Systematic Innovation

e-zine

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In this month's issue:

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

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Readers' comments and inputs are always welcome.
Send them to **darrell.mann@systematic-innovation.com**

Beginning @ The Beginning
Versus Beginning @ The End

One of the very nicest thing about being the company that we are is that we get to work with clients that are open to trying new things. This article relates to one of the recent experiments we've been able to conduct with one of those clients. Per the usual form, names, topics and specific details of the defined problems and solutions have been concealed in order to protect confidentiality and allow us to focus on the important learnings from the experiment. Which in this case relate to assessing whether there are differences in the quality and quantity of output obtained from a workshop session when two groups start from very different places in the creativity process. Specifically, we wanted to have one group ('Team Yin') starting from a 'traditional' problem definition position, while the other ('Team Yang') started from a far less traditional solution generation position. Team Yang, in other words, was asked to generate a cluster of 'solutions' first and only then work out what problems they might have solved afterwards.

The Set-Up

As in any experiment – especially one which is free-riding on the more important task of delivering some tangible output to a paying client – there is no such thing as the perfect set-up. There are lots of things that can be controlled in an experiment – duration, problem descriptions, tools, etc – but then there is typically a much bigger list of (largely intangible) things that either can't be controlled at all, or can only be partially controlled – motivation, stress, engagement, etc. Here's what we were able to do:

1) Two weeks prior to the start of the workshop, we conducted a Thinking Styles assessment of all 16 participants, and used this information plus their role and domain knowledge skills to design two 'equal' teams. We also sought to achieve a matching balance between technical, marketing and manufacture people in each team in order to hopefully benefit from some degree of cross-functional synergy.
2) We also worked with the workshop organization team to identify a suitable 'panel' of impartial experts to help us to judge the quality of the solutions once they had been generated. Having found a pair of suitable (senior management) candidates, we worked with them to create a short list of criteria they would use to score each solution. We worked on two basic measurement axes – one looking at the relative 'idealness' of the solution, the other looking at its 'ease of deployment'. For this second axis, we used a slightly modified version of the internationally recognized Technology Readiness Level' scale (Reference 1). The primary reason for the modification was to allow for some 'someone, somewhere solved your problem' knowledge to be incorporated into the assessment. The problem we were trying to overcome here was an anticipation that the teams could derive solutions that would be completely new to the client organization (TRL = 0), but were in fact well proven in other domains and therefore not nearly such a high level of risk as might traditionally have been scored. We designed protocols for assisting the panel to make these 'other domain risk mitigation' assessments by bringing to bear our knowledge search tools after the workshop ended.
3) One week prior to the workshop, we circulated a 1000 word problem brief to all 16 participants. In crude terms, the overall problem we were expected to solve was defined in a typically fuzzy-front-end manner: 'we wish to grow the market share of product family X in geographic region Y by amount Z in the next 5 years'. We gave

no hints and suggestions regarding any kind of other pre-work, telling delegates that all they needed to bring with them to the workshop was an open mind.

4) The overall duration of the workshop was fixed at two days, and there was an expectation from the session sponsor that both groups converged to achieve an overall set of initial 'this is what we're going to do next' conclusions by the end of the second afternoon. Prior to the workshop, none of the participants had any knowledge of any of the SI tools and so the first six hours of the first day was dedicated to learning a selection of tools appropriate to the problem at hand. All 16 delegates were exposed to the tools at the same time and conducted the same exercises to gain the same hands-on experience. During the teaching of the tools, we alternated problem definition (TrenDNA) and solution generation (Inventive Principles, Trends Of Evolution, Function & Patent Database) tools in order to try and minimize any bias that might be attributable to primacy or recency effects. Figure 1 illustrates the overall timetable for the two days.

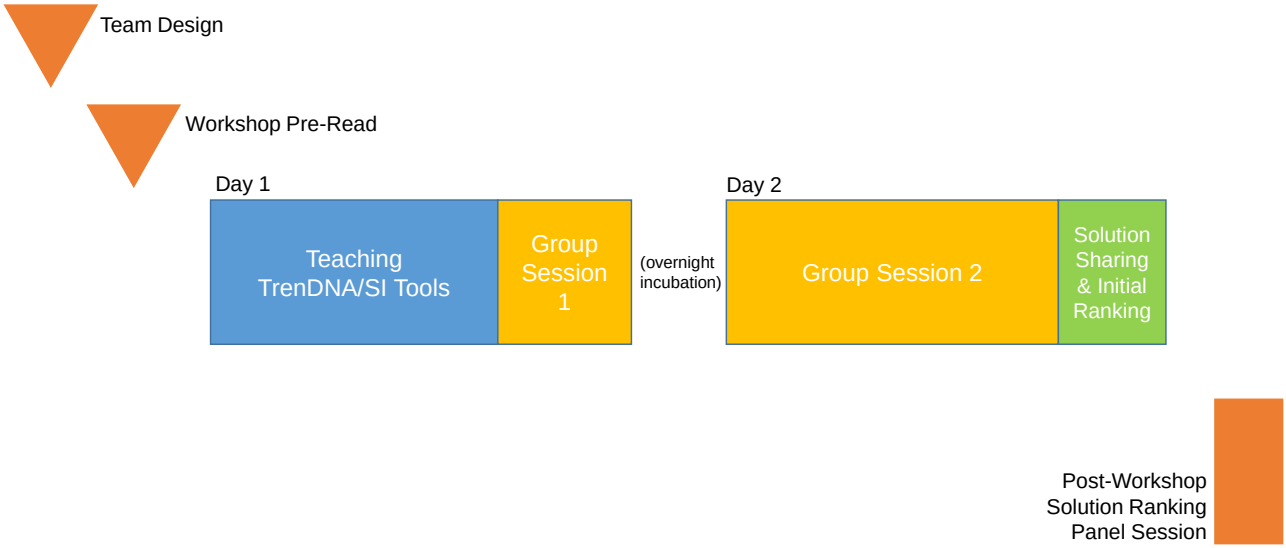


Figure 1: Workshop Schedule

Within the two main working sessions of the workshop, the Yin and Yang groups were working independently of each other. At the start of the first session, Team Yin, were asked to start their work on the actual target problem by using 'whichever they judged would be the most useful' of the TrenDNA problem definition tools. Team Yang was given an equivalent instruction based on the SI solution generation tools. One of the main ideas behind getting the groups started before the end of the first day was giving them time to get far enough into the problem at hand to have something to incubate during the time between the end of the first day and the start of the second. Other than telling both groups that incubation was 'an important part of the creative process', the groups were not asked to do anything specific as 'homework' at the end of the first day. Both teams were given equal quantities of TrenDNA and SI text book resources. These stayed in the workshop rooms after the end of the first day to emphasise the point about no homework.

As sole facilitator of the workshop, I tried to divide my time equally between the two teams and confined my interventions to an absolute minimum, in the end confining my intrusions to periodic interjections about overall timing ('we're halfway through the time, perhaps you'd like to start considering when to shift from solution to problem' (or vice-versa), or, 'we have about 30 minutes to go, please could you start converging on the solution clues and ideas you would like to share with the other group'), team organization ('you might be more efficient if you split into two smaller groups at this point in the process'), and on a

couple of occasions to ‘unstick’ a group (both times, Team Yin) that seemed to be getting too bogged down in minutiae or uncertainty about the tool they were using.

The Workshop

Figure 2 summarises the overall time sequence of the activities undertaken by the two teams in terms of the tools they were using at any particular point in time through the two days:

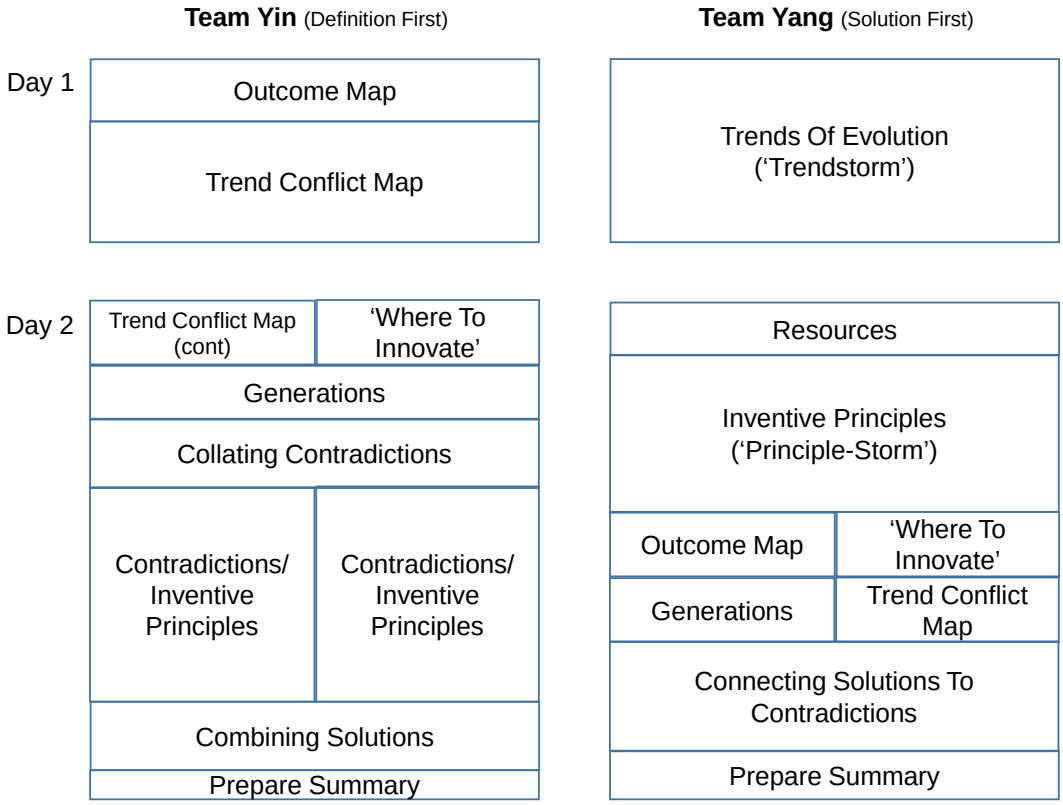


Figure 2: Actual Sequence Of Tool Usage By The Two Teams

In a bit more detail:

Team Yin: having been given the TrenDNA start point, decided to begin their work by creating a simple Outcome Map, really, I think, because it allowed them to ease their way into the subject in what they thought was a fairly gentle manner and because it was the first tool in the default sequence. After they finished their Maps (they produced a pair – one for their target end consumers and one for their direct customer), they decided to ‘bite the bullet’ (their words) and construct a big trend conflict map. Having decided that there were over 60 market trends they thought needed to be included in the map, they spent the whole of the rest of the afternoon on this activity and still didn’t quite finish it. Consequently, at the start of the second day, they were advised to ‘divide and conquer’ such that half of the group finished the trend conflict map while the other half worked their way through their next tool, the (their choice) ‘Where To Innovate’/white-space-finding tool. After this the two groups converged again to work through the Generations tool. The end of this activity coincided with the approximate mid-point of their overall available time, and, realizing they had very few solutions ideas (they had made themselves a ‘car park’ space to place random solution ideas that might have emerged during the earlier activities, although there wasn’t a lot in it by the time of this realization), they decided to ‘quickly’ focus on defining the main contradictions they had found. From there, they again decided to split into two groups, each taking a ‘top four’ contradictions, mapping them on to the

Contradiction Matrix, and then using the resulting Inventive Principle recommendations to generate solutions ideas… importantly, I reminded the groups when they started this activity to write ideas down even if they didn't sound like good ideas ('quantity is more important than quality at this stage'). Finally, the two groups came together again to look at all the 'clues and ideas' they'd written down such that they could prepare their feedback to Team Yang.

Team Yang: launched immediately into a Trendstorm activity. They ended up spending the whole of their available Day 1 time doing this. They stayed together as a group throughout, each individual with a pile of Post-It notes, and all of them looking at each of the trends in turn by projecting the EvPot+ software onto a screen, and forcing themselves to spend at least 5 minutes looking at each trend. I also noticed the group was simultaneously comparing each trend to not only the products under investigation, but also the packaging, manufacture processes, and on at least a couple of occasions, their advertising strategy associated with the products. At the beginning of the second day, the team decided to give themselves 'an easy start' and did a simple 9-Windows resource search. Having got themselves 'warmed-up', they then decided to do a 'quick' brainstorm using the 40 Inventive Principles as stimulus. When I could see that this activity was potentially heading towards infinity, I reached a point where I advised the team that they might care to start heading over into problem definition territory. When they were ready for the transition, they too decided to 'divide and conquer' and thus split into two sub-groups. When it came to constructing a trend conflict map, the responsible group decided to be very pragmatic, bypassing much of the process and focusing instead on a quickly selected 'top 10' trends (actually 12) and focused on finding conflicts between those trends. Finally, having gathered their TrenDNA insight 'clues', they undertook a concluding exercise to start mapping the solutions they'd obtained to the problem opportunities they'd found. Essentially, as I was watching them do this, what in effect they were doing was using their TrenDNA findings to rank the solution ideas they'd derived.

The Results

Figure 3 summarises the overall results obtained after the judging panel had made their assessments of the relative merits of the solution ideas presented by the two Teams:

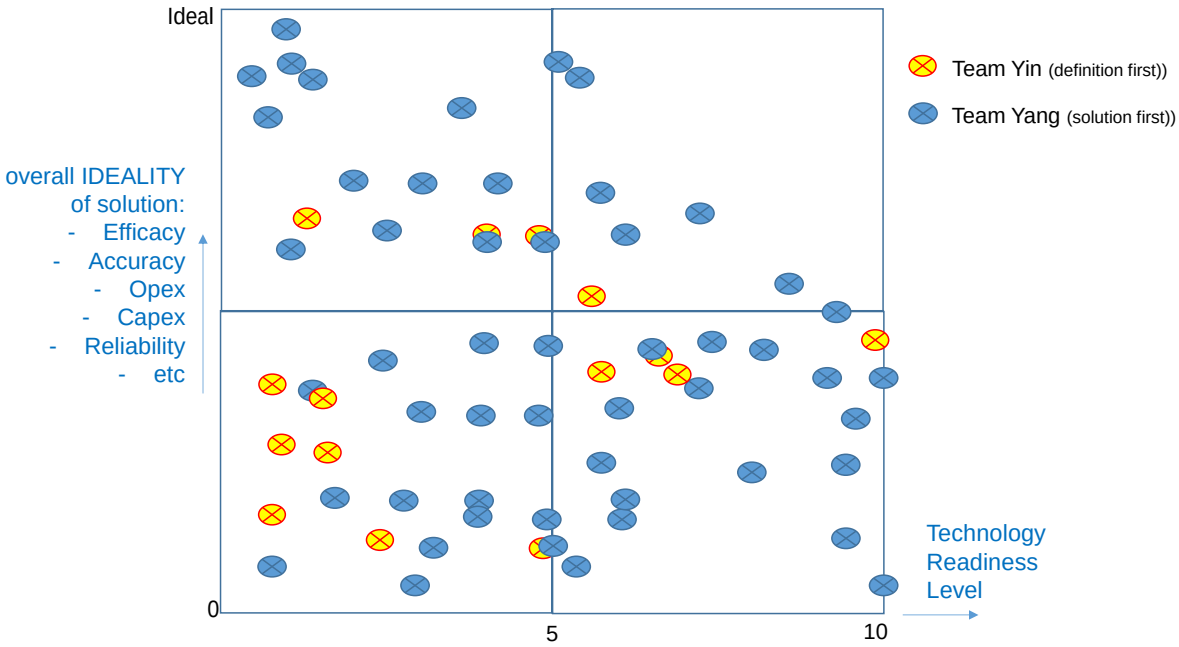


Figure 3: Ideality-Versus-TRL For The Solutions Produced By The Two Teams

The scoring convention and means of presentation used in the Figure 3 image is such that the ultimate ideal solution – technically 'ideal' and also already available (TRL = 10 on the modified version of the standard scale) – is denoted by the top right hand corner of the picture. Not surprisingly, no solutions derived during the workshop found itself at this position. Rather, the point is intended to define a means of assessing overall solution quality – the closer a point on the graph is to that top-right-hand-corner point, the higher the 'quality'. With that in mind, any point in the top right hand quadrant of the picture is deemed to have a higher quality than points in any of the other three quadrants. Team Yin managed to get one point into this 'best' quadrant; Team Yang managed to get seven.

The top left quadrant, then, denoted the high quality but less mature solution possibilities. Team Yin managed to get three of their solutions in to this quadrant, compared to 13 by Team Yang. Two of the three solutions obtained by the Yin's were also identified by the Yang's.

In terms of the overall number of ideas presented at the end of the workshop, Team Yin had 15 ideas, while Team Yang managed 53. Overall, there was a substantial enough overlap between five of the solutions from each group to be able to say they were effectively the same solution.

The Learnings

We have long hypothesized that a majority of people find it easier to work 'back to front' on complex problems – generating a bunch of 'answers' first and then working out afterwards what problems those solutions might help to solve. We'd never before had any real data to be able to speculate how much easier and how better that approach might turn out to be. The fact that Team Yang – the 'back to front' team in this experiment – outperformed Team Yin was unsurprising in that it seems to confirm the basic hypothesis. What was surprising was the dramatic margins by which Yang beat Yin on every front – over three time the total number of solutions; a seven times advantage in terms of the highest overall quality solutions; and an almost 5 times advantage in terms of the overall ideality (ignoring TRL) of the ideas generated.

Of course, the results of this one experiment shouldn't have too much read in to them. They should, however, cause the 'traditionalists' – which necessarily includes the majority of the TRIZ world (and particularly the Russians that 'insist' that the only way to solve inventive problems is to work through a definition-then-solution schema as prescribed in the various versions of ARIZ) – to at least contemplate the possibility that there might be alternative strategies that can be brought to bear when working on fuzzy, complex problems.

If we try to explain why the solution-first strategy worked so much better in this experiment we think, reflecting on the session, the answer boils largely down to one of psychological inertia. Because Team Yang was asked to launch directly into solution generation mode, they had no way to determine whether a solution that emerged was good or not, hence all they could sensibly do was keep generating more ideas and trust that they would eventually be able to map those solutions to something useful. The trust issue was no doubt helped by the fact that very quickly the team could see that the Trendstorm was pointing them in directions that were at the very least 'intriguing'. Conversely, when Team Yin allowed themselves to enter solution generation mode, there was a strong tendency that whenever someone suggested their (inevitably very fragile) idea based on a direction suggested by the Inventive Principles, someone else would almost immediately offer up a comment like, 'but how does that help us to solve the contradiction we're working on?' By allowing themselves to get into this kind of debate – even though I repeated the 'quantity

not quality' mantra several times during their ideation session – they effectively prevented themselves from writing down solution clues that might have turned out to be useful. I had no way of assessing how many ideas they had that didn't get recorded, but my subjective conclusion is that, because they were using several of the Inventive Principles Team Yang had used, there must have been significantly more overlap between the two groups than the final results suggested.

Another reflection I think is relevant to an overall learning from the exercise: Team Yang started with the Trends part of the process and, as best I can tell over two-thirds of their eventual solutions total came from their use of this source. Team Yin, on the other hand, although the Trends and EvPot+ software were also available to them, decided that having spent so much time finding contradictions, their best course of action was to use the Inventive Principles to try and solve them. While this was and will always be a logical conclusion to draw, but of course, each jump on each of the Trends is also about a way of solving a contradiction. Whether it's the more tangible images and examples that accompany the Trends versus the Principles that ultimately make the difference, it is probably too early to make any meaningful conclusions, but what does seem clear is that people tend to generate more good solutions faster using the Trends than any other part of the SI toolkit.

Finally, thinking about the overall fundamentals, when we were ultimately able to combine all the work done by both Teams, we end up with the best of both worlds – some very good (psychological-inertia-free) solution ideas and some deeply insightful problem definitions. The real magic then boils down to how well we're able to match the two sides of the equation together. As we've been suggesting for a long time now, 'innovation is enabled when we successfully match the Voice of the Customer to the Voice of the Product. What this experiment seems to confirm is that it doesn't actually matter which Voice we start with.

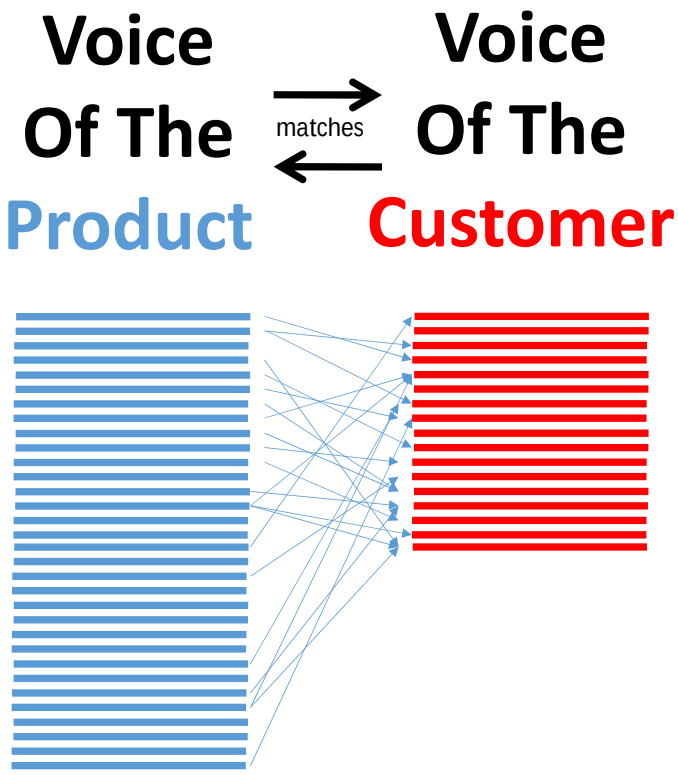


Figure 4: 'Voice-Matching' Solution Mapping Schema

Reference

1) Mankins, J.C., ‘Technology Readiness Levels: A White Paper’, NASA Office Of Space Access & Technology, April 1995, http://www.hq.nasa.gov/office/codeq/trl/trl.pdf

Free, Perfect & (Not) Now

"Put your hand on a hot stove for a minute, and it seems like an hour.
Sit with a pretty girl for an hour, and it seems like a minute.
That's relativity."
Albert Einstein

Several eons ago, back in the mid-1990s, we found ourselves working with several of the big automotive OEMs on various versions of what became known as 'X-Day Car' projects. The big idea was that manufacture and logistic processes should be made so efficient that a customer ought to be able to walk into a car dealership, chose a car, design their perfect suite of options, press a button that would send an instruction to the relevant production line to start making their car and then have it delivered to them in X days. Where 'X' was either 3, 5 or 7 days depending on how ambitious the OEM was. Part of the idea, of course, was to overcome a dealership related contradiction – dealer's primary motivation was selling the cars they had rather than the cars the customer actually wanted (for one OEM who shall remain nameless, 75% of all dealer-originated transactions involved customers being sold something that compromised on what they *actually* wanted – such that they accepted a different colour, or trim or accessory or whatever, usually in return for some kind of discount). After several million dollars-worth of 'improvement' activity, all talk of the 3-Day or the 5-Day car suddenly disappeared in a partially hidden shroud of thinly veiled embarrassment on the part of the OEMs. It turned out customers weren't that interested in a 3-Day car. Great that the logistics people had found a way of stripping some very tangible waste from their processes, not so great that the industry had fallen in to the trap of failing to understand the behavior-driving intangible customer needs.

It is that tangible/intangible discrepancy that serves as the focus for this article. In the tangible word, systems evolve to an Ideal Final Result (IFR) in which the ideal is 'now'. In the emotion-driven, intangible world, it seems, the ideal is usually something quite different. Per the Einstein quote at the head of the article, intangible time appears to be very non-linear. And thus identifying the 'true' IFR (tIFR?) can often be a somewhat more precarious activity than has traditionally been assumed.

In the case of the erroneously targeted 3-Day car initiatives, what the OEMs failed to understand with the timing of the gap between when a customer orders their new car and when it arrives is that there were several intangibles that were likely to come in to play:

- A perception that a very rapidly built car would have 'inevitable' quality compromises made to it… people want to think that their precious new vehicle has been cared and sweated over (we can observe a lovely solution to this intangible from some luxury car manufacturers these days in that they provide customers with a website that allows them to see the progress of their vehicle through the different stages of the manufacture process; a level of transparency that assures the customer that everyone along the line is taking good care to do things well).
- A desire to 'do their homework' by reading-up on and preparing for the impending arrival to the family, ensuring that they know how to properly look after the vehicle. And not crash the first time they drive it off the forecourt!
- A desire to show-off and brag about their about-to-arrive new car to friends, neighbours, and – very importantly – the rest of the family. Or if not 'showing-off'

per se (not everyone gets to buy their dream car), at least cushioning the blow by justifying why they chose the car they ended up choosing.

Taken together, at least one of the major OEMs has now worked out that, taking these intangibles into account, the tIFR time from ordering to delivery of a new car is somewhere between 7 days and 6 months depending on the purchase price, geographic region and age of the customer. It's still not quite a science, but it's getting to be somewhere close.

Here are a few other examples of situations where providers have been able to observe and/or to understand or make use of the ideal intangible timing drivers:

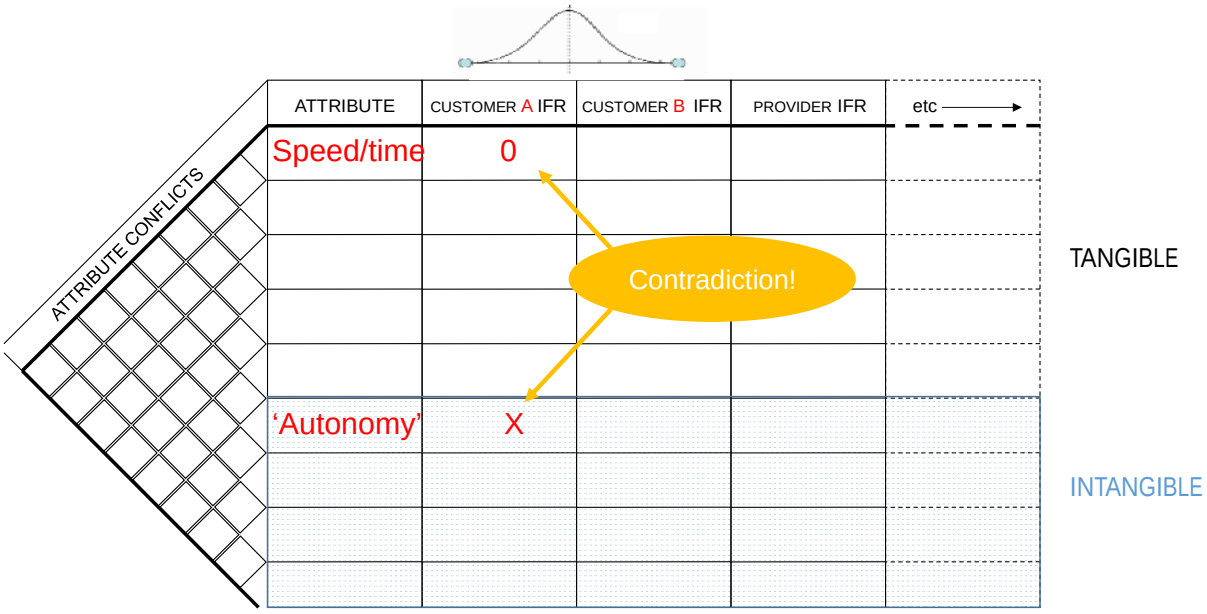
1) 'Sin' products/services and delayed gratification: if you ever get the chance to (surreptitiously – you might cause offence if you're spotted!) watch a smoker lighting up a cigarette, or a drinker taking their first taste of a glass of wine you will frequently observe a brief pause before the ignited flame is brought to the tip of the cigarette, or pause to smell or appearance of the wine. Almost like, to take the smoker example, the lit match or lighter sends the clear (tangible) signal that nicotine is 'safely on its way', i.e. that relief from the craving is at hand, so that the pause is a way that the smoker is able to re-assure themselves that they are still in control – and/or actually that withholding the relief makes the relief that much sweeter when it finally arrives.

2) Downloading content from the Internet or waiting for a piece of software to complete a calculation: here's a classic case of tangible IFR being different from the intangible – never are people more impatient than when waiting for their computer to do something. Seeing more than a couple of seconds of the dreaded Microsoft egg-timer or spinning-circle icon is a sure fire way to drive people to want to attack their keyboard with a lump hammer. But at the same time, intangibly, if I just spent a substantial amount of money on an album or piece of software and it downloaded in under a second, there is a doubt about whether I've just been ripped-off: 'if it downloaded that quickly, it can't have any real content'. Smart software companies have learned that this now-and-not-now contradiction is best solved by keeping users productively occupied on other things while their download is taking place: people, in other words, don't mind waiting for things provided they don't feel like they're trapped and unable to do anything else.
3) Anticipatory assistance: assuming it doesn't come across as intrusive ('someone was watching me'), when a service provider anticipates the needs of a customer early – ideally earlier than the customer themselves perceives them – there is the opportunity for one of the biggest intangible-driven 'wow's. The tIFR in these kinds of situations is a negative number… my real ideal is I want assistance before I actually need assistance; I want to feel like someone in the tribe cares about me. This kind of 'pre-condition interception' solution is most frequently observable

between close friends and partners – passing your loved one a tissue just before the sad scene in her favourite movie perhaps being the most clichéd example. From a product perspective, the extraordinary success of products like Vick's First Defence – 'kill the cold before the cold arrives' – plays to this anticipatory role. Without wishing to cast any aspersions about the tangible pharmaceutical benefits of a product like First Defence, the very fact that it purports to solve a problem before the problem has actually arrived offers, very likely, all the (intangible!) Placebo benefits needed to deliver a tangible benefit.

Each of these examples points towards one or more of the three core intangible drivers – autonomy, competence and relatedness – we discussed in last month's article:

The point of that article was to provide a checklist to help complete the Outcome Map. The ultimate point of this article is to suggest that it's the same basic checklist we should be looking to use when trying to uncover the IFR-oriented contradictions:



The ultimate point then, of course, being that every time we are able to identify differences between, for example, tangible and intangible IFR definitions for a customer, or between two different intangibles-driven IFRs, we've just found a contradiction. And finding contradictions gets us pretty much to the heart of our very best innovation opportunities. That or finding a new outcome – such as incorporating an intangible-driven IFR for the first time – are in fact our only two ways of innovating.

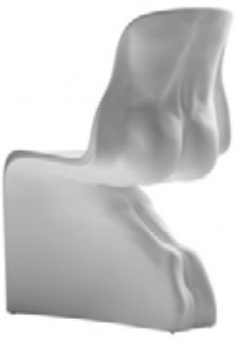
Not So Funny – Straight Lines Evolving To Curves

The TRIZ trends of evolution tell us that straight lines will eventually evolve to become curved, firstly in two dimensions, and then ultimately in three. The basic idea being that there is a functional benefit to be accrued. Sometimes designers understand the curvature part of the trend, but don't quite get a full grasp of the functional part. You decide…

If the base of a shelf unit is flat, sure as eggs are eggs, it needs to become, err, curved…

Speaking of eggs, why have a 2Drug when there's a completely unused third dimension…

Actually, I think I'd quite like one of those in the office. Not sure about these other overly-curved furnishing 'solutions' though….



Door handles… point to line to curve to 3D curve. Et voila…

Urinals… 2D curve to 3D curve. Thanks, Mother Nature for the inspiration. Whenever I get the chance I always like to pee in large man-eating flower replicas…

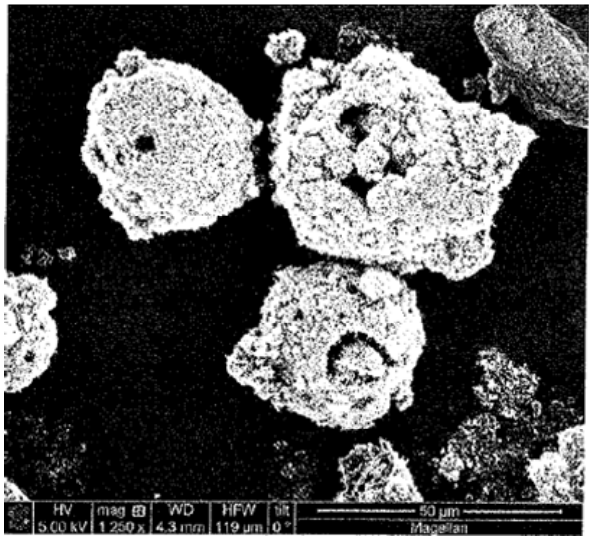
Speaking of such matters, how about this for the ultimate in 3D millinery. The weirdest thing about this one is I'm sure I've heard people telling me I've been wearing a hat like this even when I wasn't…

A tad more subtle, for those that like a good manicure. Here's the hundreds and thousands version, beautifully turning an ergonomically designed smooth, flat thing into a potentially useful 3D roughened thing. Careful where you stick it, though…

(Good reminder, too, how easy it can be to manufacture 3D stuff: step 1: paint nails, step 2: dip in small 3D things)

Finally, the gravy boat I received for Christmas this year. I've spent the time since doing tablecloth laundry.

Patent of the Month – Carbon Nanotubes From Flyash



Patent of the month this month takes us on a rare excursion to Saudi Arabia and specifically an inventor at King Abdulaziz University. US8,609,189 was granted on December 17. Mere mention of the phrase 'carbon nanotube' (CNT) is usually enough to fill us with a deja-vu-like feeling of underwhelm-ment these days, there being so many CNT-mentioning patents being issued. Sure, CNTs offer significant step-change opportunities across just about every aspect of human engineering endeavor, but once you've seen one good (Level 3/4) CNT-based patent, you've seen the thousand (Level 1) others that follow somewhat depressingly in its wake. Here's one of the best Level 4 solutions we've seen in quite some time. And a fantastic example of a 'Lemons Into Lemonade' solution to boot. Here's what the invention disclosure background description section tells us about the basic Lemons probem:

Fly ash is one of the residues generated in combustion, and is formed from the fine particles that rise with the flue gases. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal-fired power plants. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO.sub.2) (both amorphous and crystalline) and calcium oxide (CaO), both being endemic ingredients in many coal-bearing rock strata.

Fly ash is typically seen as an environmental hazard and is considered a waste product with little to no reclamation potential. Water desalination processes, in particular, create large quantities of fly ash, typically in the form of carbon-rich flue ash. Power plants also produce large quantities of such carbon-rich fly ash, typically from crude and heavy oil processes. For example, in Saudi Arabia, water desalination plants and power plants, which are typically fueled by crude oil or heavy oil, produce large amounts of fly ash daily that may have a carbon content of 80%-90%, the remainder being oxides of silicon, aluminum, nickel, vanadium and iron. Most of this fly ash is treated as waste, and is disposed of at landfills.

Due to the environmental hazards of producing fly ash and disposal of fly ash as a common byproduct of many industrial processes, it would be desirable to provide a method for recycling the fly ash into useful components, such as reactive carbon, which could be used for other desired processes.

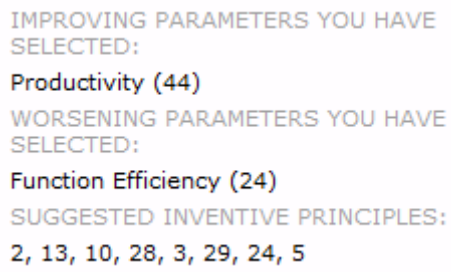
Thus, a method of forming carbon nanotubes from carbon-rich fly ash solving the aforementioned

problems is desired.

Forget upcycling of waste materials, what this inventor has basically done is turned one of the very lowest forms of waste into one of the potentially highest value materials on the planet. For that ambition alone, we ought to salute Dr Salah. But then when we learn how the alchemy is performed, we get to take the praise up another notch when we are told that ultrasound is involved. Here's the basic inventive step:

A method of forming carbon nanotubes from ultrasonically treated carbon-rich fly ash of burned heavy oil from desalination plants and power plants, comprising the steps of: providing carbon-rich fly ash of burned heavy oil from desalination plants and power plants; ultrasonically treating the carbon-rich fly ash to produce an ultrafine powdered ash, wherein the hybridization for each carbon is sp2, the ultrasonic treatment includes the steps of: dissolving the carbon-rich fly ash in water to form a solution; sonicating the solution for about five hours; separating the ultrafine powdered ash from the solution; and drying the ultrafine powdered ash; and reacting the ultrafine powdered ash in a low pressure chemical vapor deposition reactor to form carbon nanotubes, the reacting step further comprises the step of introducing a carrier gas into the reactor when the temperature of the reactor reaches about 700.degree. C., wherein the carrier gas is at least nitrogen.

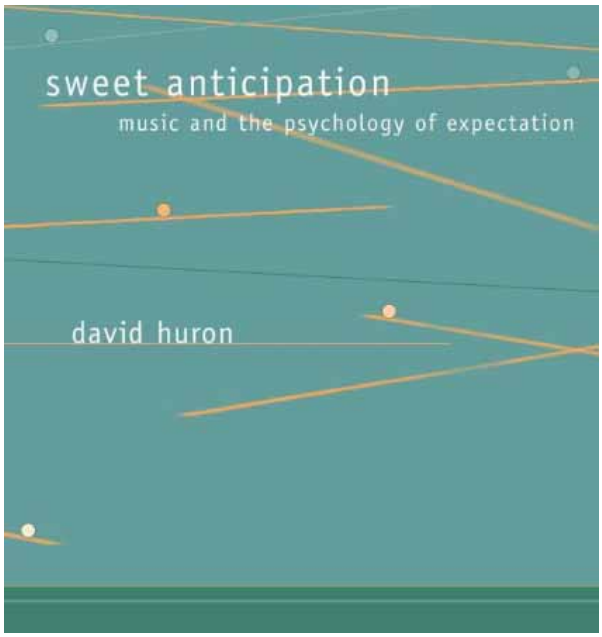
Not that it really needs it when we see an invention this good, but for the sake of completeness, from a contradiction perspective, we might map the basic problem being solved as a productivity versus efficiency conflict. Here's what happens when we look that pair up on the Matrix:



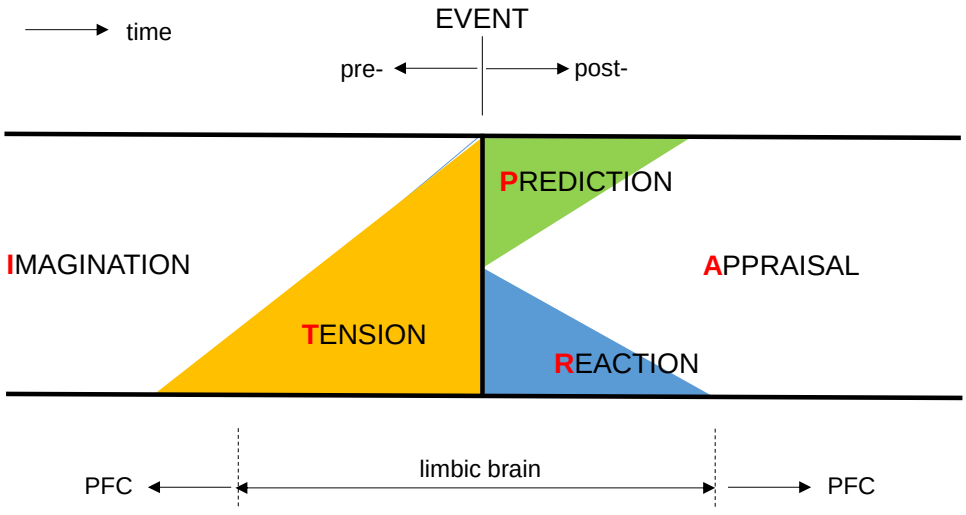
Good to see that Principle 28 is there to point a way towards the use of the ultrasonic field. Also interesting to note that Principle 29 helps us to get to the fluidisation part of the solution and Principle 24, Intermediary takes us to the incorporation of the nitrogen 'carrier gas'. Easy when you know how…

…now to start working on the problem of reducing the cooking time from five hours down to a few seconds. Resonance anyone?

Best of the Month – Sweet Anticipation



Maybe not everyone's cup of tea, but we think this month's book choice represents a classic case of a 'someone, somewhere has solved your problem' story if you're interested in the dynamics of 'wow' and you don't mind dipping your toes into the world of music. We only opened this book because of its possible relevance to our upcoming music post-doctoral research project, but it turns out, maybe because music is such an extreme example of the human brain's uncanny ability to 'predict the future', that author David Huron has pieced together a jigsaw that no-one in the traditional world of psychology seems to have uncovered. You might not be interested in music, but that shouldn't prevent you from taking a look at this (heavyweight – 450 pages!) gem of a book. The first and last thirds in particular will likely be of interest to anyone keen to understand more about how the 'wow' effect works: the first third of the book proposes that emotions evoked by expectation involve five functionally distinct response systems: reaction responses (which engage defensive reflexes); tension responses (where uncertainty leads to stress); prediction responses (which reward accurate prediction); imagination responses (which facilitate deferred gratification); and appraisal responses (which occur after conscious thought is engaged).



For real-world events, these five response systems typically produce a complex mixture of feelings. The book identifies some of the aesthetic possibilities afforded by expectation, and shows how common musical devices (such as syncopation, cadence, meter, tonality, and climax) exploit the psychological opportunities. The theory also provides new insights into the physiological psychology of awe, laughter, and spine-tingling chills. Huron traces the psychology of expectations from the patterns of the physical/cultural world through imperfectly learned heuristics used to predict that world to the phenomenal qualia we experienced as we apprehend the world.

The final third of the book shifts the focus from describing the model to a more proactive look at using it to create different emotional responses – predictability, surprise, tension – and as such makes for an almost recipe-like formula that can be used to create musical compositions that deliver the desired effect. Although the focus is on music, we think that Huron has hit upon something much more universally applicable to a host of other ‘design’ situations.

Rest assured, you’ll be hearing more from us on some of these applications. Not to mention how we can already see how it will combine very elegantly with our previous work on the application of TRIZ Inventive Principles in the creation of musical wows.

Conference Report – Innovation In Music

The UK's main music innovation conference of the year took place at the University of York during December. It marked a rare venture by us into the 'creative arts', and as such we were more than a little nervous presenting our paper on 'Systematic (Music) Wow'. Turns out we needn't have worried at all. The musical creative arts turn out to be a lot like other creative arts in that they are crammed to the brim with lots of very, very uncreative people. First sign: almost everyone carried at least one Apple 'look I'm creative' product (thus, as in other walks of Apple life, obviating the need to demonstrate any actual creativity). Second sign: an array of presentations that veered wildly from the dull (is there anything worse than presenters who make a Powerpoint slide deck full of just words… that they decide to read verbatim to the audience?) to the tortuous (a stupifyingly mind-numbing presentation on the Djent heavy-metal music genre delivered by a person who thought the best way to communicate what he'd 'discovered' by not having any slides, music or anything other than him sitting at a table reading his paper aloud. In not so glorious monotone).

Part of the thinking behind our music research is that the industry, having pretty much imploded over the course of the last five years, is ripe as it will ever be for innovation. If the 80 or so attendees at this conference were anything to go by, when someone finally does innovate within the sector, it is very unlikely to be by anyone within the sector. Which hopefully bodes well for us. Not so much for this lot…

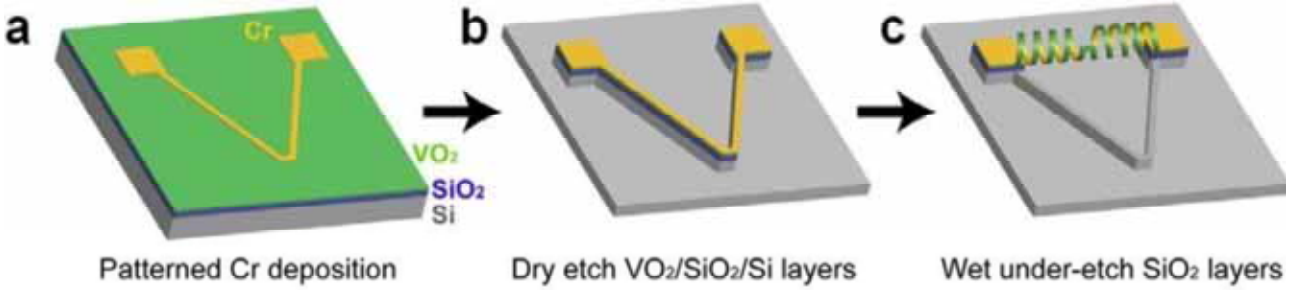
KES International	Innovation In Music 2013		DRAFT CONFERENCE TIMETABLE *subject to change*
Wednesday 4th December 2013			
18:30	18:30 Registration & Drinks Reception and 19:30 Opening Concert	**'IMPRINTS'** - Opening Concert in quadraphonic.	York St John University, Temple Hall, Lord Mayor's Walk, York, YO31 7EX
Thursday 5th December 2013			
08:30	Registration & Networking		Music Research Centre, Department of Music, University of York, YO10 5DD
09:00	Conference Opening and Welcome	Welcome talks from hosts, KES International and Conference Chairs	
09:05	**Keynote Talk**	**Crispin Murray** (Guilde Productions) - "Restoring Audio Quality"	
09:50	Special Session	**'Tweeting Machines'** with Jerry Fleming	
10:20	Coffee & Networking		
10:45	**Parallel Paper Session 1**		
		Paper Session 1A - Technology & Artistic Innovation 1 *(chaired by Jez Wells)* • William Campbell - "A Quantitative Evaluation of Signal Masking in Summed and Compressed Audio" • Dr. Rob Toulson - "Evaluating harmonic and intermodulation distortion of mixed signals processed with dynamic range compression" • Benjamin Eyes - "Real Time Drum Augmentation with Physical Modelling" • Dr.Chris Barlow - "Potential for reduction in noise exposure using closed back headphone monitoring for rehearsal - a pilot study"	**Paper Session 1B - Composition & Innovation** *(chaired by Ben Burrows)* • Darrell Mann - "Automated? Wow? Generation In Musical Composition" • Dr. Rob Smith - "Interdependiable: Case studies on improvised music, composition and contemporary dance" • Dr Mark Marrington - "Contemporary music technology and creative autonomy: auteurship and the DAW" • Bruce Darlington - "Music On The Screen"
12:00	Lunch		
12:45	**Keynote Talk**	**Thomas Lund** (TC Electronic) - "Give Peaks A Chance"	
13:30	Industry Special Session	**Phil Dudderidge** (Focusrite) - "Planned collaborations – when two minds meet and actually agree!"	
13:50	Industry Special Session	**Dave Hodder** (Novation) - "Unplanned collaborations – creating the foundations for unexpected and diverse innovation"	
14:20	Special Session	**'Theremin Ballards'** with David Young	
14:45	Coffee & Networking		
15:00	Special Session	**Paul Ferguson** - "LOLA Rehearsal"	
15:30	Special Session	**J.A.M.E.S.** - Panel on "Music Technology and Knowledge Transfer", chaired by Dr. Rob Toulson	
16:10	**Parallel Paper Session 2**		
		Paper Session 2A - Musical Innovation *(chaired by David Young)* • Prof. David Howard - "First applications of the Vocal Tract Organ" • Thomas Webster - "OWL Stage Effects Pedal" • Oliver Larkin - "pMix-Touch"	**Paper Session 2B - Past, Future & Present** *(chaired by Jez Wells)* • Marcus O'Dair - "The Slow Burn" • Dr. Amalie Harris - "Monetizing consumer behaviour in a multi-sided music business environment" • Andra Ivanescu - "The Music of Tomorrow, Yesterday! (Music, Time and Technology in Bioshock Infinite)"
17:15	Conference day finishes		
19:30	Conference Dinner	**Conference Banquet and Networking**	Royal York Hotel (next to York Railway Station)

KES International	Innovation In Music 2013		DRAFT CONFERENCE TIMETABLE *subject to change*
Friday 6th December 2013			
10:00	Registration & Networking		Music Research Centre, Department of Music, University of York, YO10 5DD
10:15	Special Session	**Jeff Levison**, (IOSONO China) - "Practical Applications Using Wave Field Synthesis in live Performance"	
10:45	Special Session	"TouchKeys" multi-touch keyboard with Andrew McPherson	
11:15	Special Session	**CollabHub** - Fostering enterprise in music technology	
12:00	Lunch		
12:45	**Keynote Talk**	Keynote Interview - **Jake Gosling** (Producer), interviewed by Dr. Rob Toulson	
13:45	**Parallel Paper Session 3**	**Paper Session 3A - Software & Uses 1** *(chaired by Jez Wells)* • Justin Paterson - "Wavefondler" • Dr. Sander Huiberts - "The Game Pulse - Timing Game Events and Music Events" • Dr. Rob Toulson - "Embedding ISRC Identifiers in Broadcast Wave Audio Files"	**Paper Session 3B - Technology & Artistic Innovation 2** *(chaired by Ben Burrows)* • Dr. Ryan Stables - "Assisted Parameter Modulation in Music Production using Large-Scale Producer-Defined Semantics" • Dr. Andrew Bourbon - "Multi-bus Diffusion System" • Matt Shelvock - "The Progressive Heavy Metal Guitarist's Signal Chain: Contemporary Digital and Analog Strategies"
14:45	Coffee & Networking		
15:00	**Parallel Paper Session 4**	**Paper Session 4A - Software & Uses 2** *(chaired by Ben Burrows)* • Dr Kenneth McAlpine - "Sampling the past: A tactile approach to interactive musical instrument exhibits in the heritage sector" • Hall Santamas - "Audio-Photographic Art: An introduction to music and photography as a single art object"	**Paper Session 4B - Technology & Artistic Innovation 3** *(chaired by Jez Wells)* • Mack Enns - "Tearing Apart the Soundscape: Fez and the Conceptualization of Space in Recorded Music" • Tychonas Michelidis - "The Art of Illusion: the magic in performing electronic music"
15:40	Conference Plenary Session	"INNOVATE" - cross-disciplinary panel-lead group discussion to which all delegates are invited to contribute.... *(Chaired by Justin Paterson)*	
16:20	Conference Close		

If there was going to be even a glimmer of hope amongst the crowd it was the interview with currently-hot producer Jake Gosling (think One Direction and Ed Sheeran). When asked about the secret to his success he revealed it was all down to 'being authentic'. I'm still not sure if he was being obvious, ironic or sarcastic in response to the tragically uninspired questioning from the (academic - naturally) interviewer. Maybe that was the point? That's often the trouble with 'creatives' – it's too easy to hide lack of creativity behind a façade of enigma. And/or cigarette smoke.

All in all, quite shocking. Not in a good way.

Investments – Vanadium Dioxide Muscle



Vanadium dioxide is poised to join the pantheon of superstars in the materials world. Already prized for its extraordinary ability to change size, shape and physical identity, vanadium dioxide can now add muscle power to its attributes. A team of researchers with the U.S. Department of Energy (DOE)'s Lawrence Berkeley National Laboratory (Berkeley Lab) has recently demonstrated a micro-sized robotic torsional muscle/motor made from vanadium dioxide that for its size is a thousand times more powerful than a human muscle, able to catapult objects 50 times heavier than itself over a distance five times its length within 60 milliseconds -- faster than the blink of an eye.

"We've created a micro-bimorph dual coil that functions as a powerful torsional muscle, driven thermally or electro-thermally by the phase transition of vanadium dioxide," says the leader of this work, Junqiao Wu, a physicist who holds joint appointments with Berkeley Lab's Materials Sciences Division and the University of California-Berkeley's Department of Materials Science and Engineering. "Using a simple design and inorganic materials, we achieve superior performance in power density and speed over the motors and actuators now used in integrated micro-systems."

What makes vanadium dioxide highly coveted by the electronics industry is that it is one of the few known materials that's an insulator at low temperatures but abruptly becomes a conductor at 67 degrees Celsius. This temperature-driven phase transition from insulator-to-metal is expected to one day yield faster, more energy efficient electronic and optical devices. However, vanadium dioxide crystals also undergo a temperature-driven structural phase transition whereby when warmed they rapidly contract along one dimension while expanding along the other two. This makes vanadium dioxide an ideal candidate material for creating miniaturized, multi-functional motors and artificial muscles.

"Miniaturizing rotary motors is important for integrated micro-systems and has been intensively pursued over the past decades," Wu says. "The power density of our micro-muscle in combination with its multi-functionality distinguishes it from all current macro- or micro-torsional actuators/motors."

Wu and his colleagues fabricated their micro-muscle on a silicon substrate from a long "V-shaped" bimorph ribbon composed of chromium and vanadium dioxide. When the V-shaped ribbon is released from the substrate it forms a helix consisting of a dual coil that is connected at either end to chromium electrode pads. Heating the dual coil actuates it, turning it into either a micro-catapult, in which an object held in the coil is hurled when the coil is actuated, or a proximity sensor, in which the remote sensing of an object (meaning without touching it) causes a "micro-explosion," a rapid change in the micro-muscle's resistance and shape that pushes the object away.

"Multiple micro-muscles can be assembled into a micro-robotic system that simulates an active neuromuscular system," Wu says. "The naturally combined functions of proximity sensing and torsional motion allow the device to remotely detect a target and respond by reconfiguring itself to a different shape. This simulates living bodies where neurons sense and deliver stimuli to the muscles and the muscles provide motion."

The vanadium dioxide micro-muscles demonstrated reversible torsional motion over one million cycles with no degradation. They also showed a rotational speed of up to approximately 200,000 rpm, amplitude of 500 to 2,000 degrees per millimeters in length, and an energy power density up to approximately 39 kilowatts/kilogram.

"These metrics are all orders of magnitudes higher than existing torsional motors based on electrostatics, magnetics, carbon nanotubes or piezoelectrics," Wu says.

The heating of the vanadium dioxide micro-muscle to actuate it can be done either globally with a tiny heating pad, or with an electrical current applied to the dual coil. Wu says heating with the electric current is the better way to go because it allows for the selective heating of individual micro-muscles and the heating and cooling process is much faster. In addition, as vanadium dioxide absorbs light and coverts it into heat, the coil can also be triggered optothermally.

"With its combination of power and multi-functionality, our micro-muscle shows great potential for applications that require a high level of functionality integration in a small space," Wu says.

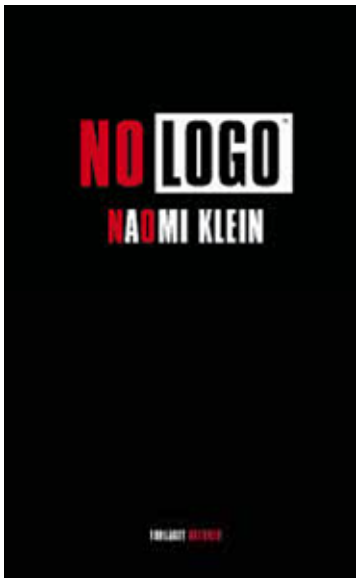
Kai Liu, Chun Cheng, Joonki Suh, Robert Tang-Kong, Deyi Fu, Sangwook Lee, Jian Zhou, Leon O. Chua, Junqiao Wu. Powerful, Multifunctional Torsional Micromuscles Activated by Phase Transition. *Advanced Materials*, 2013; DOI: 10.1002/adma.201304064

Generational Cycles – Nomad Brands

This article represents the first in a series (of four – one for each of the main generational archetypes) looking at the relationship between a generational cohort and the brands they buy. Or don't. A point most appropriate to what is undoubtedly the most difficult of the archetypes for marketers to attract, the Nomads. That's where we start this month, looking at the Generation X cohort born between around 1962 and 1980. The primary traits of this generation are 'abandonment' when growing up, 'alienation' when in their early adulthood years, and then becoming 'pragmatic' in their 40s and 50s. The main difficulty advertising to this generation resides in their 'alienation' years.

The alienation most usually manifests as a rejection of authority. Anything that an authority figure – parents, politicians, bosses and big companies – says to the alienated Xer is very likely to be rejected, irrespective of the merits of what is being said. In other words, here is a generation who's deepest instincts frequently see them cutting their nose off to spite their face. The enormous problem for marketers in big companies is that no matter what they say, merely because what's being said comes attached to an 'evil' corporate logo, means it will be very unlikely the Xer will listen. Corporate logos make for Nomad advertising kryptonite.

That doesn't mean that Nomads are necessarily 'impossible' to sell to, merely that different approaches are needed. Right at the heart of the Nomad 'DNA' is a 'not selling out' meme… inspired in no small part by the classic No Logo book phenomenon written by Nomad-icon Naomi Klein (born 1970).



What No Logo said to every Nomad that read it was that all big businesses by definition have sold out. Not-selling-out means that advertising needs to be completely 'authentic', something that a large organization finds it almost impossible to be. The best (only?) option for advertisers in this situation is to play on being authentically-false. A classic example here would be Unilever's (an evil giant if ever there was one in Nomad terms) Pot Noodle advertising. Everyone knows that Pot Noodle is cheap junk food, so rather than try and make it out to be something that it isn't, what Unilever did beautifully was exaggerate the negatives. Hence…

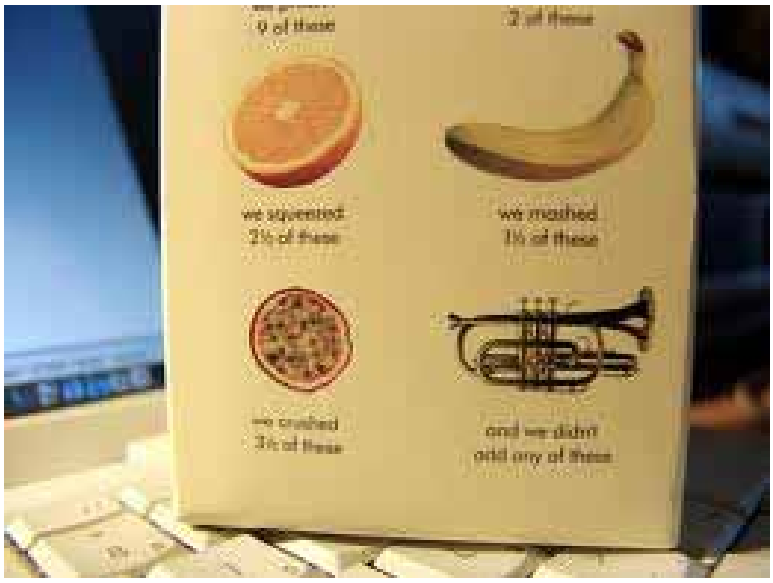
Self-deprecating and funny is probably as good as it will get for big businesses in Nomad-land. What Nomads really like are classic David-versus-Goliath product successes. See for example, the extraordinary rise in micro-breweries over the course of the last 20 years. There's nothing authentic about 'Miller Time'; everything authentic about a lone beer-lover deciding to start brewing tiny quantities of beautifully cherished and nurtured 'real ale' in a shed at the end of their garden.

In the UK, the all-time classic Nomad brands of recent times have been Innocent (smoothies) and Green & Blacks (chocolate). Green & Blacks took the whole idea of Fair Trade to heart, but managed to beautifully convince Nomads that not only were they helping ('little guy') cocoa farmers in developing companies, but were also getting a product that tasted significantly better than the products being churned out by the big companies.

Innocent was started by (1973-born Nomad) Richard Reed in 1999.

The company began selling smoothies at a music festival. They put up a huge sign with "Who thinks we should leave our jobs to make smoothies?" written across it. Two big bins stood in front of paying customers, one said YES in big letters and one said NO. Customers voted with their empties, and sure enough, at the end of the weekend the yes

bin was heaving. A story that takes authenticity about as far as a beverage maker could possibly go. Plus, even the most cursory looks at their product packaging reveals they also totally understand the idea of self-deprecating humour. The added touch of Nomad-friendly surrealism doesn't harm either:



Biology – Coachwhip Snake (*Masticophis flagellum)*

A new study from the University of Waterloo shows that snakes can optimize their vision by controlling the blood flow in their eyes when they perceive a threat.

Kevin van Doorn, PhD, and Professor Jacob Sivak, from the Faculty of Science, discovered that the North American and Mexico native coachwhip snake's visual blood flow patterns change depending on what's in its environment. The findings appeared in a recent issue of the *Journal of Experimental Biology.*

"Each species' perception of the world is unique due to differences in sensory systems," said van Doorn, from the School of Optometry & Vision Science.

Instead of eyelids, snakes have a clear scale called a spectacle. It works like a window, covering and protecting their eyes. Spectacles are the result of eyelids that fuse together and become transparent during embryonic development. When van Doorn was examining a different part of the eye, the illumination from his instrument detected something unusual. Surprisingly, these spectacles contained a network of blood vessels, much like a blind on a window.

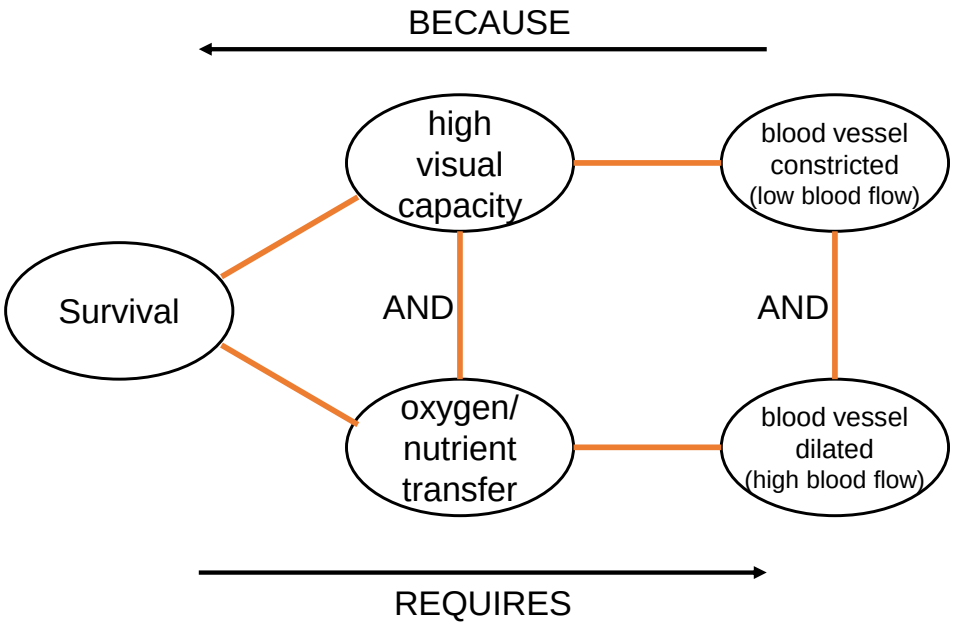
To see if this feature obscured the snake's vision, van Doorn examined if the pattern of blood flow changed under different conditions. When the snake was resting, the blood vessels in the spectacle constricted and dilated in a regular cycle. This rhythmic pattern repeated several times over the span of several minutes.

But when researchers presented the snake with stimuli it perceived as threatening, the fight-or-flight response changed the spectacle's blood flow pattern. The blood vessel constricted, reducing blood flow for longer periods than at rest, up to several minutes. The absence of blood cells within the vasculature guarantees the best possible visual capacity in times of greatest need.

"This work shows that the blood flow pattern in the snake spectacle is not static but rather dynamic," said van Doorn.

Next, the research team examined the blood flow pattern of the snake spectacle when the snake shed its skin. They found a third pattern. During this time, the vessels remained dilated and the blood flow stayed strong and continuous, unlike the cyclical pattern seen during resting.

If (Principle 15) Dynamic eyesight is the answer, the underlying conflict the extraordinary coachwhip snake solution has successfully resolved is about parallel needs for high visual capacity and efficient transfer of oxygen and other nutrients to each part of the body. Here's what the problem looks like when mapped on to one of our Contradiction Templates:



And here's what the Matrix has to say about how others have resolved similar problems:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Ability to Detect/Measure (49)

WORSENING PARAMETERS YOU HAVE SELECTED:

Loss of Energy (27)

SUGGESTED INVENTIVE PRINCIPLES:

35, 3, 19, 15, 28, 37, 13, 2

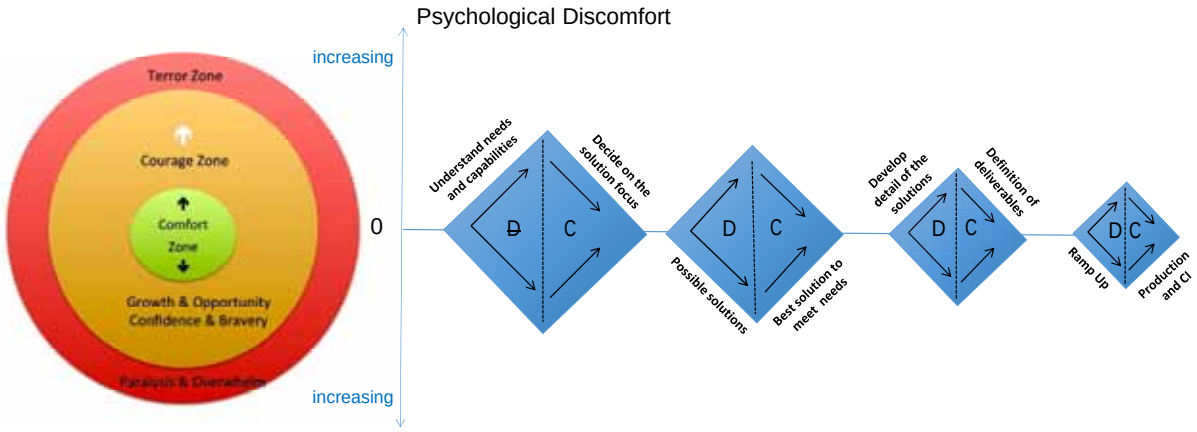
Almost as if the coachwhip snake had read the script. Or written it.

Read more here:

K. van Doorn, J. G. Sivak. **Blood flow dynamics in the snake spectacle**. *Journal of Experimental Biology*, 2013; 216 (22): 4190 DOI: 10.1242/jeb.093658

Short Thort

"The tantalizing discomfort of perplexity is what inspires otherwise ordinary men and women to extraordinary feats of ingenuity and creativity; nothing quite focuses the mind like dissonant details awaiting harmonious resolution."
Brian Greene



The more divergence you can bear; the greater the likelihood of breakthrough.
Diverge 'til you can't quite breathe any more.
No (psychological) pain; no (creative) gain.

News

India

Sometimes you wait an age for a bus, then several all come along at the same time. No sooner have we returned from one trip to India, we're invited back again. This time for Darrell to keynote at the annual Defence Research & Development Organisation (DRDO) directors conference. The event will take place in Delhi on January 23. Not that the event is open to the public, but rather to mention that if anyone wants Darrell to come and do something with them, the days 24-28, immediately after the event are available. Two of the days already look like they will be reserved for a client job; the other 2 (or 3 if you don't mind working on a Sunday) are currently looking for a home.

IRDG Ireland

Speaking of Research & Development organisations, we're also happy to be able to announce we'll be conducting a pair of workshops with Ireland's biggest Industry-lead R&D network organization during 2014. The first, scheduled to take place in April, will focus on SI and TrenDNA. The second, a bigger event scheduled for the autumn will be a big Design Thinking jamboree.

TrenDNA Russia

While it's not certain how we will be making our TrenDNA research available to the mass market in the future, existing clients may like to know that we have recently completed an analysis of the Russia and former Soviet-Bloc countries and are now able to offer coherent

workshop or project offerings using the TrenDNA method to examine market opportunities in that part of the world.

IRANFINEX
We are happy (and slightly amazed) that we get an opportunity to return to Tehran in 2014. No surprise that the visit will involve TRIZ (on Google Trends, Iran comes only slightly behind Korea in terms of TRIZ search frequency); highly surprising that we'll be giving a business-TRIZ workshop to the national financial services sector conference. 29-30 April and 1 May are the dates. In case you're thinking of attending.

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

Pharma – TrenDNA workshops
Pharma – SI Certification programme
Rail – ICMM Journey Study
Automotive – SI mentorship programme
Aerospace – SI workshops
Construction – Low-Water Consumption Toilet IP licensing
Utilities – Eyes-On-The-World Solution Finding project
FMCG – ApolloSigma IP and White-Space Study

2014
Given that the e-zine usually appears at the end of the month, please allow us to take this opportunity to offer all of our readers thanks for their support during 2013 and wish everyone a happy, prosperous and peaceful 2014.