Systematic Innovation

e-zine

Issue 167, February 2016

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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

ABC-M Landscapes

In last October's ezine (Issue 163), we introduced the idea that, when it comes to the intangible aspects of any innovation attempt, the main success criteria involved making our ABC-M (Autonomy-Belonging-Competence-Meaning) tetrad 'get better for each stakeholder at each moment of truth'. Really simple to say, much more difficult to achieve in practice. On the other hand, 'being difficult' should never be a reason for allowing oneself to fail to try and achieve.

This short article concerns the next stage of evolution of the 'ABC-M gets better' story: the ABC-M Landscape.

The basic idea is very simple: identify the (moment of truth) steps in a process or journey; calculate ABC-M for each stakeholder at each of those stages; plot on a graph. Here's what the resulting landscape looks like for a case we did for a recent analysis of the growing world of restaurant food home-delivery services:

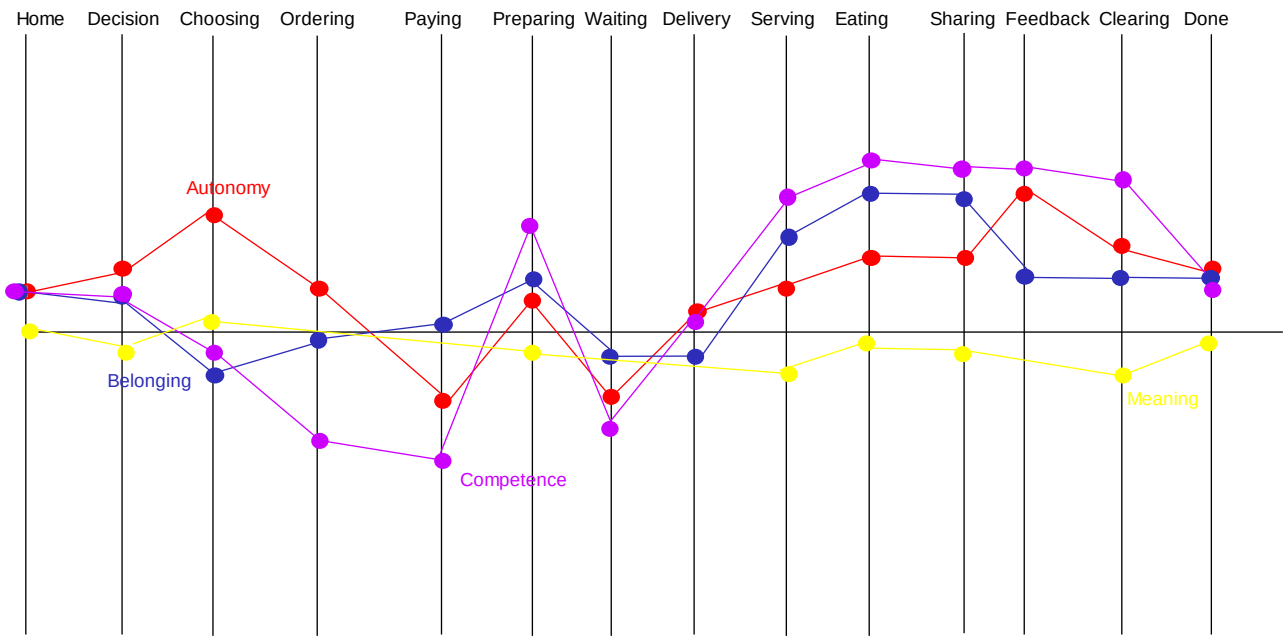


Figure 1: ABC-M Landscape For Restaurant Food Delivery App Service

The point of mapping and showing the landscape is to assist the designers of the service to make improvements to that service. Knowing that (for example) the payment system makes people feel incompetent – as is indicated in Figure 1 – should be a spur to work out why, and then re-design the system such that they no longer have that negative feeling.

So much for the theory. The practice requires one or two additional thoughts in order to get the most out of the landscaping concept. Here are a few of the things we already know are important to get right:

1) Absolute versus relative measurements. Measuring intangible factors like a person's perceived level of Autonomy is very difficult in absolute terms. Fortunately, it is not necessary to obtain an absolute measurement for a given situation. What is rather needed is an understanding of the relative shifts between the different

moments included in the pathway. The manner in which we've taken to construct the figures is to make a starting assumption that ABC and M are datumed at a point just before the start of the journey. We've taken to datuming A, B and C at the same 'mildly positive' level, and Meaning – because it sits on a higher emotional plane than the other three – at a neutral level. Having datumed each element just before the start of the journey, the basic questions to be answered at each subsequent journey stage are a) has the element got better or worse than the previous stage? and, b) has the element passed below a zero-line such that the stakeholder now possesses a negative feeling about that element. This zero-line thus forces us to establish whether a stakeholder has switched from feeling positive about their (say) Autonomy ('I feel in control') to feeling negative ('I do not feel in control') about it.

2) Start-And-End Of The Journey – in the same way that we plot the landscape at a point in time 'just before' a process journey begins, we believe it is a good idea to end it just after the journey ends. What we are in effect aiming to do when we plot these two 'neutral' start and end points is explore whether there might be any residual after-effects of the journey. In most cases – especially when doing something as mundane as ordering a curry on an App – the expectation would be that the end ABC-M values would be the same as the initial datum. Where we find that the end value is different to the initial, it is an indication of the overall effect of the journey. In the case of the Figure 1 food deliver App service, the fact that Meaning at the end of the journey is lower than that at the beginning is indicative that the journey has reduced Meaning for the customer. Whereas one might have expected the food ordering journey to be merely 'meaningless', it has in affect made life a little less meaningful. (A separate analysis of customer frustrations seemed to confirm this in that there was a degree of post-takeaway guilt on the part of, particularly, parents.)
3) Meaning-less – look at the world through a 'Meaning' lens and you quickly realise there is an awful lot of meaningless stuff out there. Sometimes so much so that it is better to leave the Meaning characteristic off the landscape plot altogether. This seems to be especially true – sadly – in many workplaces (see Darrell's 'ABC-M Tetrads At Work' blog article). Rather than thoroughly depress people, better to create some kind of sense of progress by focusing on the ABC.
4) It probably won't surprise you to learn that there is a PanSensic ABC-M lens and that we're rapidly reaching a point where we can construct and create these ABC-M landscapes in an automated fashion. The main challenge involves creating a journey ontology and training the system to recognize narrative that applies or doesn't apply to each of the stages. In the healthcare sector, where there has already been much work done on defining 'patient pathways' the job of plotting ABC-M landscapes is already made relatively easy. With other clients, we're in the process of building specific journey ontologies. Right now we're at a point where we need as many case studies as possible. If you think you have your target audience journey stages mapped, and you have lots of barely-analysed narrative data laying around doing nothing, the PanSensic team will be more than happy to talk to you.

Evolving The Creativity Scan

Our fifteen-year programme of research into ‘effective creativity’ (also known as ‘innovation’) has revealed a number of critical insights into the creative process. From that research we saw a need to separate two important aspects of intelligence: firstly there is what we might think of as our ‘creative intelligence’; second is the more traditional (‘IQ’) interpretation of the word, which we might define as ‘knowledge intelligence’. In simple terms, ‘knowledge intelligence’ is how much stuff we know, and thus how well we perform in school exams and general knowledge quizzes.

Our hypothesis has been that, as we all live our lives there is an innate transfer of intelligence from one of these types to the other:

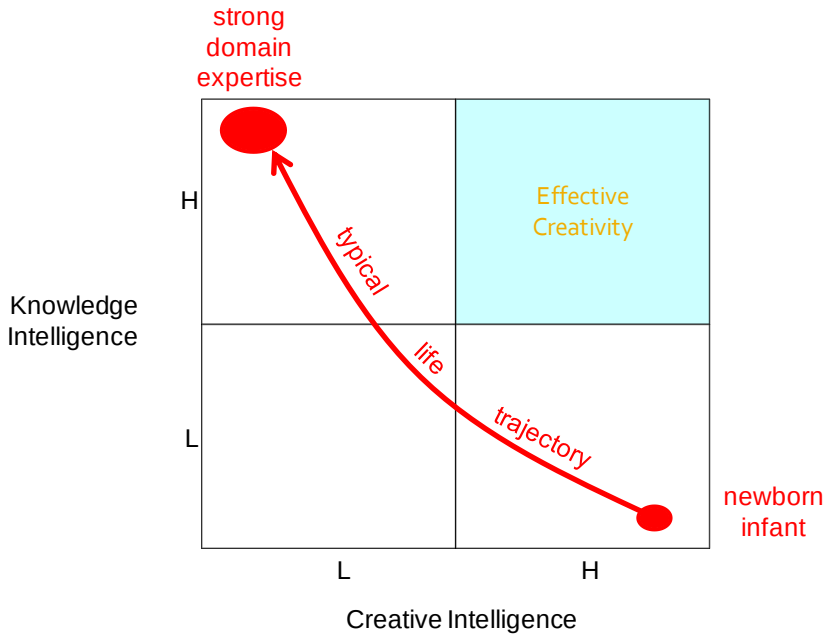


Figure 1: ‘Creative’ Versus ‘Knowledge’ Intelligence

When we are born, we are all fundamentally born with lots of unconnected neurons inside our brain. Because they are un-connected, we have many, many ways in which they can be connected. Our creative potential – and therefore, we propose, our creative intelligence – is, in this state, at its peak. Never again will we experience such plasticity and flexibility. And a good thing too, since, as we quickly learn, having a certain amount of knowledge about the world is useful for our survival (‘don’t put your hand in the fire’). Certain neurons get connected to others, and get reinforced into immovable, concrete pathways as our knowledge increases. But there is a definite trade-off occurring when this essential advance happens: the more knowledge we acquire, the more neural pathways we make rigid, and hence the less creative potential we have…

…until, ultimately, after, say, finishing a PhD in ‘high Nusselt Number, particle-laden supersonic aerodynamics’ (insert image of one of my best friends here) we have an awful lot of really useful specialized knowledge and very little potential to create new supersonic aerodynamic solutions.

The knowledge-versus-creative-potential trade-off is inherent. Inherent, but, fortunately, not unsolvable. ‘Effective Creativity’, then, is about solving the contradiction:

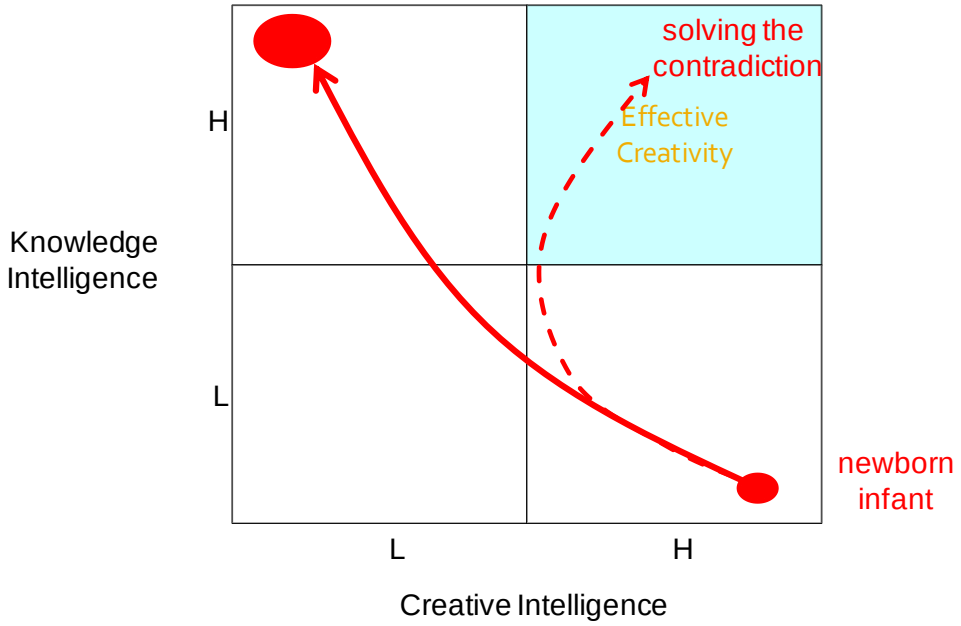


Figure 2: Solving The Creative-Knowledge Intelligence Contradiction

And it is a contradiction that really has to be resolved: the designers of Concorde, for example, were stuck when it came to reducing noise because their excess of domain knowledge prevented them from seeing out of the box. Conversely, while I'm pretty confident my twelve-year-old niece would be great at generating brand spanking new ideas for a supersonic aircraft, I don't think any of us will be setting foot inside one of them anytime soon. What is needed here and everywhere else are ways and means of thinking that successfully combine the best attributes of both high knowledge *and* high creative intelligence.

The measurement of this 'creative intelligence' was what inspired us to design and validate the Creativity Scan starting back in the late 1990s. At the time of its inception, in true TRIZ fashion, we started from an assumption that 'someone, somewhere had already solved our problem'. No point re-inventing any unnecessary wheels, we thought.

Although it was very easy to find a whole swarm of 'creativity tests', none seemed to quite get the idea of either 'effective creativity' or 'creative intelligence'. Measuring the 'creativity' of an individual, it seemed, was a subject full of difficulties. Some tests - Myers-Briggs, DISC, Belbin, Kirton Adaptor-Innovator to name four – appeared to capture some of the story, while others (Torrance Test of Creative Thinking (TTCT)) seemed more suited to keeping my niece amused for an hour, rather than delivering any objectively meaningful answer.

And so our job became a combination of coupling together of partial solutions, plus filing in the (many) gaps with the perspectives 'serious' creative problem-solving philosophies like TRIZ offered up through its fifty-plus year journey to capture the critical differences between 'invention' and 'innovation'. The first task was to compile a comprehensive and coherent list of attributes. We ended up with eight:

Abstraction - the ability to abstract concepts from ideas.

Connection - the ability to make connections between things that don't logically appear to have any connection with one another.

Perspective - the ability to shift one's perspective on a situation – in terms of space and time, and interfaces with other people. In many ways, the perspective skill is about ability to empathise with the views of others.

Curiosity - the desire to change or improve things that everyone else accepts as the norm.

Boldness - the confidence to push boundaries beyond accepted conventions. Also the ability to eliminate fear of what others think of you.

Paradox - the ability to simultaneously accept and work with statements that are in conflict or contradictory to one another.

Complexity - the ability to carry large quantities of information and be able to manipulate and manage the relationships between such information.

Persistence - the ability to force oneself to keep trying to derive more and stronger solutions even when good ones have already been generated.

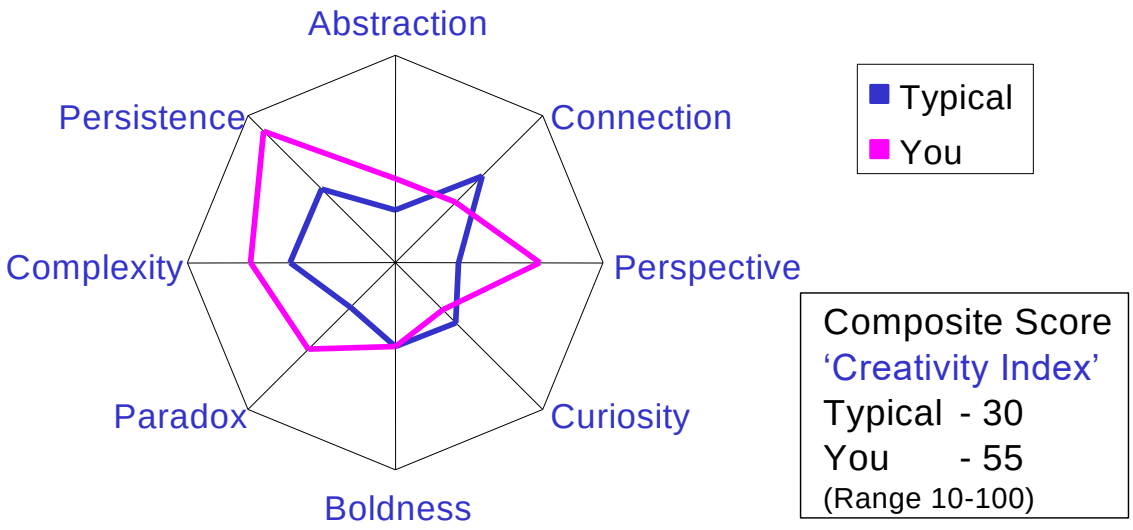


Figure 3: Creativity Self-Assessment Tool Output Format

Having created a structure, the next job was to solve what we saw as three critical problems found in nearly all kinds of psychometric assessment tool:

1) The parallel need for a measurement method that is detailed enough to deliver a meaningful answer, but at the same time simple enough that anyone using the instrument would be motivated to keep going to the end.

2) The need for a measurement tool that participants would not be able to 'cheat' on. Many questionnaire-based surveys do a pretty poor job of obscuring the 'right' answers, and just about all of them are prone to the '4G Effect – people either Gift, Game, Guard or Guess their answers, rather than providing the 'truth' (Figure 4). Our job was to try and ensure participants taking the Scan were in the neutral 'Gold' part of the model. We ended up achieving the solution to this problem in two ways: firstly, by formulating questions in such a way that it was not possible to know what

the ‘right’ answer might be. Then, secondly, and probably more important, creating a suite of questions that impacted our eight different creativity attributes in different ways. So, to take one example, when a person indicates that they enjoy doing crossword puzzles – one of the closed questions – the Scan scoring system will score positively on the ‘Connection’ axis, but negatively against the ‘Complexity’ and ‘Boldness’ axes.

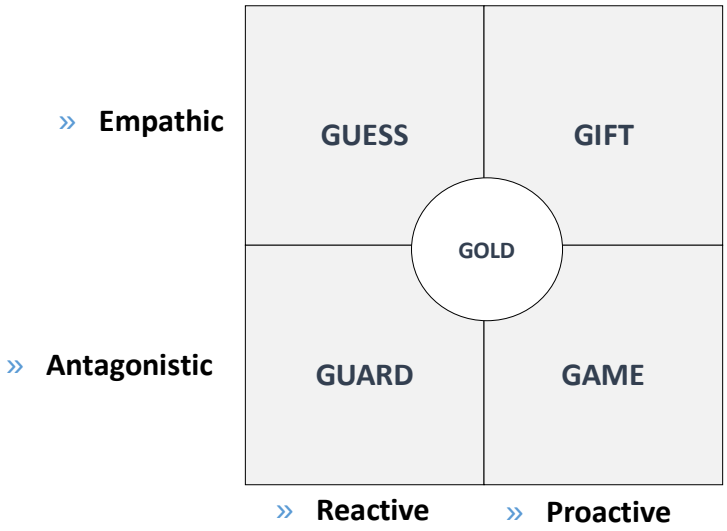
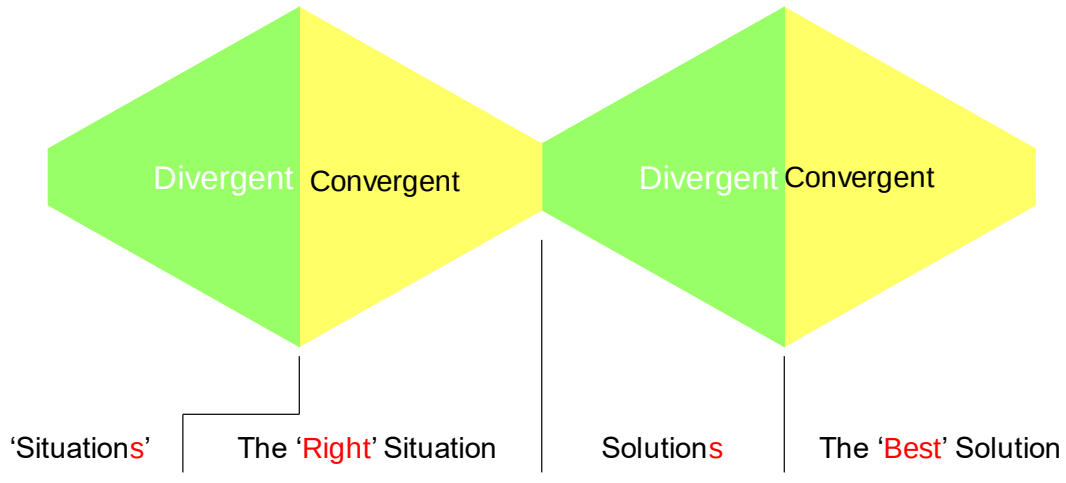


Figure 4: 4G Customer Survey Effect

3) Specific to the assessment of creativity, there is a need to account for the divergent-convergent nature of the creative process. ‘Effective creativity’ in our terms, requires at least two of these divergent convergent cycles, and any measurement instrument therefore had to be able to accommodate each of them. What this meant in practical terms is that there was a need for a combination of open and closed question types.



The first version of the Creativity Scan was eventually launched in 1999, really as a fun way to drive traffic to our website. Then, as luck would have it, it was featured on BBC World, and within the space of a few weeks we had had over 100,000 people taking the test. We had hit upon a nerve it seemed.

A big enough nerve to prompt us to conduct a series of controlled experiments to try and validate the findings of the test. Over the years we’ve had various opportunities to do this

with some of our long-term innovation clients. Clients that had already done much work to try and understand the ‘creative potential’ of the people within their work teams.

These trials, plus the continued interest in the Scan (to date the total number of completed tests is well over 500,000) have since prompted us to undertake an ongoing programme of enhancements.

The first of these targeted the open questions featured in the Scan (‘what can you see in this picture?’). The first version of the tool simply tallied the *number* of answers that a person chose to enter, but did nothing to assess the relevance or quality of those answers. When we first built the tool, computer-based semantic analysis tools were not readily available. Now that they are, it has become possible to do a far better job of gauging the ‘effective creativity’ being demonstrated in a person’s answers. If a respondent enters words or phrases connecting potential uses of a brick to ‘building a house’ for example, this ought not to score as highly as, say, ‘topping a cake’ – a connection that requires two degrees of separation (brick – chocolate – melt). The greater the number of this kind of separation, we hypothesized, the greater the level of creativity.

The second, still not formally launched evolution, brings the Creativity Scan into the fold of the growing suite of PanSensic (www.pansensic.com) narrative analysis software tools. Rather than asking someone to fill in a questionnaire, the PanSensic strategy says that we can automatically assess a person’s ‘effective creativity’ by scraping large amounts of their (already existing) narrative data – Facebook page, blog articles, email traffic, etc. We’ve already built the tools to automatically assess a person’s MBTI, Belbin or KAI score. In the next couple of months, we’re expecting to be able to add the Creativity Scan to that roster. In this way, we’re hoping to be able to engage past, present and future users of the Scan to assist us in the job of cross-calibrating the automated Scan output coming from PanSensic with the results obtained when someone takes the questionnaire version of the Scan.

Once that’s done, we’re a mere step away from being able to conduct very wide-ranging analyses of ‘effective creativity’ across wide swathes of society. How creative are British people relative to how creative they *think* they are? Are surveyors and accountants less creative than other professions? Are the ‘creative arts’ creative at all? We’re pretty close to really knowing for the first time in mankind’s history. I’m feeling a little nervous already.

Really Not Funny – Reasons For Visiting The Hospital

Among the funny - and sometimes tragic - stories doing the rounds in hospital casualty departments is the one of the patient who waited hours to see a doctor because the new shoes he had been given for Christmas were giving him blisters.

The man sat patiently for four hours before a doctor was free to see him, and when it was pointed out to him what the problem might be, said: "Gosh, doctor, you could be right."

Here's a recently compiled 'Top 10' – as in, 'these things happen a lot' – most ridiculous reasons people call 999 or go visit their nearest Accident & Emergency department:

10) 'patients' wanting someone to cut her toenails because they have been unable (or too lazy) to organise a chiropody appointment.

9) Diarrhoea.

8) Constipation.

7) Sick pets… how dare there be no NHS for animals.

6) Hangover.

5) "I didn't want to wait for a cab." Patients that thought the 20 minute quote that the taxi company gave them was unacceptable, so decided to dial 999 and thus save themselves a few precious moments blue-lighting past the other traffic…. For an ingrowing toenail. Or blocked nose.

4) "I heard this on the news..." Whether you agree with it or not, the media is the one who controls this country and ultimately the knowledge that you and I have. People see on the news, that the latest flu virus has killed a person and that you, as the general public, should get checked out immediately if you show symptoms. One has died....out of 10,000,000. So here we go. You get the sniffles, here we come. You get a sneeze, here comes the ambulance. You get nauseated, (not factoring in the large Mexican dinner you

had), here comes the ambulance. The media, in whom you consider a source that is educating you, has induce a panic in which they think that the end of the world is near.

3) "I ran out of medicine" Um..okay...and what would you like *an ambulance crew* to do about it. I mean, if it is a true medical emergency where you may need an Albuterol treatment for your asthma, then I'm sure they would be more than happy to help you, but because you ran out of your antibiotic for your infected toe...if the crews didn't laugh about it, they'd cry.

2) "I thought it would go away" Now before you crucify hospital staff with this one, this is for a special breed of patients. These people are the ones that have been sick for over a week, have not gotten any better, and on a late Sunday night, need medical care with the excuse "my doctor is not in so I called you." Well, most private physicians are usually NOT in at midnight on a Sunday morning and I could see how they were not in the office ALL WEEK that you were sick.

1) Items found in "inappropriate places." Enough said.

And here's a different Top 10, this time, one ranked in terms of people for whom the only sensible remedy involves some kind of public humiliation. Preferably flogging.

10) A woman who couldn't remove her false nails.

9) A woman who had paint stuck in her hair.

8) A mother who took her child to A&E because he had stepped in dog poo and she wanted staff to clean it off.

7) A woman rushed to the department saying her hand had turned blue. It was dye from her jeans.

6) "I didn't want to wait in the triage area". This is the person who decided they had been waiting for too long, has seen ambulance cases 'getting ahead' of them in the queue and

have called 999 from within the room to get an ambulance to come and move him up the queue.

5) A man had the word “dick” written on his forehead in permanent marker pen, and wanted it removed.

4) Four-month-old verruca.

3) The woman with the turkey - a woman rings the hospital up asking how long she should cook her turkey. "The nurse who took the call said it was hardly an accident and emergency problem, to which the woman replied: 'If we don't cook it properly, we're going to get food poisoning and we'll have to come in - then it'll be your problem'. "We told her to give it 20 minutes per pound plus twenty minutes on top and she seemed satisfied."

2) A woman who dialled 999 to ask if paramedics could bring in her washing. The incident happened during a 2015 cold snap. The unnamed woman asked ambulance crews to collect her laundry for her because she didn't want to walk down her icy path.

1) A man called 999 as his wife had gone out and not left him anything to eat.

Across England, unnecessary A&E attendances are estimated to cost at least £80 million to £100 million a year. Every attendance at A&E in the UK costs a minimum of £59.

A new campaign is urging people not to go to A&E unless their condition is a genuine emergency, after figures suggested as many as a quarter of people who go to A&E could care for themselves or use alternative treatment. In true NHS fashion, I suspect the whole thing will back-fire badly. In a society where many seem to crave their ’15 seconds of fame’, getting their name in the paper by doing something utterly stupid start to look like a viable option. Rather too many have realised that dialling 999 is the best short-cut to fame ever devised. Flogging fame-seeking ‘patients’ isn’t currently legal, but I’m willing to start a petition.

On the other hand, it seems the street runs in both directions:

Woman falls in hospital, told to call ambulance

LAURA STONE
AND THERESA BOYLE
STAFF REPORTERS

When Doreen Wallace fell and broke her hip in the lobby of a Niagara Falls hospital, she figured at least she'd get help — and fast.

But that's not what happened.

Instead, the 82-year-old Wallace — who was leaving with her son after visiting her dying husband at Greater Niagara General Hospital on Oct. 8 — was told by staff no one could help her until an ambulance was called.

To a hospital

erybody who walked through the door stopped and stared at me," said Wallace, who already had a broken arm from a previous fall. She ended up spending almost 30 minutes on the ground.

HOSPITAL continued on A17

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Store and box price Monday to Friday $1.00 including tax (prices higher outside the GTA)

Patent of the Month – ElectroKinetic Nanothruster

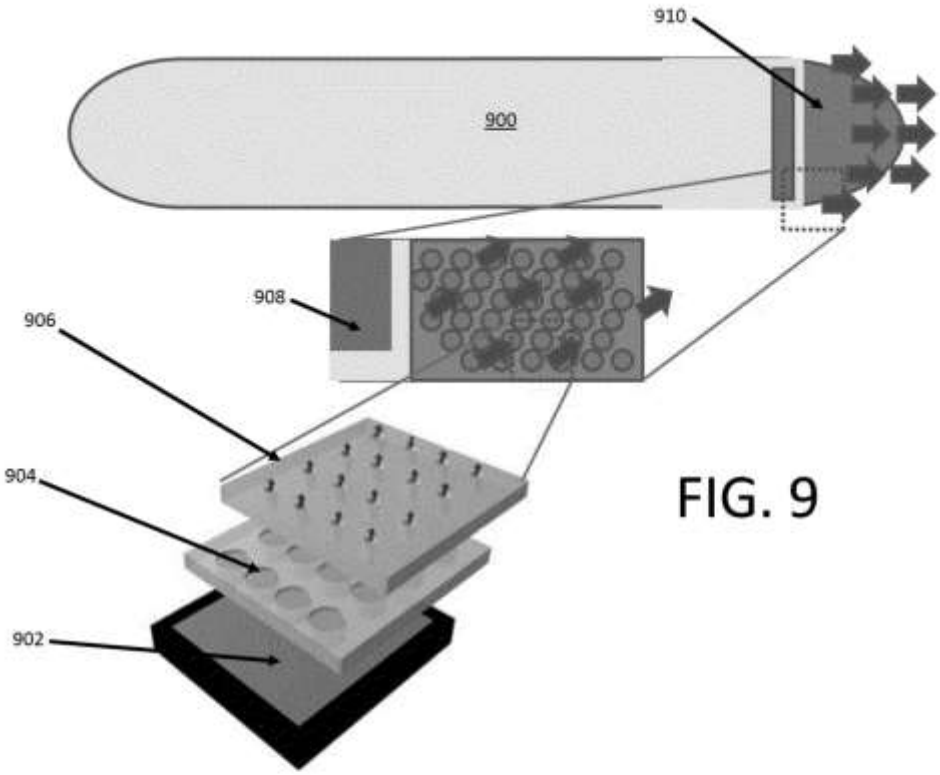


FIG. 9

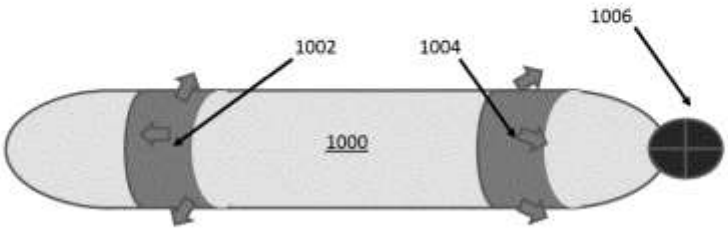


FIG. 10

Here's another one we've been watching for a while. Finally the patent has been granted to a Rutgers University inventor. US9,252,688 was published on the 2nd of this month. What got us excited when we first noticed the application just over two years ago was the fact that, although electrokinetic phenomena were first observed experimentally in the nineteenth century, it has been conventional belief that The Nano electrokinetic thruster is a merely theoretical solution for essentially space propulsion systems. The concept is based on the principle of electro-osmosis. The theory allows for a high specific impulse and high thrust-to-power ratio as well as a high final velocity which, again 'in theory' makes it suitable for a wide variety of applications. Due to real world difficulties associated with production, the theory has remained precisely that. Until now at least. Here's what the invention disclosure has to say on the matter:

An electrokinetic actuator for a propulsion system is described. The actuator includes an array of channels, with each channel having an inlet and an outlet. A reservoir is included that contains an

ionic solution of particles. A first electrode proximate to the inlet and a second electrode proximate to the outlet are connected to a voltage source. The voltage source and electrodes apply a voltage across the length of the channels to generate an electric field parallel to each channel. The electric field causes an electro-osmotic flow of ions from the reservoir to the outlet producing electrokinetic thrust at the outlet. By varying the concentration of the ionic solution and the magnitude of the electric field, the electro-osmotic flow of ions is controlled.

In one scenario, the electrokinetic actuator can be used to propel a space craft. This scenario exploits the advantages of the electrokinetic effect as the basis for a new class of nano-scale thrusters suitable for space propulsion. Among such advantages are their small volume, fundamental simplicity, overall low mass, and actuation efficiency. Their electrokinetic efficiency is affected by the slip length, surface charge, pH and molarity. These design variables are analyzed and optimized for the highest electrokinetic performance inside nano-channels. The optimization is done for power consumption, thrust and specific impulse resulting in high theoretical efficiency with corresponding high thrust-to-power ratios.

In another scenario, the electrokinetic actuator can be used to propel an underwater vehicle. The electro-hydro-dynamic model of the electrokinetic flow in nano-channels and represents the first attempt to exploit the advantages of the electrokinetic effect as the basis for a new class of nano-scale thrusters suitable for underwater propulsion. Among such advantages are their small volume, fundamental simplicity, overall low mass, and actuation performance. For a given working fluid, the electrokinetic performance is affected by the slip length, and surface charge. These design variables are analyzed and optimized for thrust, thrust-to-power ratio, and velocity inside nano-channels.

And here is the basic Claim:

1. A vehicle propulsion system having an electrokinetic actuator: an array of channels of the vehicle propulsion system, each channel having an inlet and an outlet; a reservoir containing an ionic liquid solution; a first electrode proximate to the inlet and a second electrode proximate to the outlet; a voltage source, connected to the first and second electrodes, configured to apply a voltage across a length of the array of channels to generate an electric field parallel to each channel, wherein the electric field causes an electro-osmotic flow of ions from the reservoir to the outlet producing electrokinetic thrust at the outlet.
2. The vehicle propulsion system-according to claim 1, wherein each channel has a length of 100 nm to one micron.

From a purely practical perspective, the invention represents a new entry into the Function Database part of the TRIZ/SI methodology. That said, because the concept has been known about for some time, one might also say that the contradiction the Rutgers work has solved is all about the desire to create a useful propulsive force being hindered by an inability to manufacture at a sufficiently small scale. Here's what that conflict looks like when mapped on to the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Force/Torque (15)

WORSENING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Stationary Object (4) and Manufacturability (41) and Manufacturing Precision/Consistency (42)

SUGGESTED INVENTIVE PRINCIPLES:

28, 35, 37, 17, 10, 15, 18, 5, 29, 9, 6, 40, 36, 12, 14, 16, 13, 25

And here are a few choice snippets from the detailed description of the invention to help illustrate some of the Inventive Principles we can see illustrated:

The operating principle behind the proposed electrokinetic thrusters (EKT) exploits a nano-scale electric double layer (EDL) that forms along non-conductive walls resulting in a stream of ions that can accelerate a column of a fluid when an electric potential is applied across the non-conductive channel.

In the underwater scenarios… gas production at high voltages from electrolysis of the water at the electrodes may present a limitation on the amount of voltage applied across the nanochannels which will limit the magnitude of the electric field. One method of overcoming this limitation is fast pulsing of the voltage. When the voltage is alternated between a positive and negative voltage at a rate faster than the reaction time of the oxygen and hydrogen in the water, gas production does not occur. The flow rate of the ionic solution can be maintained by proper timing of the voltage pulses. Since the flow rate is dependent on the product of voltage and time, a high flow rate can be maintained by applying a voltage in one direction that is substantially higher than the alternating opposite voltage.

Our guess would be not to expect to see real world manifestations of the invention sailing around your local marina anytime soon, but hopefully that shouldn't stop us admiring another important shift from mechanical to 'no-moving-parts' 'field' based propulsion means. It's like the future just arrived.

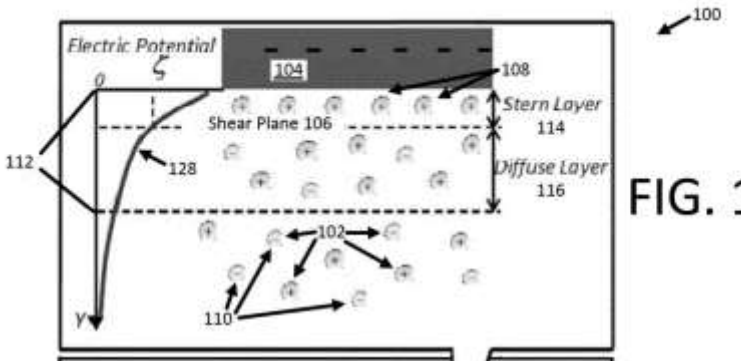


FIG. 1A

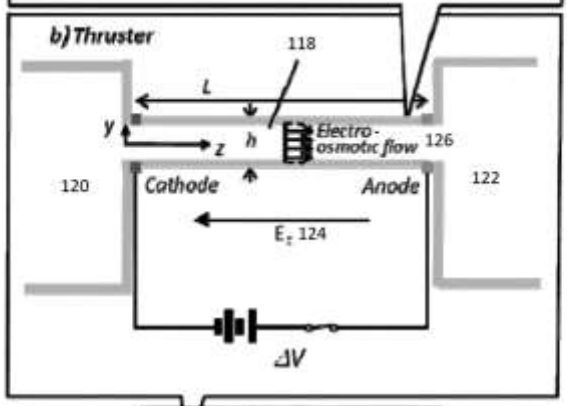


FIG. 1B

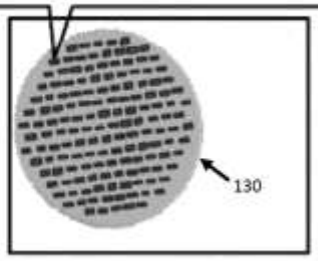
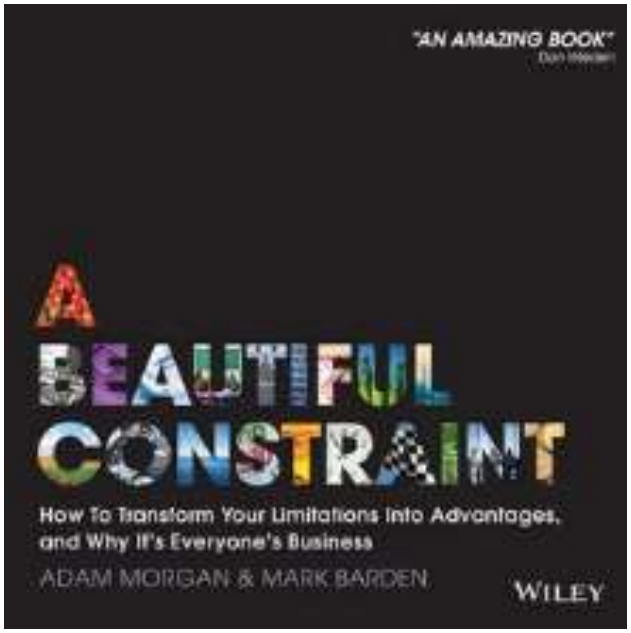


FIG. 1C

Best of the Month – A Beautiful Constraint



I have to admit, at first, I hated this book with a passion. Yet another book, I thought, where a pair of blinkered idiots re-invent TRIZ. Badly. This version being one of the more unusual cases where the part being re-invented is Contradictions. And, true to convention, when it comes to trying to re-invent the TRIZ contradiction resolution strategies, this book is no better than the norm. The authors manage to find eight of the 40 Principles. Congratulations! Not.

Beyond this frustration, however, the two authors, marketing consultants Adam Morgan and Mark Barden, have actually done a very elegant job of making the contradiction subject more interesting than the TRIZ community ever has. The pair begin their investigation into constraints (e.g., too little time, too little money) and how to overcome them by dividing the world into three kinds of people: *victims*, who lowered their ambitions when faced with constraints; *neutralizers*, who did not lower ambitions but instead found different ways to achieve them; and *transformers*, who saw constraints not as barriers but as something that could be used as opportunities. Transformers, according to the authors' theory, even believed that constraints could be leveraged to achieve even greater ambitions. In fact, the authors identified two sub-types of transformers — the *responsive transformers*, who successfully responded to constraints, and the *proactive transformers*, who deliberately imposed constraints on themselves to spur greater creativity and ambition. In case you missed it, the 'pro-active transformers' are the TRIZ-people of the world.

For the authors, world-class graphic designer Michael Beirut, whose clients include the New York Ties, Saks Fifth Avenue, Disney and The Clinton Foundation, represented one of the transformer type. However, when they interviewed Beirut, he disagreed slightly with their concept. Victims, neutralizers and transformers were not three distinct types of people, he told the authors, but three stages through which everyone goes through as they face constraints. "This was an important shift in our thinking," the authors write. "If we have a tendency to initially react one way to the imposition of a constraint, we need not

see this as fixed and final. We all have the potential to move from victim to neutralizer to transformer."

In *A Beautiful Constraint*, the authors lay out a six-step methodology for progressing through the stages — a methodology that addresses mindset (do we believe it is possible?), method (do we know how to start to do it?) and motivation (how much do we really want to do it?). After discovering in the first step the potential of the transformer stage, that is, using rather than defeating constraints, step two (also focused on mindset) involves, in the authors' terms, breaking path dependence. Most people, the authors write, eventually come to depend on certain well-trodden paths that they take to achieve their goals or commitments. Becoming a transformer requires understanding that we must break our dependence on these paths.

The next three steps deal with the method for breaking this dependence and discovering ways to use constraints. Step three is to ask *propelling questions* — questions that will propel us off the comfortable tried-and-true paths. Step four (the rubbish-TRIZ part) is to adopt a can-if mindset: instead of thinking, "we can't because …" transformers consistently say, instead, "we can if …" Step five is to *create abundance* — to recognize that we inevitably have more resources than we think we have. After the three "method" steps, the authors close their methodology with the final step, linked to motivation: activating emotions, which explores the potent role that emotions — from fear to excitement — play in generating the passion and persistence required to transform constraints.

Each step is supported with multiple examples. Best of all, they've managed to avoid the 'usual suspect' case studies and found a near goldmine worth of compelling unknown stories and examples. For example, the creators of the FIFA 13 game faced the constraint of a long load time, which frustrated their gamers. A propelling question — "How can we make waiting a valued part of the experience?" led to a can-if solution: "We can turn loading time into one of the most rewarding parts of the game if we think of it as a chance to build skills and make better players." The solution to the loading constraint was thus: skill-building games that gamers could play during the load.

This book highlights the full potential of print publishing: engaging graphics and illustrations and a clear design reinforce and support the insightful and inspiring lessons of looking for and challenging contradictions. Remove the rubbish step-four chapter and replace it with a TRIZ Contradiction text book of your choice, and what you're left with is quite possibly the best Contradiction communication tool yet created. To the point that I'm suggesting many of our clients use this as an easy entry into the subject.

Wow In Music – Heroes: David Bowie RIP

10 January 2016 saw the end of an era. The passing of David Bowie marked what will probably be the last of the mainstream musical innovators. Never has there been an artist that has had so much popularity and simultaneously re-invented his image and the music he made so many times. Few artists have the wherewithal to re-invent themselves once. Bowie managed the feat a dozen times.

I think it is not only instructive but quite enlightening when we have the opportunity to know more about the creative processes involved in the work of the artists we admire. Richard Buskin's account (below) is one of these cases and describes Bowie's interaction with fellow musicians like Brian Eno and Carlos Alomar who, in the mid-seventies, got involved in the creation of 'Heroes', "a highly experimental piece of art-rock" and one of

Bowie's major hits. Berlin, where Bowie had just arrived, a "stark, scary place (with) a very exciting nightlife" seems to have had an impact in this process. I think you will be delighted with this story:

"1977 was a busy year for David Bowie. He produced Iggy Pop's records The Idiot and Lust For Life, toured anonymously as Iggy's keyboard player, made a film appearance alongside Marlene Dietrich and Kim Novak in Just A Gigolo, and narrated Eugene Ormandy's version of Peter And The Wolf. After relocating to Berlin following the release of his avant-pop opus Station To Station the previous year, he began straightening out from a coke addiction, studying art and immersing himself in Euro-expressionist, synth-based music. Accordingly, early 1977 saw the release of Low, Bowie's experimental and highly influential electronic album which, courtesy of his collaboration with Brian Eno - an acquaintance from Bowie's Ziggy Stardust days, when Roxy Music were his opening act - fused mainstream pop with the avant garde, and he quickly followed this up with the equally groundbreaking Heroes. Again utilising the talents of Eno, this record echoed Low's semi-vocal/semi-instrumental structure while boasting a more heavily layered, harder-edged sound, thanks in part to the guitar contributions of Robert Fripp. In turn, the hauntingly atmospheric title track became an international hit."

"Working with Bowie is much more than going to a studio," asserts Tony Visconti. "It's a social event, too. We would eat together, go to shows together, go to clubs together, and really soak in the local culture. That was always his way of working, and Berlin was perfect for him in terms of what he wanted at that time. It was a stark, scary place, yet it had a very exciting nightlife, with exotic locales such as the Turkish quarter, and it was swarming with artists like Tangerine Dream, who were friends of ours. David was writing with Brian Eno back then, and the three of us got on really great."

"Since Station To Station, David had been working with a rhythm section consisting of Carlos Alomar on guitar, George Murray on bass and Dennis Davis on drums. All three were amazing musicians. You'd just throw a few chord changes at them and they'd run with it. Carlos, especially, could whip up these little instant licks that would gel the whole thing together - he's a rhythm guitarist extraordinaire, and his lead playing ain't so bad either. Bowie and he would bounce off each other brilliantly - Carlos might come up with the germ of a part, and then Bowie would help him elaborate, but once the two of them began exchanging ideas back and forth, you'd get amazing stuff."

"For instance, the underlying riff on 'Heroes' was Carlos's idea, as was the pre-chorus part, which is like a viola and cello section, whereas Fripp overdubbed the high, wailing parts. The point is, David's modus operandi would be to throw a bunch of chord changes and a bunch of ideas in a very loose structure at the band, and he knew he could rely on those guys to immediately do something. They were jam experts, and so within half an hour they would jam the few chords that David threw at them into a wonderful structure. The lyrics would often come about a month or two later. We would work on the musical content, David would have some idea as to what the song was about, and we would use that idea - like if it was going to be a happy song or a depressing song - to make the instruments come out with an emphatic arrangement or sound in order to invoke the desired emotion. Then the stage would be set and David would just throw his lyrics on at the very last minute. He would write his lyrics in a morning, it would take him an hour or two, but beforehand he'd also need a month or two to let the ideas really germinate."

"Such was the case with 'Heroes'. Before recording commenced on the album, Bowie and Eno spent a couple of weeks working out some basic song structures, but again there were no lyrics and no melodies. One of the stronger structures was that which would

evolve into 'Heroes', yet whereas the finished version clocks in at just over six minutes, the track was actually about eight minutes long when it was recorded.”

“We just kept going round and round with these very long cycles of verse, two verses and then pre-chorus and chorus," Visconti recalls. "Then, about four minutes down the line, a bridge kicks in. When you record in this fashion it's inevitable that you bring out the razor blade, and if you looked at a lot of the Heroes multitrack tapes you'd see loads of edits. Most of the tracks on that album had to be cut down as we would just over-record, but sometimes it would be useful to do that because we'd find, for instance, that there was a better chorus at the end. I would make a 24-track to 24-track copy and edit that chorus earlier because it was played better or whatever. This was before Pro Tools! And it was dangerous living, because you couldn't do too many edits on the same point without the tape starting to curl up or the backing coming off. You had a maximum of, say, two edits that you could do and undo in the same area, but we firmly believed that if you didn't do it, it wouldn't be worth keeping the track anyway. So, living dangerously wasn't that dangerous really.”

“Having completed his contribution after about two and a half weeks into recording of the Heroes album (representing the first third of the project), Brian Eno departed, and at that point it was a case of 'What shall we do next?' for the co-producers. Among the answers was a sound resembling a Stax horn part that surfaces at the start of the title track's second verse. As it happens, this was a brass patch out of a Chamberlin, successor to the fabled Mellotron, which Bowie had first employed on the Diamond Dogs album and which now provided a cheap and instant - if less desirable - alternative to real-life sax and trumpet players.”

“It was definitely written as a trumpet part, but it sounds more like a weedy little violin patch," Visconti admits. "Still, we liked it in the end. We just said 'Oh, that'll do,' because it sounded weird.”

“In line with this way of thinking, when the two men wanted to add a cowbell and didn't have one immediately to hand, they sufficed with an empty tape reel of the German variety; a metal plate on which the tape basically sits. The echoey result of David Bowie and Tony Visconti alternately bending it out of shape with a drumstick was achieved not using artificial reverb, but by miking it in the large room at Hansa.”

…

“One of Bowie's most hypnotic recordings, 'Heroes' draws in the listener by way of a multi-layered rhythm, while the vocalist builds from a low croon to near-hysteria. The aforementioned live trio of Alomar, Murray and Davis was augmented by Bowie on piano, the band remaining in Berlin for about 10 days as per the norm for his projects.”

“David likes to do these backing tracks, he gets very enthusiastic about them," Visconti explains, "but we send the band away very quickly and maybe keep a person like Carlos for an extra day or two so that we can double-track some of his parts. With 'Heroes', on the other hand, we built the track over the course of an entire week of careful overdubbing. For instance, Brian brought his EMS Synthi with him, which is a synthesizer built in a briefcase, and it has no real keyboard - it's got a kind of flat, plastic keyboard which Brian very rarely used. He used the joystick a lot, and the oscillator banks, and he would do live dialling - they look like combination-safe rotary knobs on the three oscillator banks. Brian goes down on record as saying that he's a non-musician - he even tried unsuccessfully to have that listed as his occupation on his British passport - and, like David, he thinks very radically and from a completely different space.”

“So, after recording the live rhythm section, everyone went home and a week later we came back to this track that was tentatively called 'Heroes', and Brian took out the EMS Synthi and got this shuddering, chattering effect by using oscillator 1 at a very, very low frequency rate - probably five cycles per second - and working the noise filter. He would slowly change the speed or change the intensity with other knobs, and he did that in a couple of passes of the tape, which by now had been edited down to just over six minutes. If you listen to the track now, this shuddering, chattering effect slowly builds up and gets more and more obvious towards the end, and that kind of set the mood.”

“Then I'd say the next thing that really moved the track along was Fripp's contribution. We already had Carlos's beautiful lines, like the bass line that was doubled on the guitar as well as the melodic part on the pre-chorus, and when Fripp came along about a week later he added a whole other dimension. He and Eno had already enjoyed a long partnership where Fripp would plug his guitar into the EMS Synthi and Brian would just play around with it, so Fripp did exactly that and he came up with that beautiful line which everyone thinks is an E-bow sound, but which is actually just Fripp standing in the right place with his volume up at the right level and getting feedback.”

“Between Bowie, Visconti, Eno and Fripp, everything was done by committee, with each person throwing in suggestions that might contribute to the final product. It was the producer/engineer's idea, for example, to triple-track the guitars in order to smooth out a sound that was patchy on the first pass. "When the song was first recorded, we had no idea what a verse and chorus were," says Visconti. "If you listened to it, the verse could have easily been a chorus, because it had a hook to it, but that was slowly evolving as we were overdubbing these instruments. Those guys are real artists. They're truly imaginative throughout the whole process, and nothing is done for the sake of it. You know, with Bowie you don't double-track a guitar because you have to. It has to have a meaning for him in order to do that, and quite often he likes things to remain single-tracked. I mean, the Beatles didn't double-track everything - sometimes they had one guitar, but it would be at the forefront of the mix, providing a very important, very solid sound, and double-tracking or triple-tracking could have weakened that. However, in the case of Fripp, we wanted this dreamy, floaty effect, so triple-tracking had a purpose. And of course it was inconvenient, because I only had 24 tracks to play with.”

“For all the sonic experimentation on display, very few effects were employed during the recording, not even the Eventide Harmonizer which Visconti had applied to live drums on

Low after memorably informing Bowie and Eno that "it fucks with the fabric of time". Visconti only used it when mixing some of the Heroes album, and not the title track itself."

"It was enough to hear the sound of that large room on the drum kit," he explains. "The studio, which had been used to record symphonies during World War II, could accommodate about 150 musicians, and there was a stage which was probably a riser for the choir. It was at one end of the room, and we used that for Dennis Davis's drum kit. In those days, we'd usually put a drummer in a booth, but Dennis took advantage of all the space, and besides his tom-toms he sometimes had an extra snare, a set of conga drums and a single timpani. When that was the case, he'd often go around his kit, and as he was doing a tom fill he'd also play a few beats on the conga drum and a few beats on the timpani. So, although those fills may sound like overdubs, that's actually Dennis Davis playing live. He's a wacko guy, one of the best drummers I've ever worked with. 'Heroes' wasn't played to a click track, but its tempo is virtually the same throughout the entire six minutes, and that's thanks to Dennis. He's not only an innovative drummer but a human metronome, and he's also a jazz guy who never plays the same thing twice. Some of his fills were priceless - on the song 'Blackout', you'll hear a lot of those fills going right around the kit, from the toms to the conga drums, whereas on 'Heroes' he was a little more sedate."

"Less than sedate, when it came time to write the lyrics, was Bowie. "He gets very, very tense," Visconti confirms, "because he's now got to commit. So, I could feel it in the air."

"And the producer/engineer soon got a breath of fresh air when the main man asked him to take a break in the middle of the day. Happy to oblige, Visconti went for a walk by the adjacent Berlin Wall with backing singer Antonia Maass, and this couple then unwittingly aided the songwriting process by indulging in what they thought was a spot of covert smooching. "David could see us, and we quickly got written into the lyrics as the lovers who kissed by the wall," Visconti admits. "He wrote the entire lyrics looking out through the windows of Hansa Studios, and when I returned after a couple of hours and asked him how it was going, he said 'Oh, I've finished.' His assistant, Coco Schwab, then took me aside and said 'I think you and Antonia are in the song.' I was married at the time, so this story was never allowed to be made public, but I don't mind now."

"Anyway, David then told me he was ready to record his vocal, and after we did a couple of run-throughs during which he wasn't sure where to place the octave, we eventually came to the conclusion to sing the first two verses down an octave and the rest of the song up an octave. That was another good way of building up the track, and it prompted the break in his voice which he himself calls 'Bowie histrionics', where he has to put everything into it in order to hit those high notes. It's right at the end of his range."

"This was immediately after he'd written the lyrics, and immediately after this he said 'Come on in, let's do backing vocals.' You see, I'm his utility person - if there's a guitar part that needs to be played and there's no guitarist in the studio, I'll play it, and the same goes for bass guitar, keyboards and singing. So, Bowie and I performed the two tracks of backing vocals on that song, meaning that writing the lyrics, singing the lead vocal and then the backing vocals was all done within the space of about five hours. That doesn't always happen, and since then I've regretted telling this story to other groups I've worked with who think they can do the same thing. Very few people can write the lyrics on the spot in the studio and then perform a great vocal in just a few takes. Bowie's one of the few people on this planet who can actually pull that off." "

Heroes is full of inventive moments, but the one that probably causes listeners to keep returning to the track the most is the amazing vocal effect. Here's Visconti again:

Hansa was a studio where you could record symphony orchestras; you can have about 150 pieces in this room, and here was David Bowie standing in this enormous auditorium. Every time he sang – he could sing very loud – his voice was echoing off the walls and the ceiling and everything. I said, "Could you give me half an hour? I want to set up two microphones." So I set up a Neumann U-47 in front of him and then about 15 or 20 feet away I set up something like a 67, then way down the hall I set up another condenser microphone.

*I only had the one track left, so I couldn't record these microphones on separate tracks. What I did is put a gate on microphone two and another gate on microphone three, so when he sang like this [*deep voice*] those microphones wouldn't open up, you wouldn't hear the ambience in the room. When he sang like this [*loud voice*], the middle microphone would open up and when he went [*screams*] – that's called Bowie histrionics – all three microphones would open up and the reverb you hear on that recording is only that room.*

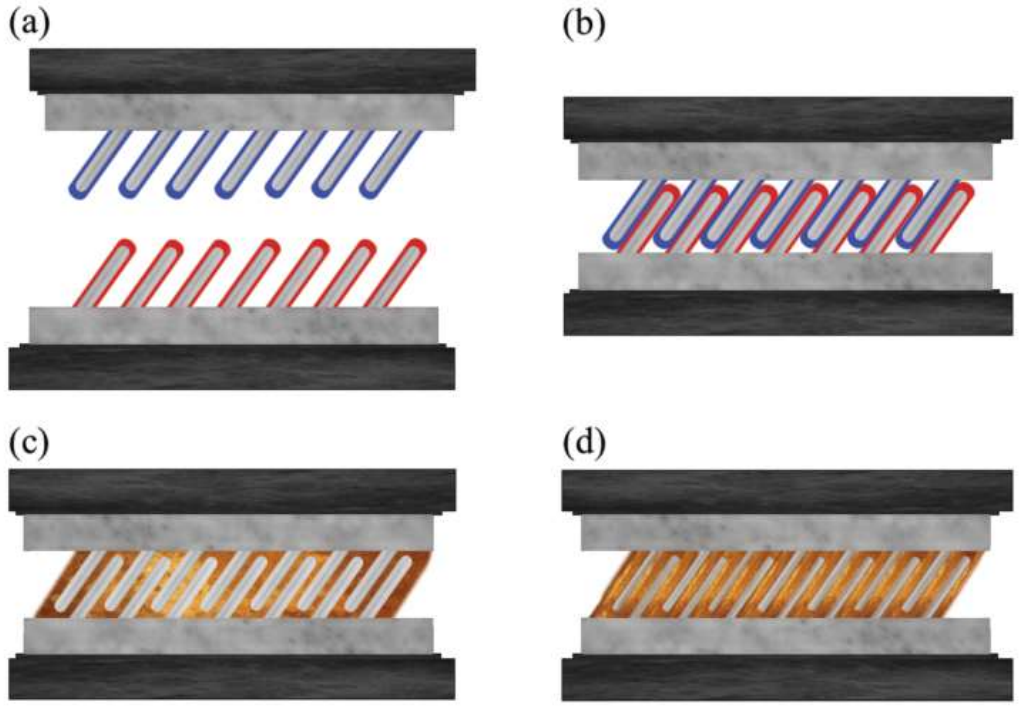
Go listen to the sing again and hear what the effect sounds like. Then think about Inventive Principle 7, Nested Doll and Inventive Principle 3, Local Quality, working together in perfect harmony.

Then, if you want to know more about this story, here is the link to the original article: http://www.soundonsound.com/sos/Oct04/articles/classictracks.htm

Investments – MesoGlue

It's not often we get to add anything new to the Function Database, but this month's 'Investment' recommendation is something that appears to merit a new entry in the 'Join' category.

A new type of metallic glue can bond two pieces of metal together at room temperature. Initial testing shows that the solidified glue is thermally and electrically conductive, and the bond is about as strong as a traditional weld, opening up a number of potential applications in electronics design and infrastructure. The MesoGlue is most likely to be used in the electronics industry and could help pack circuit board components more tightly than is possible with soldering, creating more efficient arrangements.
MesoGlue, developed by Hanchen Huang, a Northeastern University professor of mechanical and industrial engineering, works by interlocking metal nanorods that are treated with a coating of gallium or indium. The two substances are kept separate until a bond is desired. The gallium-coated nanorods are applied to one metal surface, while the indium-coated rods are applied to the other surface you wish to glue. The nanorods, once applied, stand up at an angle like the teeth on a comb. When the two surfaces are pressed together, the nanorods interlock in a similar way to Velcro. The gallium and indium react with each other to form a liquid that oozes into any open space. The liquid mixture then reacts with the exposed metal cores of the nanorods, solidifies, and binds the two surfaces together.



a) Coated rods are arranged along a substrate, like angled teeth on a comb. b) The teeth are then interlaced. c) When indium and galium come into contact, they form a liquid. d) The metal core of the rods turns that liquid into a solid. The resulting glue provides the strength and thermal/electrical conductance of a metal bond.

It requires some pressure to make sure the bonding process works, but that's it. No additional application of heat is necessary, so the bonding process is less likely to damage

electronic components. A paper detailing the glue's development was recently published in Advanced Materials & Processes.

"Hot processes like soldering and welding can result in metallic connections that are similar to those produced with the metallic glue, but they cost much more," says Huang on Northeastern University's research blog iNSolution. "In addition, the high temperature necessary for these processes has deleterious effects on neighboring components, such as junctions in semiconductor devices. Such effects can speed up failure and not only increase cost but also prove dangerous to users."

Besides circuit board components, the glue could serve as a replacement for thermal greases used in electronics. You could even glue your CPU directly to the heatsink to improve heat dissipation, as long as you're okay with them never coming apart again. Huang also believes the metallic adhesive could be used in solar panel technology and as a more efficient way to attach pipe fittings.

At this point MesoGlue can only be applied in a laboratory, but Huang and his team are working to develop a commercial version of the product that can be used at home. Just make sure you want whatever you're gluing stuck together forever before you go mixing the two parts of the metal adhesive.

Finally, in addition to offering us a new entry in the Function Database, it’s also worth noting the basic contradiction being solved by MesoGlue: the desire for bond Strength versus Temperature (i.e. we don’t want to weld). Looking up Strength-v-Temperature on the Matrix gives a pretty good instruction manual to get to the solution… Principle 3, 24, 35, 40 and a dash of 7.

Read more here:
http://mio.asminternational.org/amp/201601/files/assets/basic-html/page-22.html#

Generational Cycles – Waiter, There's A Y In My Soup

It's reached a point where I've become almost allergic to restaurants. Nothing to do with food, everything to do with Generation Y servers. They don't want to be there, and I don't want them serving me. I can empathise with their situation: I'm a grouch and they know there's nothing heroic whatsoever about serving food to sullen, mono-syllabic old people. It's a downward spiral that's difficult to escape from. On both sides of the equation.

Some restaurants have tried to resolve the impasse by instructing their staff to 'interact more' with the diners, 'engage them in conversation, be nice to them'. Sadly, this tends to make things worse. The Hero's idea of 'making conversation' is telling you all about themselves. And heaven forbid you should ever ask them their opinion about what they recommend tonight. Twenty minutes later, you're probably still caught in a conversation about what they ate for lunch last Thursday. Or was it Friday. No, it was dinner. Sunday.

Every generation knows that waiting tables is a terrible, terrible job. But then again, one of the functions of the role is to act as some kind of social-skills rite of passage. Everyone is supposed to spend a year or two being abused, mocked and generally treated like a slightly inferior being. It builds character. And an appropriate level of disdain for your fellow humans (there speaks Generation X). Enter the concept of 'paying dues': the right of every generation to get their own back on the next generation of servers. I suffered, and so now it's your turn.

Except it doesn't work so well when a Hero generation enters the picture. Heroes have been reliably informed by their parents that they don't have to stand for the abuse. They've also been told they don't have to 'settle' for second-best. They've been told they can be whatever they want to be.

(Somewhat ironic here that these self-same parents are the ones that get the other end of the unwilling server stick when they go to a restaurant. You reap what you sow. At least in theory. In practice, most whining GenX diners are whining about GenY servers that are very likely best friends with their own precious, over-protected offspring.)

Heroes don't pay dues.

Prophets and Nomads paid their dues, now they expect payback.

It's a situation that is never going to end well.

Not to mention what the Heroes tell each other about being a restaurant server. Here's a fairly typical blog article from a disenchanted Generation Y savant. If you're not a Hero, remember this next time you think about eating out:

Waiting tables in a restaurant is a terrible idea. For starters, your schedule is the complete opposite of that of everyone else in the world. When people are getting out of work, you're just going in. Everyday, you have to deal with an endless amount of commands, rude people and poor tippers. You're stuck as a server who earns close to nothing compared to the amount of work that you do.

Don't get me wrong; waiting tables can be fun for a summer job. The weird hours and endless restaurant bullshit forms an impenetrable bond between you and your co-workers. This bond usually equates to nights of aggressive binge drinking, sexual relations and mild drug use. ANYONE who's worked in a restaurant or bar can attest to this. It's just part of the business. The money isn't what's wrong. Waiters make enough money to get by on. It's the habits and mindset you'll build as a server in a restaurant that will ruin your life.

So if you managed to avoid the hospitality industry your entire life or have never had a job, I'll illustrate why waiting tables is the worst possible job for members of Generation-Y.

Here's a familiar scenario:
You come into work a few minutes late and take a minute to look at the schedule for the next week before the shift meeting starts. Your idiot (most likely, Generation X) *manager says something, but you brush it off because you don't really care what he has to say.*
Realizing that you are scheduled to work two weekend shifts and two weekday ones, you know that you're going to make good money but you also know that you'll be late to [insert coworker's name here] party on Saturday night. Oh well.
Even though you hate everything about your job, you keep coming back in week after week. You say you enjoy spending time with the cool people you work with, and unfortunately they're in the same position as you. However, you know that nothing about these people, or your job is actually cool. The only thing that may possibly be cool about your job is that as a server, you get paid in a way that's very uncommon for the rest of the job market.

You go into work and you leave work with money.
Repeat.
You go into work and you leave work with money.

A server expects an immediate return (cash) on their investment (time).
The immediate return (cash) acts as positive feedback, a direct reinforcement for the work that you just did. It's okay that you just spent eight or more hours getting covered in spaghetti sauce, bringing people extra money and wiping off dirty tables, the money's there. Money to pay your bills, money to go out, and money to buy things, money is comfort.
You might be serving tables one day in a horrible mood ready to quit and never return, but then someone leaves you a gigantic tip. If you're a girl there's probably a phone number attached. Your serotonin levels start soaring and it all becomes bearable again.

Cash is scientifically proven to bring us happiness. Getting to go home with it every single night isn't a bad thing. Oh wait, it's a terrible thing. It's the worst possible thing you can be teaching yourself.

Here's what happens: You become accustomed to getting paid to take orders and follow instructions. This becomes a habit. The habit becomes a mental state. Your concept of work

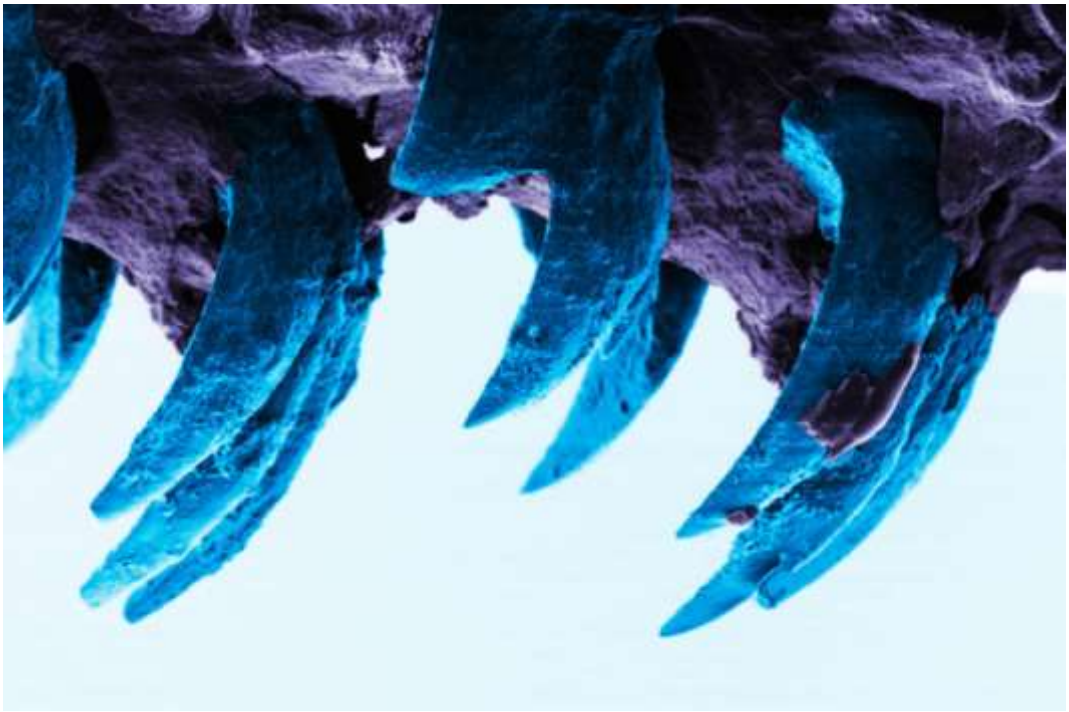
changes to this employee attitude.The employee attitude stifles your creativity and drive. There's no reason to be creative or try something new. You know what it takes to get paid and will do just that.You become dependent on this money and work environment. You find yourself unable to survive in other environments and situations.There's absolutely no freethinking or problem solving involved with waiting tables. I don't care whether you work at a five-star-steakhouse or local faux Italian chain. You're taking orders and bringing people things they're going to put in their mouths only to shit out later.

Why this should terrify you…
The jobs aren't coming back. As a member of Generation-Y, you're sitting in a talent pool that runs deeper than that of any other time in history. You aren't just fighting your peers either; you're fighting the girl in India who taught herself how to write Ruby on Rails in two months from tutorials on Youtube.

If you have the server's mindset, there is absolutely no way you will be successful.
Why? Because in real life, there is no direct way to measure input and output.
Who knows how many networking events you'll have to attend before you meet the right recruiter, client or business partner.
Who knows how many times you'll have to call, email, visit or text that prospect before you're able to turn the relationship into the biggest deal of your life.
Who knows how many times you'll have to face rejection, get thrown out and pull yourself together before you finally find the success that you're looking for.
Success can never completely be defined. You cannot throw hours at these problems and expect solutions. You need to be constantly learning, working and evolving to end up in a position where you will be "lucky" and be in the right place and right time.
This could take weeks, months, years or decades.
If you continue to work a job where you're developing the server's mindset, then you're going to be stuck. You aren't going to wake up one day and figure out what you're meant to do with your life. Each day is a struggle, an adventure, and a grind to work harder and explore creative solutions to the problems that surround us.
But if you're locked into this mindset where you take orders and follow instructions to get paid, that's all you're ever going to be.

Aah, the sweet, sweet smell of quarter-life crises.
Bring on the Real Heroes.

Biology – Limpet Teeth



Limpet teeth might be the strongest natural material known to humans, a new study has found. Researchers from the University of Portsmouth have discovered that have teeth with biological structures so strong they could be copied to make cars, boats and planes of the future.

The study examined the small-scale mechanical behaviour of teeth from limpets using atomic force microscopy, a method used to pull apart materials all the way down to the level of the atom.

Professor Asa Barber from the University's School of Engineering led the study. He said: "Nature is a wonderful source of inspiration for structures that have excellent mechanical properties. All the things we observe around us, such as trees, the shells of sea creatures and the limpet teeth studied in this work, have evolved to be effective at what they do. "Until now we thought that spider silk was the strongest biological material because of its super-strength and potential applications in everything from bullet-proof vests to computer electronics but now we have discovered that limpet teeth exhibit a strength that is potentially higher."

Professor Barber found that the teeth contain a hard mineral known as goethite, which forms in the limpet as it grows.

He said: "Limpets need high strength teeth to rasp over rock surfaces and remove algae for feeding when the tide is in. We discovered that the fibres of goethite are just the right size to make up a resilient composite structure.

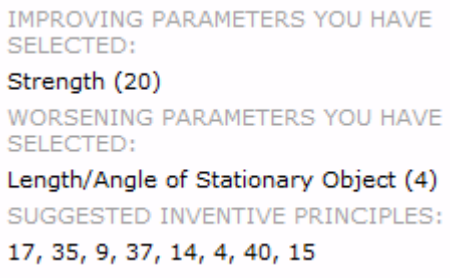
"This discovery means that the fibrous structures found in limpet teeth could be mimicked and used in high-performance engineering applications such as Formula 1 racing cars, the hulls of boats and aircraft structures.

"Engineers are always interested in making these structures stronger to improve their performance or lighter so they use less material."

The research also discovered that limpet teeth are the same strength no matter what the size.

"Generally a big structure has lots of flaws and can break more easily than a smaller structure, which has fewer flaws and is stronger. The problem is that most structures have to be fairly big so they're weaker than we would like. Limpet teeth break this rule as their strength is the same no matter what the size."

And perhaps that's the most interesting part of the story. At least contradiction-wise. Here's how we might best map the problem onto the Contradiction Matrix:



Which seems to fit pretty well in terms of the goethite (Principle 35) and the composite structure (Principle 40). I also have a suspicion that when the University is able to take their atomic force microscopy to the next level of capability we'll also start to see evidence of some of the other Principles… maybe we're reaching a point where the Matrix is telling researchers what they need to go look for?

For more details check out::
Asa H. Barber, Dun Lu, Nicola M. Pugno. **Extreme strength observed in limpet teeth**. *Royal Society journal Interface*, 2015 DOI: 10.1098/rsif.2014.1326

Short Thort

"Example is not the main thing in influencing others. It is the only thing."
Albert Schweitzer

"Sometimes, if you want to change a man's mind,
you have to change the mind of the man next to him first."
Megan Whalen Turner

News

InnoMeto
This one seems set to roll on and on. The latest is that there will now be two conferences, a little one on the 'original' 30-31 May dates, and a full version later in the year during November. The May version will take place at the newly completed AULIVE creativity-ranch in the Australian outback. I've been promised no leaches this time. More details from the InnoMeto website.

University Of Buckingham
In addition to the 'Big Data Analytics: Measuring What's Important' one-day workshop scheduled for 21 June, Darrell has been commissioned to run two other events this year. The first – 'Design Thinking For Managers' will take place on April 14 (http://www.buckingham.ac.uk/event/design-thinking for more details), and the third one – Systematic Service Innovation – will take place on October 18.

US
It looks like Darrell will be back in the US during April (21-29). Four of the days are already assigned to clients, but it looks like there are one or two days still free if anyone is thinking of doing something. Get in touch with Darrell directly to explore the possibilities.

HOSI Edition 3
In the process of finalizing the content for the 3rd edition of HOSI, we're looking for short reader comments to feature at the front of the book. There's also a small competition for

past readers. One of the things we see a lot is beat-up copies of the book, covered in annotations, sticky-tabs, blood, sweat and tears. Send us a photo of your bashed-up HOSI and we'll be giving our free copies of the new edition to the 'most used' entries. Send your photos to cara.faulkner@systematic-innovation.com by the end of April to be eligible for consideration.

New Projects

This month's new projects from around the Network:

- Government – PanSensic & Strategic study
- Retail – Strategic Study
- Industrial – SI Certification workshops
- Industrial – Strategic Study
- Tourism – PanSensic Dashboard
- Education – SI Certification workshops
- Pharmaceutical – Technology Roadmap Workshop
- Pharmaceutical – PanSensic Study
- FMCG – Strategic Study
- Manufacture – SI Certification workshop
- Automotive – SI Certification workshops
- Pharmaceutical – SI Certification workshop series
- Education – Seminar lecture series
- Insurance – TrenDNA Anthropology Project