# Systematic Innovation


# e-zine

Issue 168, March 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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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.
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(this article is based on a presentation given at DTU on 2 March)

# Don't Just Do Something, Stand There

These days, I fairly frequently end innovation workshops by heading back into the generic world of Continuous Improvement and the specific world of the Plan-Do-Study-Act cycle. My aim being to compare the original theory – that each of the four activities should receive the same amount of time and attention – and the distorted reality I see in most of the organisations I visit (Figure 1). I always make sure to say, 'I'm sure this doesn't apply in your organisation', but almost invariably the looks in the room indicate that it does. My point in the workshop is then to suggest that, even if organisations refuse to spend more time at the Plan stage, then they should at least be asking better questions. Like, for example, 'where's the contradiction?'

But that still leaves me, after the workshop has ended, with the question about why is it that we – all of us – are much happier Doing and Firefighting than we are Planning? Why can't we stop doing something and just stand there?

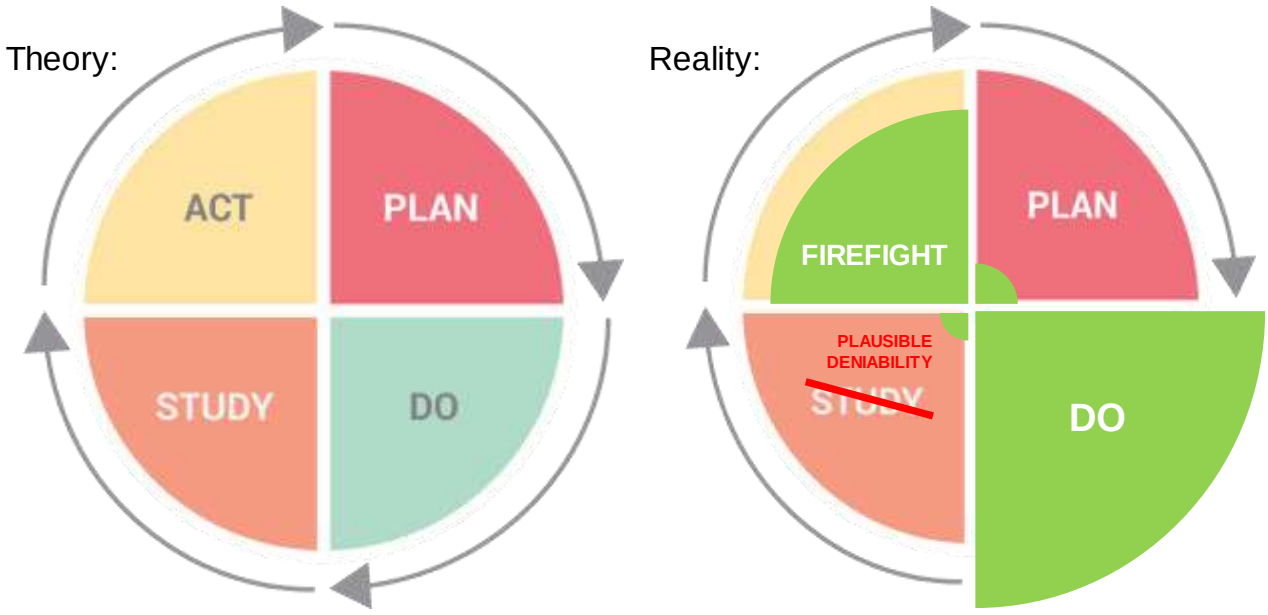



**Figure 1: Plan-Do-Study-Act Cycle – Theory Versus Reality**

## Three Why's

Having now spent a lot of time thinking about the problem, I think there are three underlying reasons that work together to create it. Each sits at a different point along a spectrum starting at one end with the manner in which our brains are wired, and at the other with the way that society has conditioned us.

Let's start with the brain. And specifically our limbic system. This is one of the older parts of our brain, the one responsible for our 'real reason' emotional reactions. It is, therefore, the one that triggers our rapid response to stress. Add a little bit of stress and our initial limbic response is a 'fight or flee' decision. Add more stress and we 'freeze'. On one level, 'freezing' sounds good because it is very definitely not 'doing something', but sadly, what

our limbic system has done when it causes us to freeze is effectively said ‘pretend you’re dead and see if the threat goes away’. We’re not doing something (good!), but alas, we’re not thinking either (bad!). The point here is that we don’t need very much stress for our limbic to take over. The moment our project hits a tricky patch, our limbic brain is telling us, ‘stop dithering, and do something’. We’re programmed by our evolutionary history to Do rather than Plan. If there’s a bear running towards you, your best bet is Do some fleeing.

If 160,000 years of evolution isn’t hard enough to fight against, at the other end of the Do-driver spectrum, many of the societal conventions we have put in place serve to reinforce the ‘stop dithering’ message. In that there are few sins in modern life as big as ‘procrastination’. No-one is going to look at us sitting at our desk, scratching our chin thinking about stuff, and conclude that we’re ‘working’. All of our reward systems – whether it be a kind word from our boss or our spouse or (damnit!) kids – are geared towards getting stuff done.

And then, perhaps worst of all, somewhere in the middle of the space between our limbic brain and the pressure society puts on us, come the words of the wise. The people we’re supposed to look up to in society. The messages they exhort. ‘Fast decisions, unless they’re fatal, are always best’ (most recently attributed to no less than Google’s Larry Page). Or, ‘Don't ask. Act! Action will delineate and define you.’ (Thomas Jefferson). Or, perhaps most famous of all, Tom Peter’s exhortation, ‘Ready, Fire, Aim’. Even one of the world’s foremost thinkers on complexity, Dave Snowden of Cynefin fame, tells us that the right thing to do in complex or chaotic situations is Do something before we sense and respond (Figure 2). Advice-wise, it seems, we’re basically not helped on any front in our quest to stop Doing something.


**Figure 2: Cynefin ‘Do Before Sense’ Advice**

## A Solution Clue?

All in all, it seems like we’re pretty much doomed when it comes to getting ourselves out of the downward Do-Firefight spiral shown on the right hand side of Figure 1. Surely, it can’t be the case that everyone is telling us the same thing? Where do aphorisms like, ‘look before you leap’ come from? Maybe they offer us some vague hope of a solution?

Perhaps the most well-thought through and proven version of this aphorism is USAF fighter pilot, John Boyd, who's success pretty much boiled down to the Observe-Orient-Decide-Act (OODA) Loop shown in Figure 3:

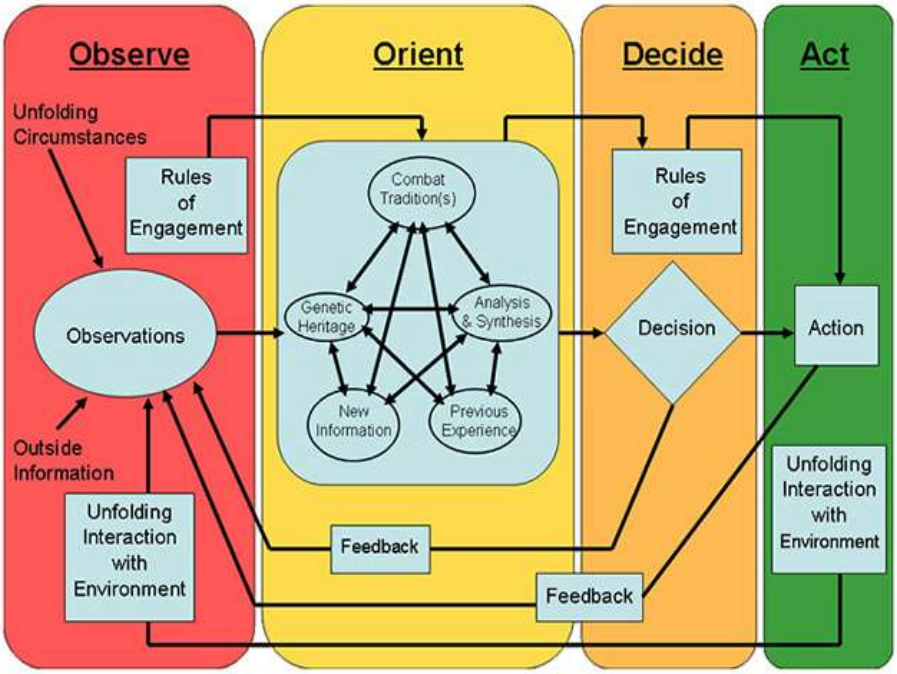



**Figure 3: Boyd's OODA Loop**

The only problem with the 'look' part of 'look before you leap', or the first 'Observe' part of Boyd's famous Loop is it seems somewhat vague in terms of what are we supposed to look *at*? The best Boyd offers up, looking at Figure 3, are the five arrows entering the Observations bubble – 'outside information', 'unfolding circumstances', 'unfolding interaction with environment', feedback from the previous Decision, and feedback from the previous Action. On one hand, that's a lot of stuff to think about, but on the other, it gives us little if any insight into Boyd's success as a Top Gun fighter pilot. We know our OODA cycle time is supposed to be shorter than that of our enemy, but in practical terms, we really don't know how to start the Loop off. We need to dig a level deeper…

**Observe What?**

A first useful think to Observe is what I usually refer to as the 'pulse rate' of a situation. Typically, when we in Systematic Innovation Land talk about pulse rates, we're talking about the rate at which, say, an industry is making discontinuous step-changes from one s-curve to another. But it can equally well apply to much more transient situations. One of the other common features of my workshops is the 'Save The Titanic' exercise. Here's the point where I give people five minutes to try and find resources to save everyone on board the sinking ship. One of the resources I provide to groups at the start of the exercise is the knowledge that the ship is going to take two hours to sink. I rarely use the phrase 'pulse rate' at this juncture in proceedings, but that's effectively what that two-hour figure represents: Two hours from now, the Titanic undergoes a significant step-change from an 'afloat' state to one of being 'sunk'. Two hours is not a lot of time, but it's not zero, and it also means that spending just five minutes, 'not just Doing something, but standing there' is a good investment of time. In those five minutes, I've never had a group ever that has failed to find sufficient resources to achieve the objective of keeping everyone alive. Most groups find sufficient resources in fact to keep the ship afloat. Perhaps the over-1500 people that in reality died on the Titanic is all the evidence we should ever need to

convince us that ‘Doing Something’ before thinking about what we do is not the smartest strategy in the world. Job one is think about the pulse rate.

Job two, then, Observation-wise, is what the aerospace industry is good at. Or perhaps ‘used to be good at’. The golden age of innovation in the industry probably culminated in the US ‘X-Plane’ activities of NACA and the first Skunkworks – Figure 4. Never before or since has so much ‘impossible’ stuff been achieved by so few, so quickly… perhaps because they too came under the influence of Boyd’s OODA Loop speed philosophy. What they added to the story was the imperative to Observe and focus on the *unknowns*.


**Figure 3: An Array Of X-Planes**

What unknowns? Three kinds in particular:

- All the things we don’t know
- All the things our opponents don’t know (whether that’s a MiG pilot, or the designer of the next MiG, or, in the case of the Titanic, ‘Mother Nature’)
- All the things we don’t know about the relationships *between* the unknowns

Once you’ve done the best job you can of understanding that lot, the next job is to do as cunning a job as possible to find the ‘biggest bang per buck’ unknowns you should focus your efforts towards solving. Solving a bigger unknown quicker than your opponent being the most significant driver. From the first X-Plane, the Bell X-1, onwards the whole Skunkworks rationale was about answering the biggest unknowns as fast as possible. The X-1, for example, was all about answering the unknown of ‘how to fly faster than the speed of sound?’ I doubt the Skunkworks team used the word ‘contradiction’, but to all intents and purposes, that’s what the unknowns they were working to solve in reality were: we want to fly faster, *but* when we approach the speed of sound the rules of aerodynamics change.

**Two Hows**

Something else they didn’t have in the classic-era Skunkworks was computer power. Today we’d tend to think of that as a problem. Computers mean we can make a better job of designing things like aircraft that can fly faster than the speed of sound. My first real job, in fact, was writing software to do exactly that. I had a big advantage over the team that designed Bell X-1. But on the other hand, they also had a big advantage over me. Or maybe over today’s generation of computer users. I might just’ve been early enough in the game to still understand what the advantage of not having a computer might be. And that

was forcing you to understand things from first principles. If you don't have a big number-crunching computer to do your maths for you, you have to think an awful lot harder about the problem you want to work on before you start dishing out the slide-rules to the team. Understanding things at the level of first principles, the Skunkworks people implicitly understood, was an extremely good way of making sure you solved the right problem in the most time efficient manner possible.

The other thing the original Skunkworks team didn't have, that unlike computing power, turned out to be less of an advantage, was that they didn't have access to the power of TRIZ. And specifically the contradiction-solving engine contained within TRIZ. Who knows how much more effective they could have been had they had access to a Contradiction Matrix that gave them a simple shortcut to 'someone, somewhere' that had already solved the 'big unknowns' they'd unearthed?

**One Way Forward**

The third thing Skunkworks people in the didn't have in the 50s was a clear understanding of complexity and complex systems. Or maybe they did. Maybe they knew just enough to know that Dave Snowden's 'Probe-Sense-Respond' advice was wrong and that smart designers did an Observe-Orient-Decide before they Probed.

Maybe they knew, too, that H.L. Mencken wasn't completely right when he stated, 'for every complex problem there is an answer that is clear, simple and wrong'. Maybe they knew, instead that, for every complex problem there are thousands of clear, simple wrong answers. But, then, also that there is also a clear, simple, right one. And that we are best able to find that one if we understand and affect problems at the level of their first principles.

**'Don't Just Do Something, Stand There'**

Is a quote I first heard used by Clint Eastwood to describe Gary Cooper's acting style. Perhaps no-one in the history of motion pictures mastered the art of 'doing nothing' than Gary Cooper. And yet, what he managed to convey amidst all of his on-camera inactivity was a character who was thinking deeply about whatever situation he was in. I like to think, too, that all that deep thought was about asking and answering the same questions as the X-plane designers:

- What's the pulse rate?
- What don't I know? What doesn't my opponent know? What are the unknowns between the unknowns?
- What are the most important unknowns? The contradictions?
- What are the first principles?
- Which ones can and should I answer to make sure I'm faster than my opponent's OODA Loop time and will beat whatever they might do?

Only when Gary Cooper know that, I think, did he stop standing there, and start clearing up Dodge. Or, in the case of High Noon, Hadleyville…

# Case Study: Hurricanes, Pop-Tarts & Optimization Versus Innovation

New York Times, November 14, 2004.
*"HURRICANE FRANCES was on its way, barreling across the Caribbean, threatening a direct hit on Florida's Atlantic coast. Residents made for higher ground, but far away, in Bentonville, Ark., executives at Wal-Mart Stores decided that the situation offered a great opportunity for one of their newest data-driven weapons, something that the company calls predictive technology. A week ahead of the storm's landfall, Linda M. Dillman, Wal-Mart's chief information officer, pressed her staff to come up with forecasts based on what had happened when Hurricane Charley struck several weeks earlier. Backed by the trillions of bytes' worth of shopper history that is stored in Wal-Mart's computer network, she felt that the company could "start predicting what's going to happen, instead of waiting for it to happen," as she put it. The experts mined the data and found that the stores would indeed need certain products -- and not just the usual flashlights. "We didn't know in the past that strawberry Pop-Tarts increase in sales, like seven times their normal sales rate, ahead of a hurricane," Ms. Dillman said.*

The Wal-Mart Pop-Tart-Hurricane 'prediction' story has been used almost endlessly by the Big Data Analytics industry since Wal-Mart went public back in 2004. Mainly as a proof-point of the value being delivered by the industry's new found ability to acquire, store and analyse terabytes worth of data. Here's a typical example of some of the hyperbole surrounding the story:

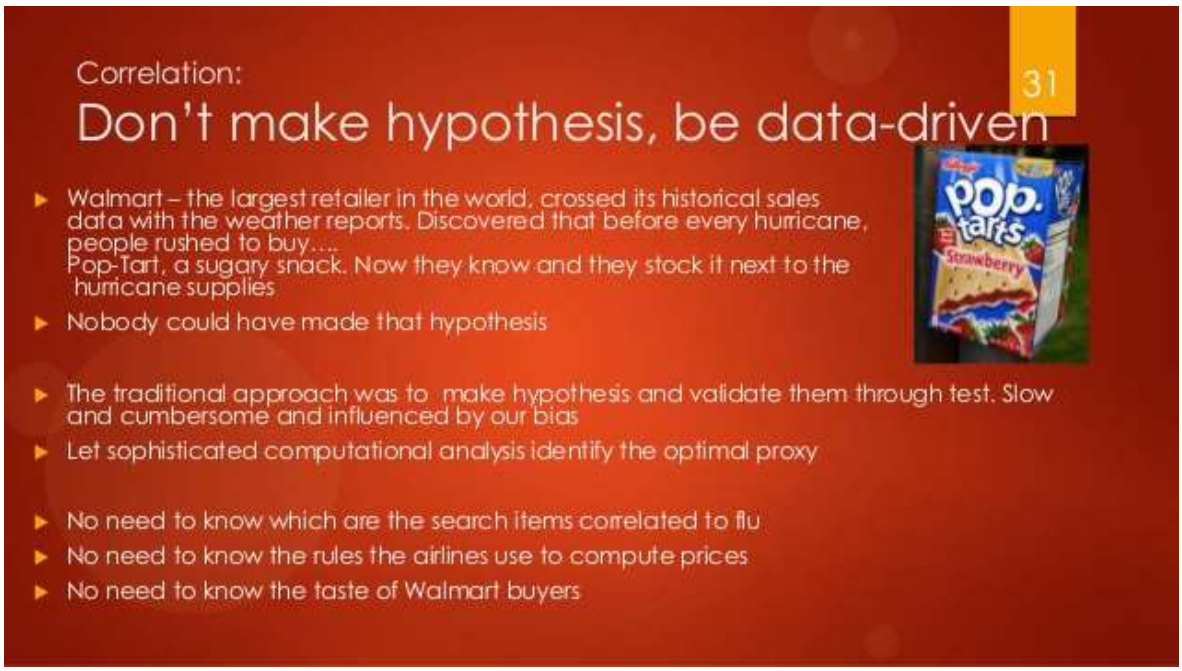



**Figure 1: BDA Predicts Pop Tart Sales?**

Pop Tart sales rise before hurricanes. Apparently, 'nobody could have made that hypothesis'. Except, of course, if they decided to engage their brain and spend more than a couple of minutes thinking about the problem. No need to go and interview people that have been involved in hurricanes in the past. Just think.

But, of course, computers mean we don't need to think any more. We just have to collect lots of data and then ask the computer to find interesting correlations. In the case of Wal-Mart in 2004 inevitably the 'data' they had access to was structured numerical data. A

mathematician's delight. Mathematicians love numbers. Give them enough numbers and enough computing power and they'll find all the correlations you'll ever want. And then several more you probably don't.

Sometimes these correlations can be useful. Oftentimes they're not. In the case of pre-hurricane behaviour the Wal-Mart team's 'discovery' about Pop Tart sales increases turned out to be a useful one. Hurricanes represent a fairly specific contextual framework around which to go and look for correlations. 'What correlates with hurricanes?' is, in the context of looking for correlations, a pretty good question to ask. If Pop Tart sales increased by a factor of seven every time there's a hurricane forecast, then it would be fairly sensible to assume that the same thing will happen next time there is a hurricane. Or at least it would until such times as someone stops analyzing the numbers, starts thinking, and innovates.

Such is the problem with optimization thinking. Wal-Mart's 'prediction' allowed them to anticipate the next Pop Tart surge by looking at weather forecasts, and then act upon the prediction to make sure the supermarket shelves were suitably seven-times over-stocked in anticipation. This is called using data to optimize your operations. The key word being optimize. As in 'not innovate'.

Here's the main problem with the BDA industry right now, it is caught in this kind of optimization-thinking prediction trap. Great to be able to optimize your ordering and delivery logistics to sell more Pop Tarts, but settling for 'optimization' almost inevitably means you've missed a much bigger innovation opportunity.

True enough, analyzing all that data meant no-one had to think, but I suspect that if Linda Dillman had've asked her staff to not trawl through the terabytes of data, but instead to sit down together in a room for an hour and brainstorm what people want when there's a hurricane on the way, one suspects they might have come up with some rather stronger ideas.

By all means use the Pop Tart data to inform the session, but then instead of accepting the information at face value, what if the team had started to think about the characteristics of Pop Tarts that made them valuable in a hurricane. Things like:

- Can be eaten hot or cold
- High calorie content
- Physically compact
- Long shelf-life
- Comfort food
- A slightly sinful treat for parents to give to the kids when they're in need of cheering up

Having done this, what they could then have done is said to themselves, 'are there other products that meet these criteria?' In which case they might well have identified a whole bunch of other foodstuffs that customers could be encouraged to purchase. The fact that the customer 'so-far' hadn't connected such foodstuffs to hurricane emergency, comfort food means there was a messaging innovation opportunity.

Even better, they could've gone back to the food industry and put out a specification for new product designs. Then we might have had some proper innovation.

Funnily enough, I'm not desperately interested in Pop Tarts. Or the Wal-Mart story. Except for the way in which it highlights some of the main problems of the Big Data Analytics world. They published the story as a big success, when in reality, from an innovation opportunity perspective, it was (and still is) a thoroughly lost opportunity. Two points in

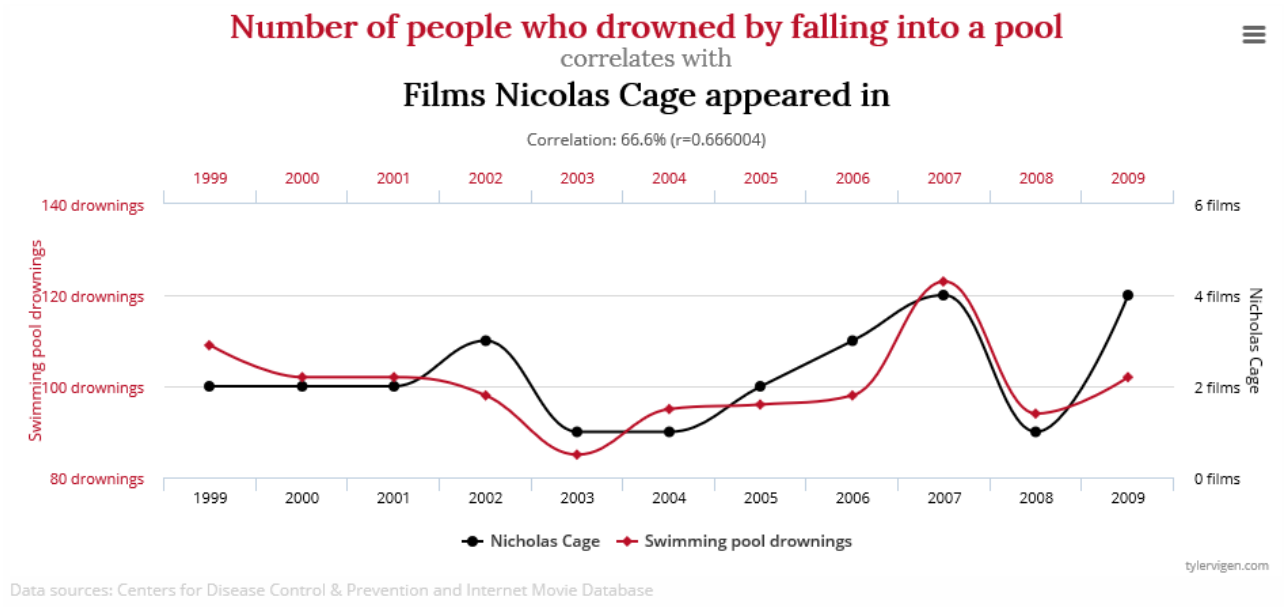
particular are worth highlighting and remembering next time your BDA team comes to you with their latest 'prediction' revelation:

1) Numerical data – irrespective of how many terabytes of the stuff you might have in your possession – allows you to only optimize what you're already doing. Optimization is the opposite of innovation. Numerical data allows analysts to find correlations. *Correlation begets optimization*. Correlation, though, has nothing to do with causation. And causation is what you need if you're going to innovate. In the Pop-Tart story, the causal links between the product and the hurricane is all the hidden stuff like 'comfort food'. What the data analysis should have prompted was a search for causal links between hurricanes and comfort food. And then, having found those causal links, found better ways than Pop Tarts to bridge them. Like self-heating chocolate drinks maybe? Or beer? Causation begets innovation.

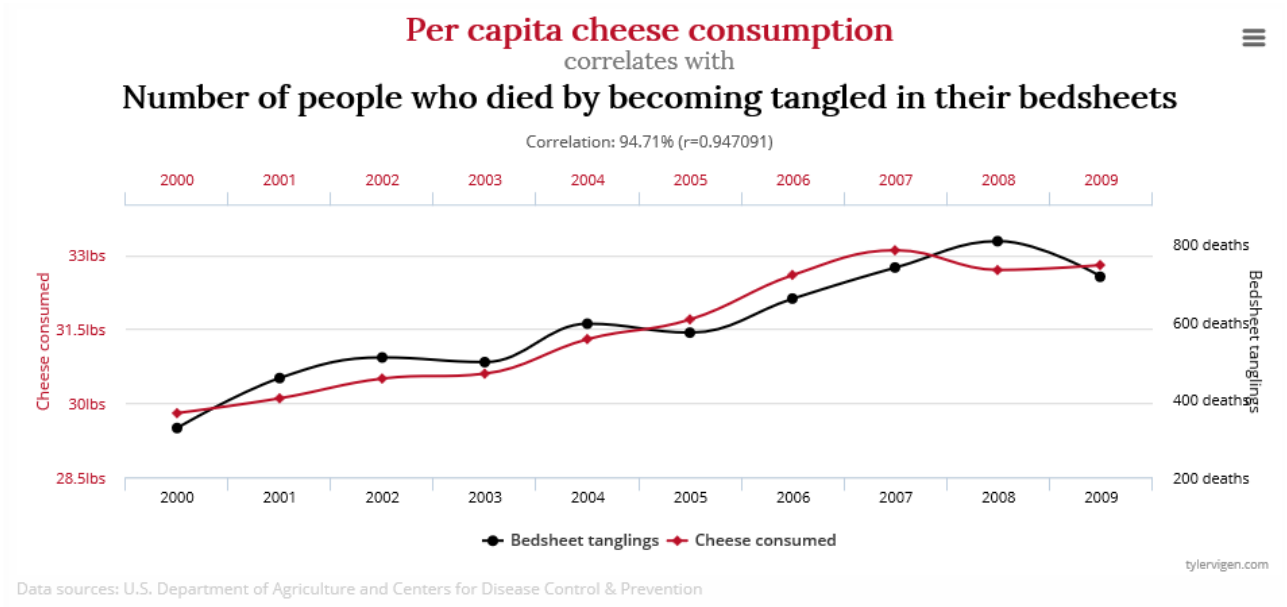
2) Recognizing that the BDA analysts are probably allergic to the idea of thinking ('doesn't the computer do that for me?'), there are ways to automatically capture causal links these days. Unfortunately, those ways don't involve analyzing numbers. Numbers correlate. In order to find causal links, you need to examine the un-structured narrative, and 'read between the lines'. You need to listen to what people are frustrated about, angry about and fearful of, and then see what those emotions *lead to*. And if that sounds like a job for PanSensic and Perception Mapping, you're probably right. The reason we've built PanSensic is because we come from the innovation world not the optimization world. PanSensic is designed specifically to reveal causality. And, to repeat again, causation begets innovation. It's the important stuff. Stuff the BDA analysts, unfortunately for them, don't get yet.

**Humour – Tyler Vigen**

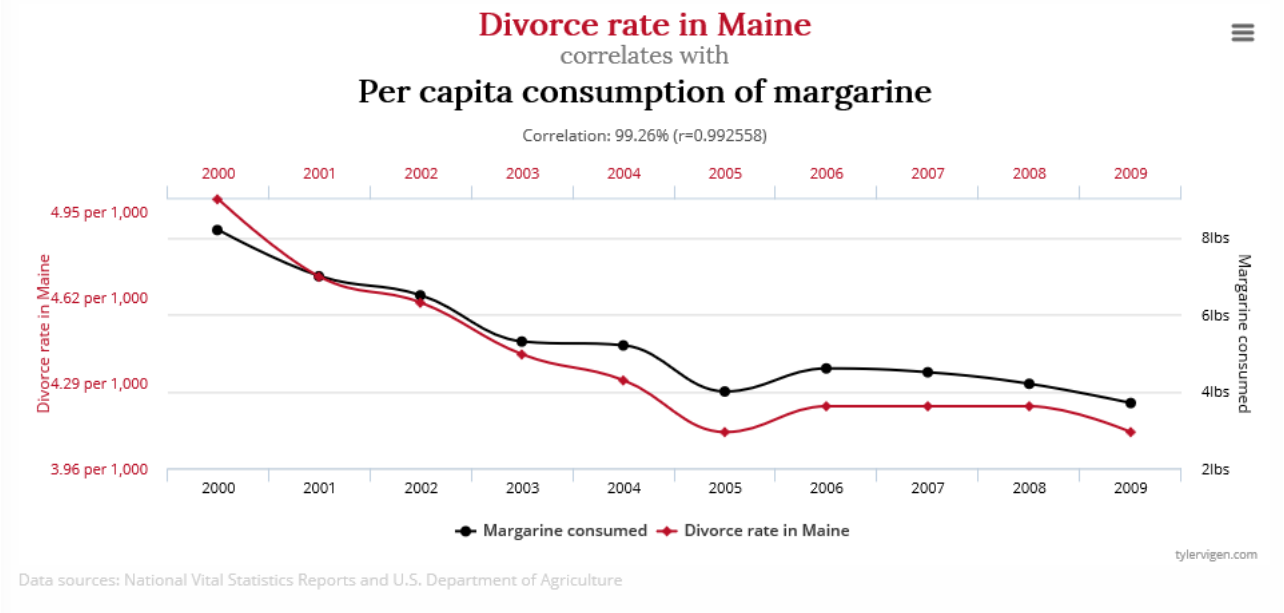
…staying with the theme of correlation versus causation, Wal-Mart clearly got something right when they asked the question, 'what do people buy more of when there is a hurricane on the way?' Not everyone asks such good questions. People like Tyler Vigen. A man who's managed to make a living out of finding spurious correlations. Like this one:




I understand the LAPD are now keeping a close eye on Nicholas Cage's movements. Who knew?
Not sure who to inform about this one, though:

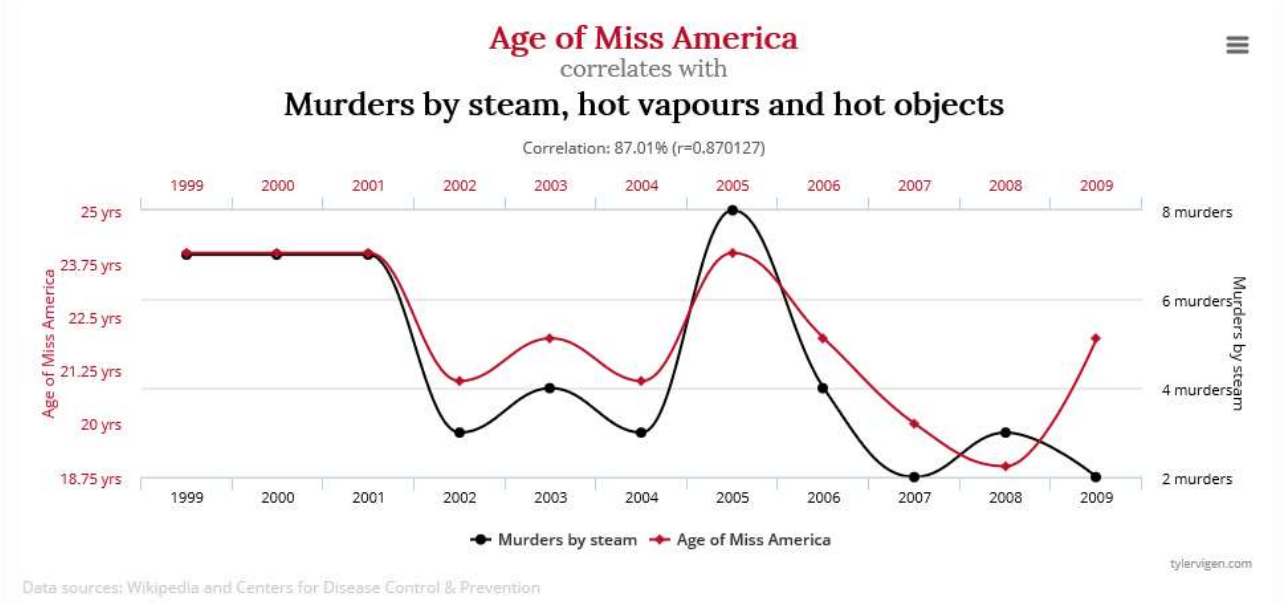



Cheesemakers of the world, I hope you can sleep at night… careful with those bedsheets, Eugene.
Here's probably my favourite one, though:




Not so utterly butterly.

No, wait, this one's my favourite:

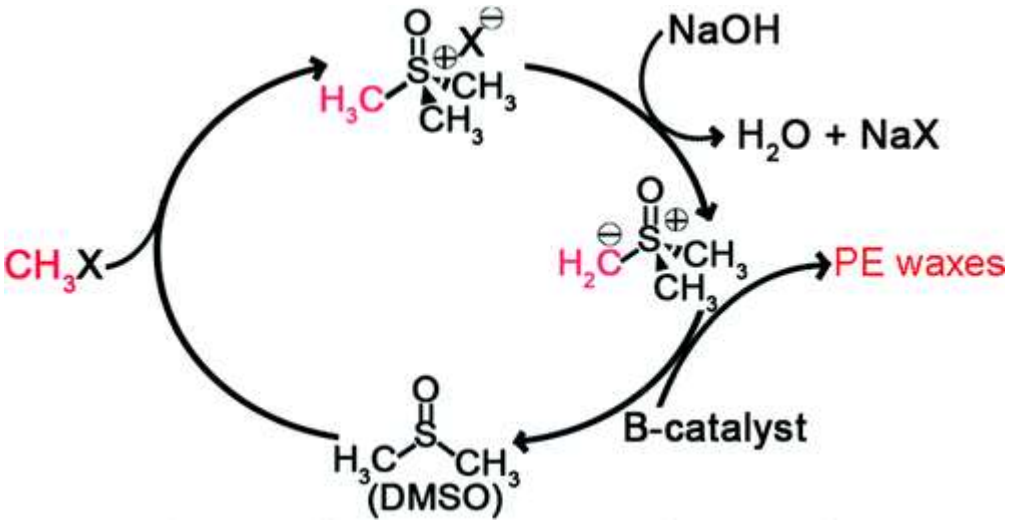



Damn those beauty pageant judges. Murderers the lot of them.

Check out Tyler Vigen's book 'Spurious Correlations'.

Rumour has it, every copy he sells increases the likelihood Donald Trump will get elected. Turns out there's some confusion amongst his voters about the word 'spurious'. I believe it's something you need to do to make your horse go faster.

**Patent of the Month – Hydrocarbon Production Method**



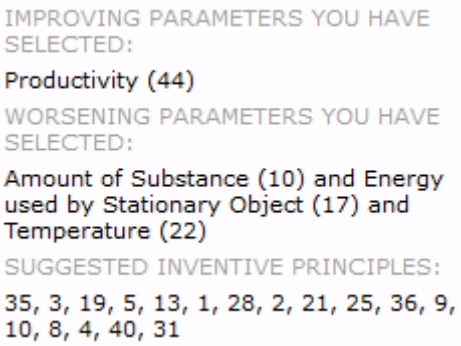

We make a relatively rare trip into the world of chemistry for our Patent of the Month feature this month. US9,273,158 was granted to a pair of inventors at the University of California (is anyone noticing how much great stuff is coming out of UCal in the past few years?). The patent was granted on the 1st of this month. Actually, we've known about one of the inventors, Professor Kenneth Shea for some time now… definitely what you might think of as a 'natural-TRIZ-thinker'. Like this current invention. The highly inefficient Fischer-Tropsch process for refining hydrocarbons has been an industry 'standard' pretty much since mankind first started pumping oil out of the ground in the 19th Century. The question of the Victorian era chemists was 'how we do refine this stuff based on what we currently know? A fair question, but one that has little to do with the world of breakthrough. When what you're producing is the 'breakthrough', maybe there is less pressure to make the making of the breakthrough into the breakthrough? Anyway, the TRIZ question when it comes to any kind of refining process might well be something along the lines, 'how could we do this at room temperature and ambient pressure, and as a consequence use very little energy. And that's what Professor Shea and co-inventor, Jun Luo, appear to have done. Here's their beautifully succinct background description:

*Polyethylene (PE) waxes are hydrocarbons with a typical molecular weight range from 600 to 7000 g/mol.1,2 These materials play an important role in contemporary society, serving as components for lubricants, polishes, printing inks, paints, cosmetics, and coating products. PE waxes are produced directly by ethylene polymerization, thermal decomposition-oxidation of high molecular weight PE, and a Fischer-Tropsch process. Petroleum remains the principle carbon source for these materials.*

*In recent years, various alternative methods have been proposed for hydrocarbon production. One such alternative method involves the polymerization of C1 carbon sources. The boron-mediated polymerization of ylides provides for the controlled synthesis of linear and substituted linear hydrocarbon polymers. However, in this process, the reaction conditions are strictly anhydrous in hydrocarbon solvents at elevated temperatures.*

*The exists a need in the art for the development of new alternative methods for hydrocarbon production which use carbon sources other than petroleum and which preferably do not require strictly anhydrous reaction conditions or extreme temperatures.*

Here's how we might best that lot onto the Contradiction Matrix:




And here's what the inventors have done to solve the dilemma:

*Applicants have discovered a new, environmentally friendly, energy efficient approach for making hydrocarbons, including linear or branched polymers, oligomers, waxes, and small hydrocarbon molecules. The present invention provides a new reaction that can efficiently convert a C1 carbon source, which may be derived from various sources such as coal, natural gas, petroleum or biomass (including non-food biomass), to valuable hydrocarbons in water at room temperature and atmospheric pressure.*

*…Such method generally comprises the step of combining a) a C1 carbon source; b) water; c) an alkaline agent; and d) an alkyl Lewis acid in an amount effective to initiate or catalyze reaction of the components to form the hydrocarbon. The methods of the present invention may be stoichiometrically adjusted to make hydrocarbons of varying size and complexity, including small molecules, polymers, waxes, fuels, oils and coatings.*

*In some embodiments, the invention may be used for the manufacture of polymethylene, a surrogate of polyethylene, by a controlled polymerization reaction in water at room temperature and atmospheric pressure. The carbon source for the polymer is methyl iodide, a C1 molecule that can be derived from various sources, including non-food biomass. The methyl iodide may be "carried" by a suitable carrier, including any onium, such as sulfoxonium, sulfonium or phosphonium salt. For example, dimethylsulfoxide (DMSO) is desirable for use as a carrier in this reaction because it is readily available as a byproduct of the paper pulping industry and is not consumed in the reaction. Because the DMSO is not consumed in the reaction, it may be regenerated or reclaimed and recycled.*

So, basically a Principle 35 + 5 solution, with a splash of Principle 25B, if we include the 'free' DMSO byproduct reaction carrier.

Still a long way to go from lab to full-scale production, but if I worked in the oil & gas industry, I think I'd be watching this one very carefully to see how things evolve. Meanwhile we all get to step back and admire an archetypal piece of IFR-oriented, 'Necessity if the mother of invention' inspired thinking.

**Best of the Month – The Formula**


Here's a book for the Big Data Analytics people. And perhaps more specifically, those that might be interested in some of our PanSensic tools. The reason we embarked on the PanSensic journey is because the BDA world is largely dysfunctional: lots of money being spent by (particularly) companies trying to better understand their customers, but not an awful lot of value being added. The field – like pretty much any new field – is a mess. Enter Fast Company journalist, Luke Dormehl, and his latest book, The Formula, to help bring some kind of clarity. Indeed, it becomes immediately apparent that this is refreshingly lucid view, which instead of looking at the 'how', focuses more on the 'what' and 'who', zooming in on a variety of practices and practitioners across wide array of fields.

Dormehl doesn't focus on a single flavour of algorithm. Instead, he turns the spotlight on followers of a developing ideology of techno-rationality, quantification and predictability. Its adherents chase objectivity through ever faster machines and ever more ambitious code. They quantify their bodily metrics, boil down love and match-making to an imagined parametric 'essence', and search for the secret recipe to a Hollywood blockbuster. They build robotic quiz champions and computerised composers (and one or two real ones – our own friend, Alexis Kirke at the University of Plymouth, for example). Their programmes claim to be able to monitor and mitigate mood dips with timely environmental interventions, notice patterns in literary structure ahead of theorists and critics, and highlight crime hotspots before they emerge. Dormehl gives an umbrella name for the various products of this mindset – 'The Formula'.

This book is organised in a sequence of vignettes, each short chunk profiling one or two Formulites, their personal worldview, and the part they have played in encoding social and psychological phenomena for digital processing or prediction, in some of the ways outlined above. This anecdotal format appears messy and disjointed at times. But this messy structure suits this messy field – shoehorning so many projects and personalities into a spurious timeline would probably feel less than satisfying.

The conclusion of the book attempts to draw these anecdotes together into both a summary and a future trajectory. The real argument of the book, mostly hidden in the shadows of the author's language and phrasing earlier, is to be found in these final pages. It is interesting, reflective, and touches on many of the issues in the BDA world, but having said that, I was left with the clear view that Dormehl was caught in a real dilemma: on the one hand, the ability of computers (and particularly 'machine-learning' systems that 'know' how to make themselves get better and better) is already demonstrating the ability to generate higher quality answers than the best of the expertise that humans can throw at a problem (medical diagnosis, school grades, duration of a marriage), but then on the other, I think there was a certain bias towards appeasing the 'humanists' and the usual knee-jerk reaction, 'computers will never be as intelligent as humans'. He perched himself on a fence, in other words. Albeit a pretty precarious one. Especially in light of the book's sub-title… 'how algorithms solve all our problems… and create more.' Well, yes, that would be right. There's always a 'next problem'. The connection I don't think Dormehl allowed himself to admit – even though nearly all his case studies make the case for him – was that when the computer is programmed to 'learn' it's not too far away from being able to learn the error of its ways. And then to correct them…

…or at least potentially solve them. The most worrying theme emerging from the discussion for me is the extraordinary level of power being inadvertently handed to the programmers of the world. The topic of 'Ambient Law' being perhaps the most troublesome: the manner in which a programmer 'programmes' the 'law', for example, opens up massive variability and opportunity for mis-interpretation relative to what the legislators had thought they were asking for.

This too, of course, is 'merely' one of a chain of 'next' problems to be solved. As such, it ends up almost being the perfect scene-setter for the problems that the PanSensic team has spent the last 6 years working to resolve: we want computers to take over certain tasks because they're (already) better at us of doing them, but we also don't want computers to take over those tasks because, damnit, we're supposed to be in charge, not them. Which pretty much boils down to highlighting the imperative of getting the 'intangibles' right. A topic, I don't think Dormehl has really connected to his dissertation in any meaningful sense. But then again, that's supposed to be our job. His was to set the scene. And in that regard, I'd recommend this book to anyone that might have even the remotest interest in PanSensic in particular, or Big Data Analytics in general. And if that doesn't grab you, I'd also say it was one of the most readable non-fiction books of the last twelve months. A veritable page-turner. Stick that in your Amazon recommendation engine and smoke it.

**Wow In Music – Rock And Roll Doctor**

If I had to choose, one of the greatest bands from one of the greatest periods in musical history has to be Little Feat. If I'm allowed eight songs on my Desert Island, I'm pretty certain four of them would be little Feat songs. They were the archetypal 'band's band'. Which might be another way of saying they never received the credit they deserved. Especially when original leader, Lowell George was at the helm.

Here's my test of what 'band's band' means. One of Lowell George's most popular compositions is the song Rock And Roll Doctor. On the surface, it's a simple blues-shuffle built around a fairly standard set of I/IV/V chords. In theory, it should be easy to pick up and learn how to play. Try and do that, and you quickly begin to realise it's not nearly as easy as it sounds. The same went for the other members of Little Feat – as it happens some of the most in-demand studio musicians of the 70s. George supposedly had to spend several weeks teaching them how to play the song.

So what makes 5 chords so difficult? Here's a clue from a PhD thesis on the subject, perhaps in itself another important clue to Little Feat's place in musical history (how many bands have PhD theses written about them?):

*"...the formulaic processes operate within the parameters relatively highly valued by traditional musicology: harmony, melodic shape, basic rhythmic pattern. Variation processes, on the other hand, often take place in parameters little valued by traditional musicology (and much harder to notate): slight pitch inflection or rhythmic variation, timbre and timbre changes, accent and attack." The music of the band Little Feat offers an opportunity to examine the use of variation and intensional development in rock.*

Formed in 1970, the band made a significant evolution jump when a new line-up was formed for their third album, *Dixie chicken*, in 1973. The four piece became six – twin guitars, keyboards, bass, drummer and percussionist. And everyone sang. This combination, plus female backing vocalists and occasional sessions musicians, created new textures in which the instrumentation was sparing and the pitched instruments, by each avoiding playing continuously, allowed a filigree of contrasting timbres to emerge, with drums and percussion providing rhythmic counterpoints to the interweaving of the guitars and keyboards. Great skill, discipline and taste were required in order to know not only what to play but also what to leave out. *Feats don't fail me now* (1974) and *The last*

*record album* (1975) consolidated the approach, and it on the 1974 album that we find Rock And Roll Doctor as the opening track and statement of intent.

The tonality, melody and harmony of "Rock and roll doctor", as in rock'n'roll itself, are fairly simple. The key is E major and the chord sequence mostly consists of triadic chords on the tonic, the sub-dominant, the dominant and the subtonic. Sometimes triads have their minor sevenths added as harmonic colouration. Usually the chords are in root position with the root note played by the bass guitar but exceptions to this are the first inversions on the sub-dominant during the slide guitar solo section. Here the bass guitar, after a bar of sub-dominant root position, moves up from the A to play C sharp for a bar of first inversion. Because the effect is exceptional (in terms of rock music norms) it has structural significance.

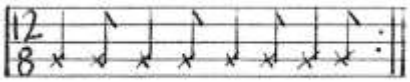
The innovation of Little Feat's music lies not in the melodies or harmonies *per se* but in the structures and textures into which they are formed. A balance of variety and coherence and of sublety and power is achieved by the avoidance of much repetition and symmetry and by adherence to an open texture which creates a filigree of sonorities in rhythmic and harmonic counterpoint in many of their most characteristic numbers. There are three things to listen out for in the song:

1. Textural and rhythmic variation

   The key to the open texture is the omission of a strumming rhythm guitar which is usually present in rock music to provide a harmonic and rhythmic layer of continuous sound and which would normally rely on superimposed "lead" instruments to provide contrast and variation. This (Principle 2) omission is unusual and significant.

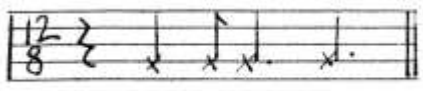
   Little Feat, in much of their music, replaced the conventional homophony of peers like the Eagles or The Band with arrangements in which the instruments contribute phrases antiphonally (Principle 13) and polyphonically (Principle 5) to the ensemble and thus create a composite texture of contrapuntal harmonies, polyrhythms and varied timbres (Principle 15). This texture has more interest than a repetitive one, without sacrificing the rhythmic drive and sonorous impact characteristic of rock. Instrumental solos and vocal lines are juxtaposed with the nuances of the accompaniment (Principle 17) rather than superimposed on a chordal background.

   In "Rock and roll doctor" none of the pitched instruments plays continuously (Principle 19). The constant rhythmic impetus is created by the drums and cabasas. The drummer varies the accents in embellishing a basic 12/8 rhythm on the hi-hat cymbal



   and a snare drum pattern of hitting beat three of the quadruple pulse

whilst the cabasas play something like



The interplay of phrases added by the players adds nuances of rhythm, counterpoint and timbre. It's an extraordinary and extraordinarily subtle jigsaw puzzle in which every member of the band has to walk a highly coordinated tightrope walk.

2. Formal variation in different performances

   The variety in Little Feat's performances, born of spontaneity and improvisation, is captured on their live recordings. The four "bootleg" albums together with *Waiting for Columbus* and parts of *Hoy-hoy!* provide enough material for comparisons to be made of individual songs in different performances. It is clear that each live performance of a particular song differs from other live performances of it as well as from the studio version. Five performances of "Rock and roll doctor" - the studio version on *Feats don't fail me now*, live recordings on *Hoy-hoy!*, *Electrif lycanthrope* and *Rampant synchopatio* and the live television performance on the BBC programme *The old grey whistle test* (17th January 1975) - all differ in duration and in the proportions of the individual sections of the piece:

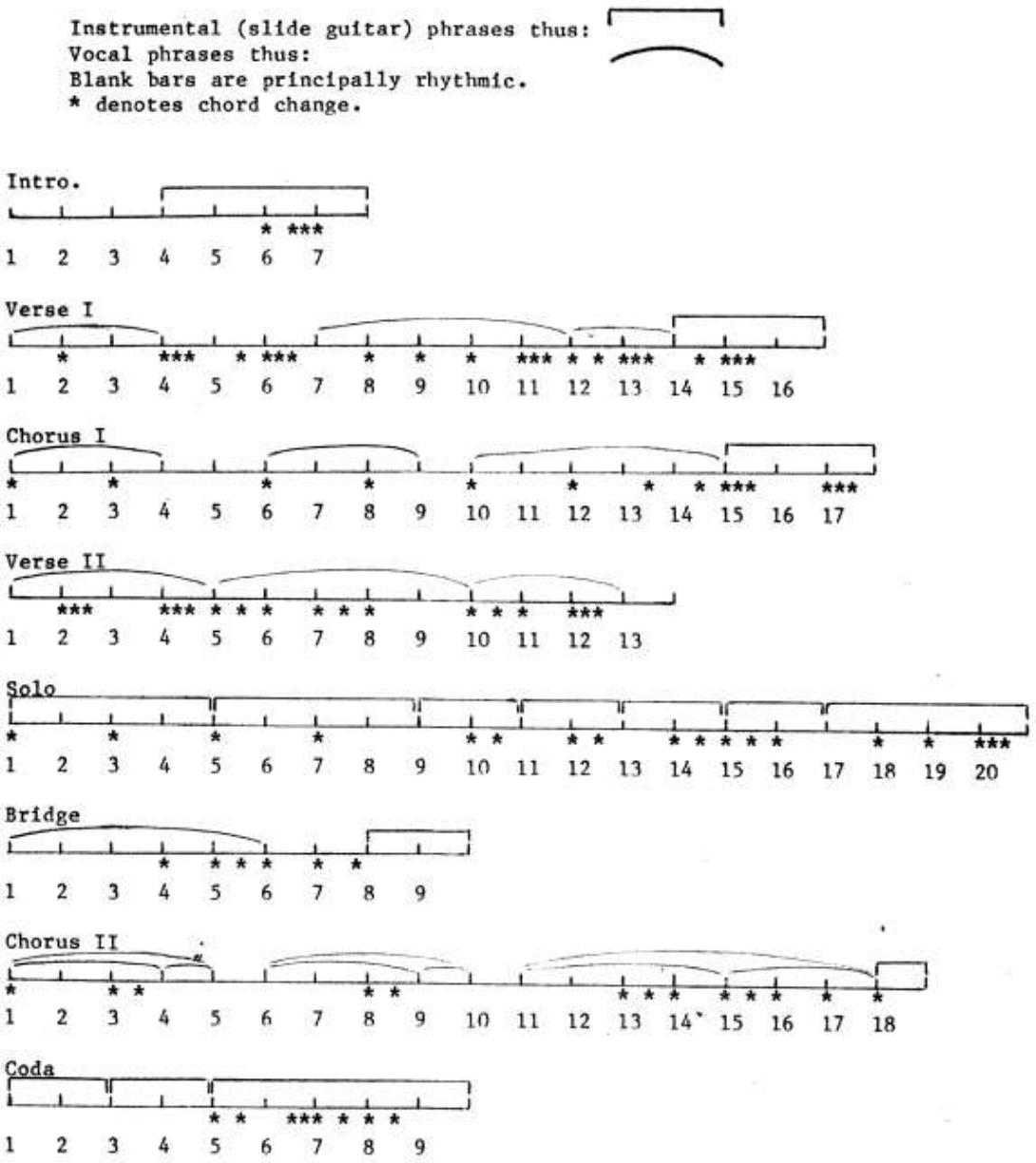
| | *Feats don't fail me now* | *Hoy-hoy!* | *Electrif lycanthrope* | *Rampant synchopatio* | T.V. |
|---|---|---|---|---|---|
| Instrumental introduction | 12 | 12 | 12 | 12 | 12 |
| Verse 1 | 26 | 28 | 29 | 30 | 28 |
| Chorus 1 | 27 | 22 | 30 | 32 | 29 |
| Verse II | 20 | 22 | 22 | 24 | 22 |
| Slide guitar solo | 31 | 28 | 50 | 54 | 49 |
| Bridge | 14 | 14 | 15 | 42 | 19 |
| Chorus II | 28 | 40 | 40 | 50 | 42 |
| Coda | 17 | 17 | 17 | 18 | 15 |
| Total duration | 2' 55" | 3' 10" | 3' 35" | 4' 22" | 3' 36" |

In other words, not only were the band giving themselves the challenge of coordinating all of the subtle interplay, they varied it every time they played it (I personally own about twenty other bootleg versions of the band playing the song and can verify it literally is different every time). Talk about keeping people on their toes!

3. Variation in structural units

   Variations in the structure of the piece "Rock and roll doctor" occur in each performance but within any one version there is the variety of the different sections. Even though there is a verse/chorus structure the verses differ from each other, as do the choruses. Thus the song is virtually through-composed with little repetition or

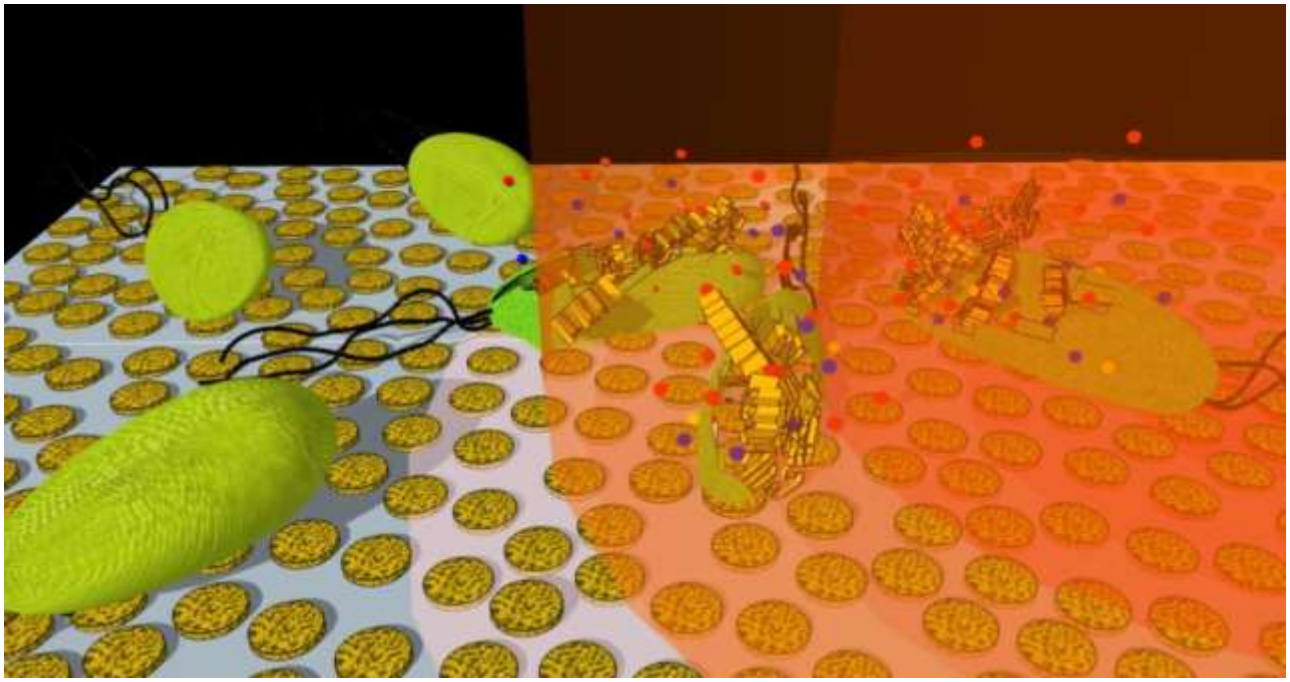
symmetry in the overall form. This lack of symmetry is also found in the phrasing within individual sections. This simplified chart of the phrasing in relation to the number of 12/8 bars in each section demonstrates how uneven and varied the phrasing is. The *Feats don't fail me now* (studio) version is used in this analysis. (To simplify this chart the lengths of phrases have been approximated and parts of slide guitar phrases that overlap with vocal phrases have been omitted.)




This degree of (Principle 4) asymmetry is unusual in rock music where strophic structures and repeated chord sequences predominate. And yet somehow – it still amazes me every time I listen to the song – you only realise it's unusual when you start trying to listen to the part of one of the musicians rather than the overall sound. The overall impression is one of simplicity, but dive in to listen to the individual contributions (Principle 7) and the level of complexity is extraordinary.

Read more in the fascinating PhD thesis here: [http://gregholt.co.uk/littlefeat.htm](http://gregholt.co.uk/littlefeat.htm)

**Investments – Light-activated gold nanoparticles**



Researchers have developed a new technique for killing bacteria in seconds using highly porous gold nanodisks and light, according to a study published today in *Optical Materials Express*, a journal published by The Optical Society. The method could one day help hospitals treat some common infections without using antibiotics, which could help reduce the risk of spreading antibiotics resistance.

"We showed that all of the bacteria were killed pretty quickly . . . within 5 to 25 seconds. That's a very fast process," said corresponding author Wei-Chuan Shih, a professor in the electrical and computer engineering department, University of Houston, Texas.

Scientists create gold nanoparticles in the lab by dissolving gold, reducing the metal into smaller and smaller disconnected pieces until the size must be measured in nanometers. One nanometer equals a billionth of a meter. A human hair is between 50,000 to 100,000 nanometers in diameter. Once miniaturized, the particles can be crafted into various shapes including rods, triangles or disks.

Previous research shows that gold nanoparticles absorb light strongly, converting the photons quickly into heat and reaching temperatures hot enough to destroy various types of nearby cells -- including cancer and bacterial cells.

In 2013, Shih and his colleagues from the University of Houston created a new type of gold disk-like nanoparticle that measures to a few hundred nanometers in diameter. The disks are riddled with pores, lending the particles a sponge-like look that helps increase their heating efficiency while maintaining their stability, said Shih.

In the new work, the researchers set out to test the antimicrobial properties of their new nanoparticles when activated by light. They grew bacteria in the lab including *E. coli* and two types of heat-resistant bacteria that thrive in even the most scorching environments such as the hot springs of Yellowstone National Park.

Then, they placed the bacteria cells on surface of a single-layer coating of the tiny disks and shone near infrared light from a laser on them. Afterward, they used cell viability tests and SEM imaging to see what percentage of cells survived the procedure.

Using a thermal imaging camera, the research team showed that the surface temperature of the particles reached temperatures up to 180 degrees Celsius nearly instantaneously, "delivering thermal shocks" into the surrounding array. As a result, all of the bacterial cells were killed within 25 seconds, the researchers report.

*E. coli* proved most vulnerable to the treatment; all of its cells were dead after only five seconds of laser exposure. The other two types of bacteria required the full 25 seconds, but that's still much quicker than traditional sterilization methods such as boiling water or using dry-heat ovens, which can take minutes to an hour to work, said Shih. And it's "considerably shorter" than what other nanoparticle arrays have demonstrated in recent studies, the researchers write. The time needed to achieve similar levels of cell death in those studies ranges from 1 to 20 minutes.

In control trials, the researchers found that neither the gold disks nor light from the laser alone killed nearly as many cells.

The technique has important potential biomedical applications, said Shih. Currently, the researchers are investigating using the particles as a simple coating for catheters to help reduce the number of urinary tract infections in hospitals.

"Any sort of light activated procedure would be much easier to implement at the bedside of a patient," instead of removing and potentially replacing the catheter every time it needs to be cleaned, he said.

Another potential application they're exploring is integrating the nanoparticles with filter membranes in small water filters, he said, to help improve water quality.

**Read more:**
Greggy M. Santos, Felipe Ibañez de Santi Ferrara, Fusheng Zhao, Debora F. Rodrigues, Wei-Chuan Shih. **Photothermal inactivation of heat-resistant bacteria on nanoporous gold disk arrays**. *Optical Materials Express*, 2016; 6 (4): 1217 DOI: 10.1364/OME.6.001217

**Generational Cycles – First Cars**

For a lot of teenagers in the affluent West, a first car is almost as emotive as a first love. Especially if you were a Baby Boomer. Baby Boomers were lucky. There were a lot of them for a start, so when they started coming of age, the automotive industry had a big incentive to produce cars that tapped into their Narcissistic Boomer-psyche. Cars like the VW Beetle (think California, surfing and the 'summer of love'), Mini and Fiat 500. Cars that were cheap-and-cool. For those of us who just missed the Boomer boat, people that lived their teenage years in the 1980s, in other words, the auto industry was in the midst of a crisis borne of the emergence of the Japanese automotive industry's cost reduction prowess. Suddenly there wasn't so much money around anymore. As the rumble of truly global competition and increased regulation presented overwhelming challenges, car companies responded the only way they could: by trying to craft the cars of the future and, as much as possible heading where the customer was heading. This meant moving up the value chain with the Boomers. That meant family cars. And computers. Whether the technology was ready or not. Vehicles would use onboard computers for the first time, while the automakers simultaneously tried to bring design and manufacturing into the digital age. The results were uneven and often sophomoric. Some manufacturers just persisted in building the cars of yesterday, barely updated for the times. Others did both: Oldsmobile sold a '60s-vintage, rear-drive Cutlass Supreme alongside the modern, front-drive Cutlass Ciera throughout the 1980s.

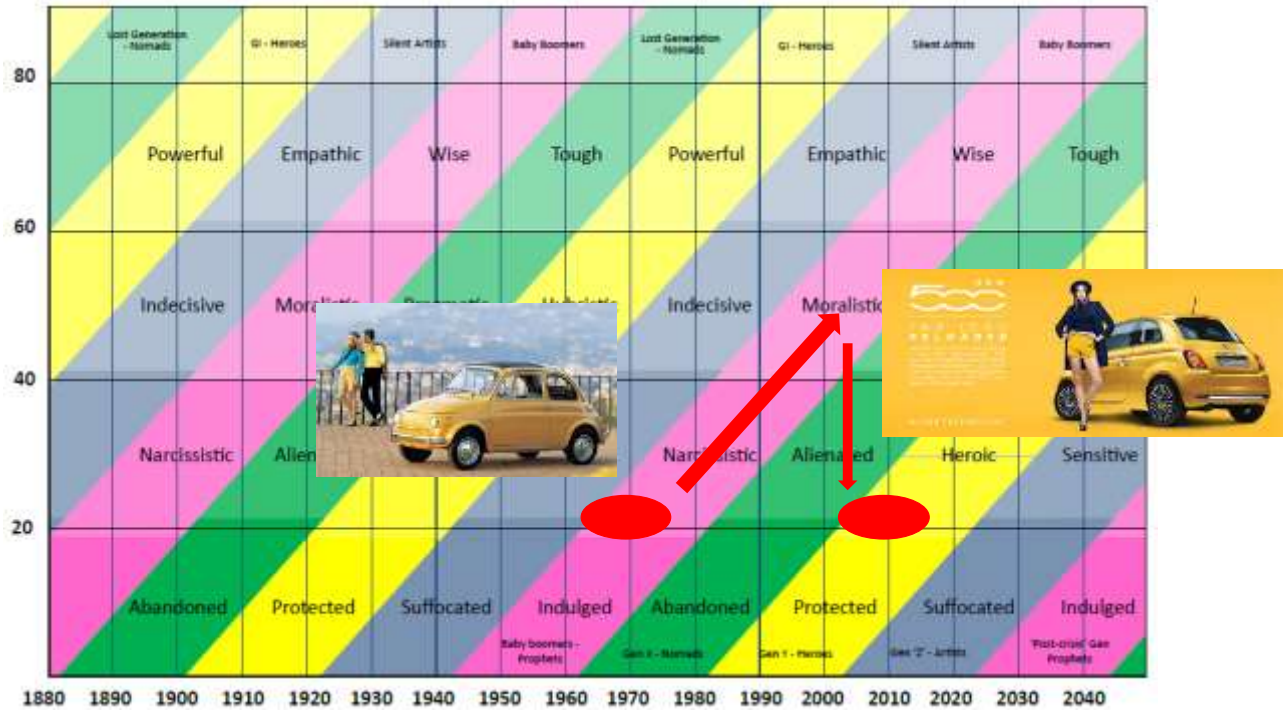
It's no wonder that this chaotic time produced a scant number of interesting cars at any price point, and it's probably safe to say that collectible cars from the 1980s are fewer in number than those from any other decade.

Things got even worse if you were Generation X and thinking about buying your first car. Not only were you a much smaller cohort you were perceived as unreasonably contrary in your buying patterns. Couple that with the fact that, 'if it was cool for Boomers, by definition it wasn't going to be cool for an X'er', and the car companies had a problem. What cool first-car should they design for the Alienated Nomad? Answer: the decidedly uncool, utterly anonymous Micra, Metro, Nova, Polo, Fiesta, Peugeot 205, or Renault 5. It was going to take some doing to make any of that little lot cool. True to form, what GenX'ers tended to do ('having to do'?) was take great pride in the level of un-cool'ness.

Think Wayne's World, and probably the absolute nadir in small-car design, the AMC Pacer. Complete, in Wayne and Garth's case with uber-ironic wheel arch flames:

Now spool forward twenty years. 1997, VW launch a New Beetle. 2001 brings the New Mini. 2007 brings the (50th anniversary!) launch of the New Fiat 500. All tapping in to a new desire for 'cool' first cars. All aimed at the next big generation, the GenY Heroes. Even better, an entitled teenager with parents' intent on satisfying their precious offspring's every automotive whim. Forget third-hand 205's, my precious angel wants a new Fiat 500. And what my angel wants, my angel gets. The automotive industry rubbed its hands with glee. Or at least found a way to get back into the black again.

Here's what the first-car story looks like when mapped on to the Generations chronology:




All in all, a bit like mini-skirts, I'd say to a youngster expecting to come of age after the next five years is likely to be in for some fairly un-cool times again as the car industry money follows the Y'ers as they grow up. Be sure to come back to your local car showroom sometime around 2045.

Not that any of us will be doing things like driving anymore.

**Biology – New Caledonian Crow**

**The crow's unique bill allows it to hold a tool tightly and see what it is doing as it forages for beetle grubs.**

How about this for evolution in plain sight. As plain as the beak on a bird's face. Cornell ornithologist and crow expert Kevin McGowan recalls the day in the late 1990s when he first saw stuffed specimens of the New Caledonian crow.

"I remember saying to a student, 'I don't know what this bird does, but it does something different from any other corvid on Earth because its bill is so weird,'" said McGowan, project manager for distance learning in bird biology at the Cornell Lab of Ornithology. In 2000, McGowan read a paper by Gavin Hunt, a senior research fellow at the University of Auckland, New Zealand, on tool use by these crows and he had an insight into the New Caledonian crow's unusual beak.

Now, Hunt, McGowan and a team of scientists from Japan have quantified what makes the New Caledonian crow's beak different and how it got that way. Their findings were published on March 9 in the journal *Scientific Reports*.

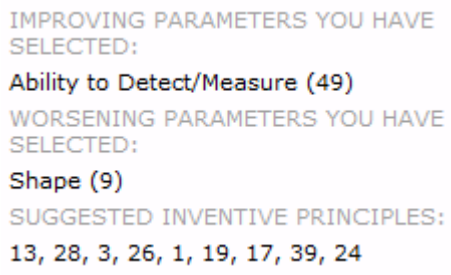
"We used shape analysis and computer tomography scanning to compare the shape and structure of the New Caledonian crow's bill with some of its crow relatives and a woodpecker species with a similar foraging niche," said lead author Hunt.

"This study shows that the unique bill contributes to the birds' ability to use and probably make tools," he said. "We argue that the beak became specialized for tool manipulation once the birds began using tools, and that this enhanced tool manipulation ability may have allowed the crows to make more complex tools."

Such tools may range from sticks to barbed leaves or hooked twigs used to fish the crow's favorite food from the trunk of a tree -- the juicy grubs of the longhorn beetle. The birds annoy their prey by poking around the grub's large, sensitive mandibles. When the grub grabs the stick or other tool, the bird hauls it out.

"Their bill is shorter than a regular crow's," McGowan said. "It's blunter, and it doesn't curve down like nearly all bird bills do. The lower mandible actually curves slightly up, which likely gives it the strength it needs to hold the tool. And because the bill doesn't curve downward it brings the tool into the narrow range of the bird's binocular vision so it can better see what it is doing."

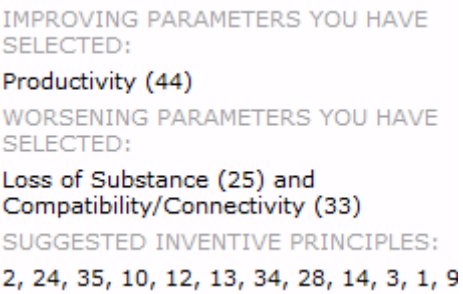
This is how this conflict gets mapped on to the Contradiction matrix, noting Principle 13 as the most frequently used strategy for this kind of detection-versus-shape problem:




Birds with blunter, straighter bills were probably more adept at handling tools for foraging and over time those features evolved, McGowan said. Tool use has now become ingrained in the crow's biology. In the case of the New Caledonian crow's beak, you might say it's not so much "you are what you eat," but "you are how you eat."

"They hold the stick tool so that it goes up along the side of their head (Principle 17) along the length of the bill," McGowan explains. "Apparently there are birds that favour one side of the head over the other -- left-sticked or right-sticked, you could call it -- it's really cool."

The question the author's couldn't answer is why the crows started using tools in the first place. It may have been a matter of chance because most birds do just fine foraging with their beaks and feet without resorting to tool-making, McGowan said. According to the Contradiction Matrix, here's why the tool-usage started:




i.e. there was an evolutionary advantage to any crow that could become more productive in its search for food, but the problem is that food is has a corresponding evolutionary advantage if it can avoid being eaten, by, for example, hiding out of reach in a hole. Note how Principle 24, Intermediary (the tool in the crow's case) is second on the list. Not that the crow had access to the Matrix, of course. Maybe we're all, deep down, programmed with this stuff ☺

**Read more:**

Hiroshi Matsui, Gavin R. Hunt, Katja Oberhofer, Naomichi Ogihara, Kevin J. McGowan, Kumar Mithraratne, Takeshi Yamasaki, Russell D. Gray, Ei-Ichi Izawa. **Adaptive bill morphology for enhanced tool manipulation in New Caledonian crows**. *Scientific Reports*, 2016; 6: 22776 DOI: 10.1038/srep22776

## Short Thort

*“There is a Jewish story, an ordinary Jewish joke. A father was teaching his little son to be less afraid, to have more courage, by having him jump down the stairs. He put his son on the second stair and said, "Jump, and I'll catch you," and then on the third stair and said, "Jump, and I'll catch you." And the little boy was afraid, but he trusted his father and did what he was told and jumped into his arms. The father put him on the next step, and then the next, each time telling him, "Jump, and I'll catch you." Then the boy jumped from a very high step, but this time the father stepped back, and the boy fell flat on his face. He picked himself up, bleeding and crying, and the father said to him, "That'll teach you."*

The tangibly safer we make things, the intangibly more dangerous they become.
The world needs more *un*safety nets.

## News

**Altshuller Institute ‘Education Excellence’ Award**
We are very happy to announce that Darrell was the inaugural recipient of the Altshuller Institute’s Education Award. The awards were presented at TRIZCON’16 in New Orleans at the beginning of March. Sadly, Darrell wasn’t there to accept the Award in person (he was teaching!), so many thanks to Phil Samuel from good friends, BMGI, for accepting on Darrell’s behalf.

**India**
Looks like it’s going to be another busy year for Darrell in India. He will be in Mumbai/Pune for a short trip in April (1-6), then back again in mid-June and again in July. Most of the days for each trip are already filled, but there are one or two spares if any of our readers are interested in having him come and do something with you.

**University Of Derby**
Congratulations go out to Systematic Innovation Network partner, Kobus Cilliers, who has just started a PhD research programme at the University of Derby in the UK. While still finding its feet, we know the project will be somewhere at the interface of SI, PanSensic and the world of innovation capability in small and medium sized enterprises. Feel free to get in touch with Kobus if you want to know more or think you might have something to contribute.

**SIN**
We are undergoing a re-design and re-launch of the Systematic Innovation Network in the next couple of months – including the creation of our first ‘SIN Handbook’ – no doubt

existing SIN members will be contacted (you've probably been contacted already for your thoughts on how we advance from where we are). If any other ezine readers are interested in becoming a part of the story, we will be interested to hear from you. In the first instance, please contact paul.frobisher@systematic-innovation.com for an informal chat.

**New Projects**

This month's new projects from around the Network:

- Pharmaceutical – PanSensic study & dashboard
- Pharmaceutical – Strategic study
- IT Services – Leadership Coaching Workshops
- Industrial – SI Certification workshops
- Financial Services - TrenDNA Anthropology Study
- Management Services – Design-Thinking Workshops
- Government – Innovation Workshop
- Education – SI Certification Workshops
- Education – PanSensic Study
- Automotive – Innovation Strategy Study