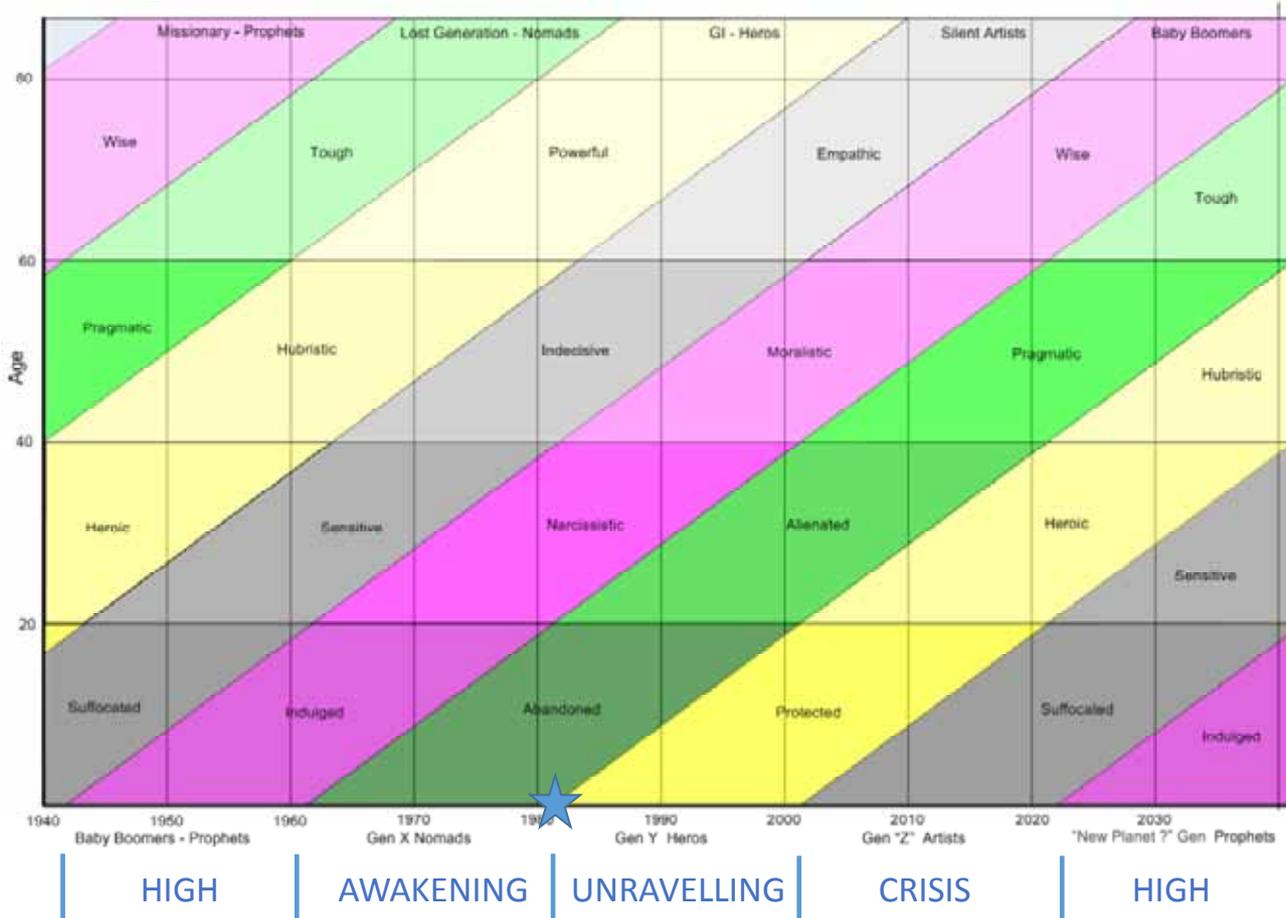

Some of the transitions from one phase of the cycle to another are quite easy to spot. The end of the Second World War, for example, was a clear point in time when a Crisis came to a head, and society entered a new, 'High' phase. Similarly, if we look at the US in the early 1960s, the transition from High to Awakening was relatively easy to spot. Think Bay of Pigs, or, even better, the assassination of JFK, and it's easy to see that here was a pair of events that caused a very non-linear response in the behavior of people in society – before the two events, all was well in the American world; afterwards, there was a clear sense that all was not well. Ditto for the start of the Crisis period – 9/11 being an event that again left all in no doubt that the world had just changed.

Which leaves the transition between the Awakening and Unravelling phases of the cycle, as denoted by the blue star on the figure. As in previous turns of the cycle, this is the one that is very often difficult to pin down precisely. In crude mathematical terms, thinking about the geometry of an s-curve, the mid-point of the curve is the point where the rate of improvement drops below zero. People might still be perceiving that things are getting better overall, but somehow there is the sense that things aren't getting better nearly as fast as they previously had been.

We know that we're looking for an event or events that occurred early in the 1980s, and we're specifically also looking for things that are likely to have the biggest impact on parents and the way they raise their offspring – this parent-child relationship, and particularly the changes that occur in those relationships that represent the whole underpinning 'DNA' of the Strauss & Howe model.

As far as we can tell – looking in particular at the US and UK in the first instance, that there were four contributory elements to the actual Awakening-to-Unravelling shift:
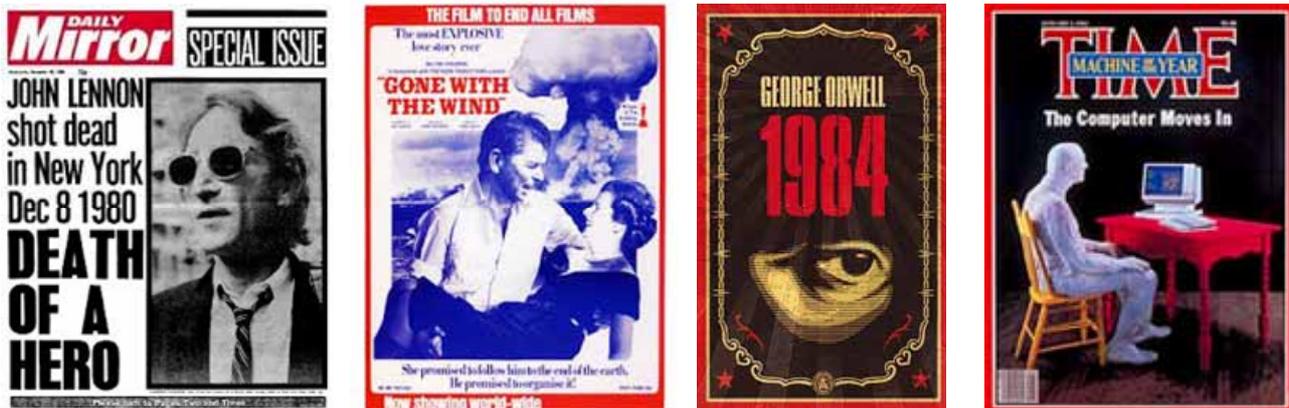
First up was the killing of John Lennon on the 8th of December 1980. Lennon wasn't the first rock'n'roll celebrity to die, of course, but he was certainly the first one to be gunned down in public. He was also a Beatle – the biggest pop group on the planet in the 1960s and as such, very likely the first idols of what were, in 1980, now parents. Perhaps most significantly of all, he was the prototype 'working-class hero'. Here was 'one of us' being killed. Every radio station in the West spent the next several months playing Lennon's anthem, 'Imagine', just in case the point didn't hit home straight away.

Second up came the landslide election victory of Ronald Reagan at around about the same time. The sea-change from left to right of the American political spectrum had an immediate impact on every citizen, but especially the Boomer parents, who voted in no uncertain terms to draw a line under the consciousness revolution of their student protest years. From now on it was every man for him or her self. In the UK, the very left-wing Socialist Worker newspaper published a Christmas cartoon poster of Reagan and recently (1979) elected UK premier, Margaret Thatcher that went about as viral as it was possible to go in those days. Somehow the Gone With The Wind image – complete with nuclear mushroom cloud in the background – seemed to 'fit' the times just right. Former ideals were precisely what the poster suggested – gone with the wind.

Thirdly, and perhaps the least specific was what we might today think of as pre-1984 tension. Where the 1984 in question was the dystopian George Orwell novel of the same name. Starting somewhere in 1982, western media commentators became obsessed with the worrying thought that all of Orwell's worst – Big Brother is watching you – predictions were about to come true, and freedom as we all knew it was about to disappear…

...no doubt helped by what we ultimately think is the biggest single societal shift that took place in the early 1980s: the emergence of home computing. It's no coincidence that Generation Y (or the 'Millennials') have become known as the first generation to experience computers from their earliest reading years. The early 1980s saw numerous high profile launches of affordable personal computers, but if you had to pick out a single

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defining moment that said to every parent, 'the future has just arrived' it was when Time magazine for the first time in its history selected a non-human as their person of the year for 1982. The fact that 'the computer' had been given the illustrious title was picked up by every media outlet in the Western world. Things would never be the same again: the Unravelling had well and truly begun.

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Biology – Polar Bear Fur

The world is still relatively short of genuine biomimetics examples. The list seems likely to grow by at least one following the recent publication of a paper by biophotonics expert Priscilla Simonis, a researcher at the University of Namur. Simonis was intrigued by the ability of polar bears to insulate their bodies to temperatures of 37 degrees Celsius (98.6 F) even during long, cold winters when outside temperatures are a frigid -40 C (-40 F). The feat was especially impressive given that the bears have a layer of fur that is only 5 centimeters thick.

The insulating power of the animals' coats made Simonis wonder why thermal insulation in buildings doesn't work as well. "Why do we need at least 60 cm of rockwool or glasswool" – common types of building insulation made from minerals or glass fibers – "to get a temperature of 20 degrees Celsius inside from about -5 degrees Celsius outside?" she asked. "Why is the polar bear fur much more efficient than what we can develop for our housing?"

Simonis and her team tackled the question by re-examining two of the different ways heat can travel: radiation, which transfers thermal energy through electromagnetic waves, and conduction, which transfers thermal energy through the vibrations of neighboring atoms and molecules. Most people assume that fur and feathers keep animals warm primarily by trapping a layer of air that slows thermal conduction, says Simonis. But she and her colleagues suspected that radiation might play a bigger role. After building a computer model incorporating both conduction and radiation heat transfer models, Simonis and her colleagues found that the reflectivity of the fur played an unexpectedly significant role in reducing heat transfer. As the reflectivity of the fur increased, the rate of heat transfer between the hot and cold sides of the computer model was dramatically reduced. All together, the model suggests that the repeated backscattering of infrared light between individual hairs (and, by analogy, barbed feathers) could be the primary mechanism for the thermal insulation properties of fur and feathers.

Simonis noted that the light scattering properties of animals' coats can also have dual purposes. With the right structure, fur and feathers can generate efficient thermal

insulation in the far infrared range while also scattering visible light to produce a white appearance in the visible wavelength range. "This is particularly useful to animals, such as mammals and birds, that live in snowy areas," Simonis says, as it provides them with both warmth and camouflage against the white snow.

For humans, focusing on ways to minimize radiative heat loss could lead to the development of new types of ultrathin insulation. "The idea is to multiply the interaction of electromagnetic waves with grey bodies – reflecting bodies, like metals, with very low emissivity and no transparency – in a very thin material," Simonis says. "It can be done by either a multilayer or a kind of 'fur' optimized for that purpose."

From a contradiction elimination perspective, the polar bear fur manages to make a step-change improvement in heat loss over the best of human engineering efforts for a given thickness of fur and temperature difference between body temperature and atmospheric temperature. Here's what that problem looks like when mapped onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Loss of Energy (27)

WORSENING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Moving Object (3) and Temperature (22)

SUGGESTED INVENTIVE PRINCIPLES:

7, 3, 35, 4, 13, 31, 17, 34, 19, 28, 21, 6, 1

Lots of clues amongst the Inventive Principle suggestions about using fur as the means of solving the conflict, but difficult to make any really connection to Simonis' discovery about the importance of repeated backscattering of IR or the evolution of the reflectivity of the hair to give just the right amount to achieve the backscattering effect. In Inventive Principle terms, what the polar bear actually provides is an illustration of Inventive Principle 32d, 'change the emissivity properties of an object subject to radiant heating'. Not present in the current version of the Matrix, suggesting that, for once, Nature seems to be somewhat ahead of the game.

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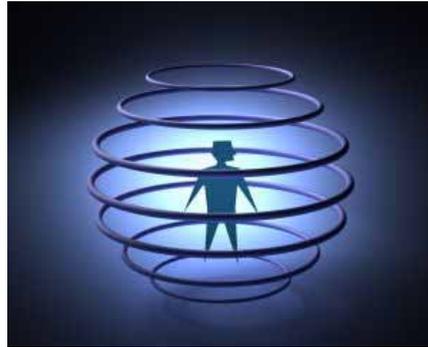
"If you do not expect the unexpected you will not find it,
for it is not to be reached by search or trail…."
Heraclitus

	PAST	PRESENT	FUTURE
SUPERSYSTEM	intangible / tangible	intangible / tangible	intangible / tangible
SYSTEM	intangible / tangible	intangible / tangible	intangible / tangible
SUBSYSTEM	intangible / tangible	intangible / tangible	intangible / tangible
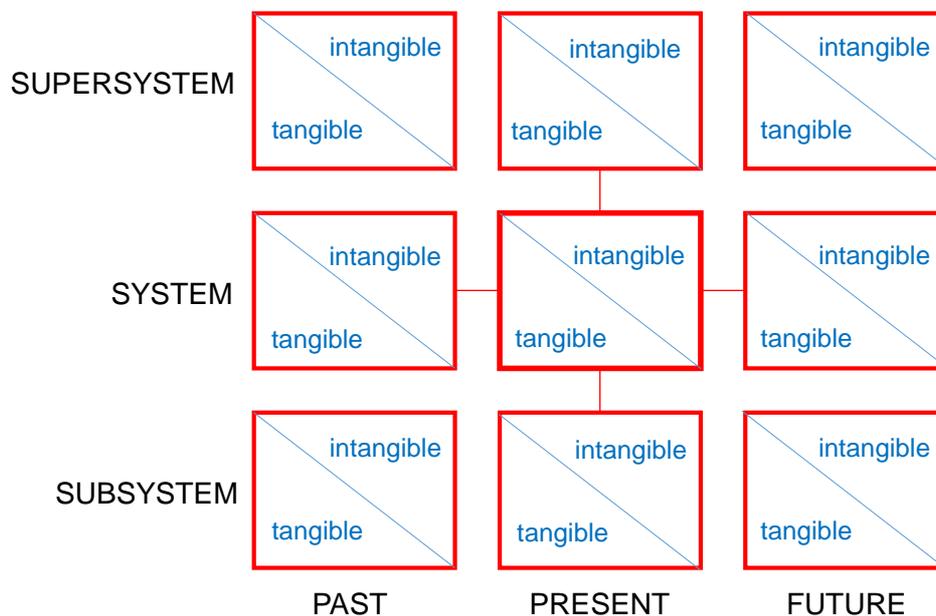
…you can, however, identify all the places you need to go and look.
And make sure you think as much about the intangibles as the tangibles.

News

Marcelo Gimenes
We welcome a new member to the SI team this month. Marcelo has just taken up the post-doctoral research position at the University of Plymouth funded as part of our music Knowledge Transfer Partnership programme with the University. Currently based in Brasil, Marcelo will spend the next 12 months at Plymouth, and the two subsequent years at the SI HQ in North Devon.

University Of Buckingham
We are pleased to announce our increased involvement with the Lean MSc programme at the University. In addition to a bigger teaching commitment, we are also working to design a new Masters programme aimed at integrating the world's of Lean and Innovation.

Generations Poster

As we put the finishing touches to the (oft-requested) wall-poster version of our Generation Archetypes time/age map, there is still a window of opportunity for readers to input their suggestions as to what additional detail the larger size will allow us to add to the picture. We already know there'll be new features looking at life-crises and transitions, at key moments in history that trigger cycle shifts, and key societal pattern pendulum swings. What are we missing that would be useful to you?

Magdalen Organic Farm Charity

We're pleased to announce a new win-win cooperation with the local Magdalen orgranisation. NGO's are always looking for funding and we're always looking for organisations that will allow us to publish the success stories we're there to help generate. Our initial job with the Magdalen team will be to (PanSensically) analyse all of their past visitor data in order to help them better understand how to engage with fund-holders and prospective future visitors.

New Projects

This month's new projects from around the Network:

    Transport – TrenDNA Workshop
    Healthcare – Innovation Leadership Strategy workshops
    Government – Employment Services strategy
    IT Services – SI workshops
    Transport – Innovation design/make project
    Pharma – SI Certification workshops
    Pharma – Bespoke SI text-book
    FMCG – Concept Design Study
    Government – Regulation innovation workshops
    Automotive – Asset Sweat Study