

Systematic Innovation



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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

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

Universal Intangibles

One of the central tenets of the TrenDNA process is that the best way to understand the behavior of people is to *not* engage with them directly. 95% of Marketing budgets are wasted (we say) because marketers for the most part ask the wrong questions, and no matter how cunning they are about eliciting the answers they think they need, they are far more likely to come away from an interview or observation of a potential consumer with a whole set of inaccurate clues than with anything that will help them create the 'next big thing' they think they're after.

Right at the start of the TrenDNA process sits the 'simple' Outcome Map template (Figure 1). Even though the overall process tells us that we can start pretty much anywhere amongst the different clue generating tools, we tend to start here (and named it 'tool 1') because if we get this part of the process wrong, everything else we do downstream is likely to be skewed in the direction of wrong too.

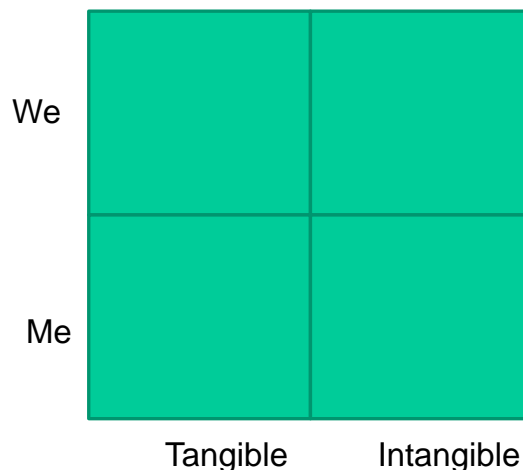


Figure 1: Outcome Map

Ofentimes, newcomers to the process worry that the things they write into the template are merely 'their assumptions' about what's driving the behavior of their target customer rather than any kind of truths that will end up determining their actual behavior. True, the tool cannot tell us everything. It cannot, for example, give us a precise steer on which of the things we write into the template are more or less important than others in the eyes of each target customer segment. But – and here's the crucial part – the things we write down, because they focus on 'outcomes', don't need direct involvement of the customer because they are all universal.

'Good reason', tangible outcomes are finite because, think about the relatively small number of function and attribute categories there are in the TRIZ-originated Function Databases, the number of functions that are available are both known. And, moreover, are known to be very stable over time. If the rate at which the SI research team adds new ways of delivering a function is 'slow', the rate at which we add complete new functions is practically glacial. The point here being that we could inadvertently miss something off the tangible side of the Map, but our only logical reason for such an error would be that we failed to adequately check through all of the already known possible tangible functions.

When it comes to the (more important) 'real reason', intangible side of the Map, the level of uncertainty about whether or not we have been comprehensive when trying to describe

all of the emotional drivers in a given situation is understandably greater. Simply because the world of emotion-related functions and outcomes has not had nearly the same level of effort devoted to mapping the world than the tangible world has had. The world right now is at a stage where for the majority of industries, designers and marketers are still stuck trying to squeeze the last drop out of the tangible outcome story, rather than explore and properly map out the relatively desert-like intangible side.

The purpose of this article – in true ‘someone, somewhere already solved your problem’ fashion – is to begin the journey through previous research from around the world, towards a correspondingly ‘complete’ list of all of the intangible functions that we might look to include in what we expect will eventually come to be a ‘comprehensive’ check-list.

Having now had the benefit of running almost a decade’s worth of TrenDNA (or its constituent parts at least) workshops with clients, we know that if we merely collated all of the outputs written into the intangible side of the Map from all of the sessions, we’d already be somewhere close to ‘comprehensive’. We know this because we see how many times groups from very different sectors end up drawing what is essentially the same short list of emotional drivers – the customer wants to be cool; they want peace of mind; they want confidence; they want to do the best for their family. The same things over and over again.

So, who has trodden this path before us?

One good answer seems to be the underpinning research that has in recent times been popularised as Self-Determination Theory (SDT) – Reference 1. SDT is centered on the belief that people have innate psychological needs that are the basis for self-motivation and personality integration. Human nature, according to the theory, shows persistent positive features, that the theory calls "inherent growth tendencies."

SDT identifies three innate needs that, if satisfied, allow optimal function and growth:

1. **Competence** - Seek to control the outcome and experience mastery
2. **Relatedness** - Is the universal want to interact, be connected to, and experience caring for others
3. **Autonomy** - Is the universal urge to be causal agents of one's own life and act in harmony with one's integrated self; however, it is about ‘being in control’ and does not mean to be independent of others

These needs are seen as universal necessities that are innate, not learned, and seen in humanity across time, gender and culture.

SDT advocates and developers, Deci and Vansteenkiste claim that there are three essential elements of the theory:

1. Humans are inherently proactive with their potential and mastering their inner forces (such as drives and emotions)
2. Humans have inherent tendency toward growth development and integrated functioning
3. Optimal development and actions are inherent in humans but they don’t happen automatically

To actualise their inherent potential they need nurturing from the social environment.

If this happens there are positive consequences (e.g. well being and growth) but if not, there are negative consequences. So SDT emphasises humans' natural growth toward positive motivation.

In terms of the Figure 1 Outcome Map, what SDT basically tells us is that the universal elements that form the basis of the two right hand columns of the Map are the trio of drivers Autonomy, Competence and Relatedness – Figure 2.

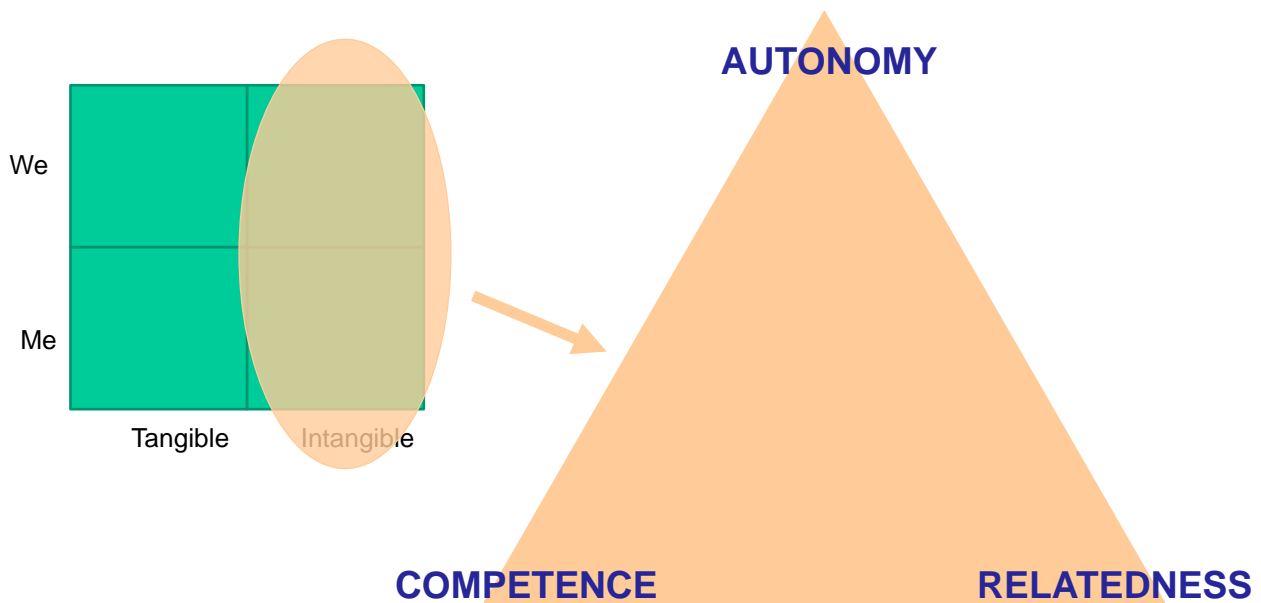


Figure 2: SDT-Based Universal Intangible Drivers

Any and all of the things we've seen written down by groups essentially fits into one or a combination of these three. (We invite readers to try it with any of their previous Outcome Maps in order to see for themselves.)

We think this trio is an important foundation-stone in the TrenDNA intangibles story, serving as what we might think of as a meta-checklist of things to make sure we've considered during any Outcome Mapping activity. For that reason alone, we hope this article justifies its existence.

Before leaving the story, however, we thought we'd plant a seed concerning possible links between SDT and the Thinking Styles work of Clare Graves. And also how we can begin to address one of the missing pieces in the present-day Outcome Mapping story – how do we know which of the listed intangible drivers are more important to a given customer without directly going to ask them?

A closer look at the three elements present in the Figure 2 model reveals the existence of a kind of cyclic progression. Having satisfying our 'relatedness' ('we') needs to become a valued member of a tribe, our focus tends to shift towards some form of autonomy ('why do I have to be with these people *all* the time') and a consequent escape from the tribe ('me'). Following our escape comes a desire for and ultimately a realisation of new skills and capabilities... which, once we have mastered, we then seek to bring back to the tribe. Figure 3 represents an attempt to plot the cyclic switch between the three poles of the SDT model:

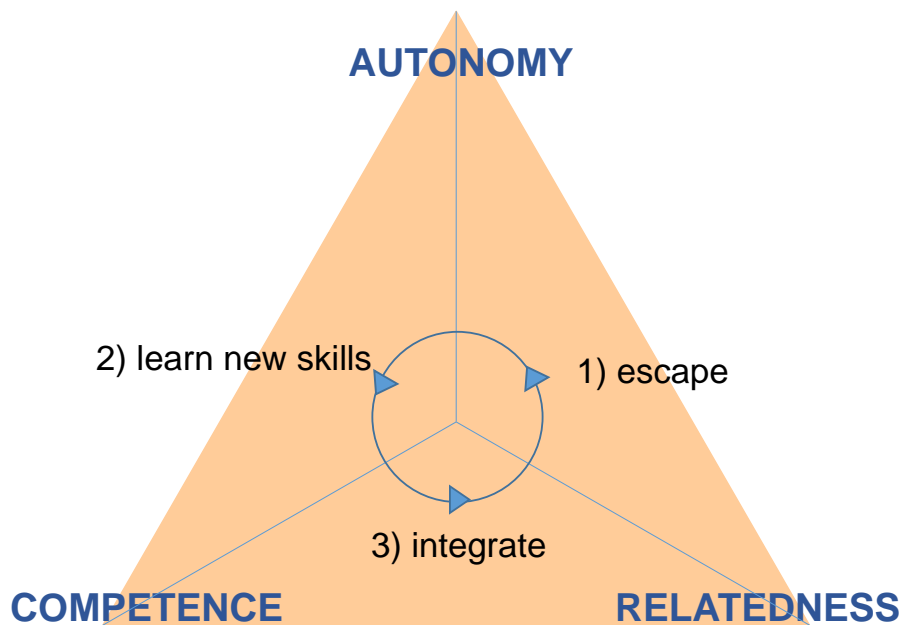


Figure 3: Relatedness-Autonomy-Competence Cycle

In effect, what the cycle represents is the same oscillation between ‘me’ and ‘we’ as may be observed in Clare Graves’ work on the evolution of human thinking styles. What SDT adds to the Graves story is that the escape to a ‘me’ (autonomy) world ends up being about learning new skills... which in turn are only useful to us if we’re able to re-integrate what we’ve learned back into the tribe. One cycle around the SDT picture may be thought of as the equivalent of the shift from one ‘we’ based meme to the next. Think, for example, about a young infant at the second ‘Tribal’ Level on the spiral. Their escape to the next Level (‘me’-focused, Feudal) occurs when they become aware of their ego and develop desires to get their own way. The resulting Level 3, Feudal independence experienced with a ‘terrible-tuos’ infant, however, isn’t a very stable state – if only because mum and dad tend not to like said infant when they behave in this way – and eventually the obstreperous child learns that their new-found egotism is only beneficial when it is able to fit into the wider (Level 4) Order.

The point here being that because we are able to detect Thinking Styles as a part of our PanSensic capability (Reference 2), we’re able to ascertain where a person is on the Graves Thinking Styles spectrum. And because we’re able to do that, we should also have a pretty good first set of clues about whether Autonomy, Competence or Relatedness are more important as intangible drivers of a person. No doubt, there’ll be more for us to say on this front in the coming months.

References

- 1) Deci, E., & Ryan, R. (1991). A motivational approach to self: Integration in personality’. In R. Dienstbier (Ed.), *Nebraska symposium on motivation: Vol. 38. Perspectives on motivation* (pp. 237–288). Lincoln: University of Nebraska Press
- 2) Systematic Innovation E-Zine, ‘Hearing What Is Really Being Said: Part 1 – Thinking Styles’, Issue 127, October 2012.

Case Study: Buy-In From The Boss

A couple of months ago I was working with a client on a new product development exercise. The company had traditionally operated in a relatively stable and unchanging part of the FMCG sector with a 'fast-follower' strategy. Recent changes in the industry had meant that there was a sudden interest in shifting to more of a pioneering approach in order to inject some new life into the market. As we came towards the end of the ideation part of the work, it seemed like we had uncovered a key consumer insight (thanks, TrenDNA!) and turned that insight into what everyone in the session deemed to be an attractive, patentable, executable solution. Being FMCG, it also looked like the sort of thing that could be prototyped very easily. By way of adding a level more robustness to the solution, the group decided to conduct a final 'yes, but' exercise before we wrapped up for the day: what, they asked, would be the next things that would prevent the idea from moving forward.

Several possible things came up, but one in particular seemed to get everyone furrowing their brows and I could feel the positive energy in the room begin to palpably sap away. The problem seemed to be the SVP that would have to sign up to provide some budget to the new project if it were to get anywhere beyond where we were now.

As a matter of course, I tend to believe that any group that allows an apparent absence of budget to hazard their future efforts is something of a red-herring. Some of the biggest and most successful innovations through history have come from groups that have had zero budget. Knowing that I'd be happy to cobble together a rough prototype in my kitchen at home of the solution we'd come up with seemed to confirm the fallacy of the group's assumption. It wasn't budget they needed, I proposed, it was an attitude that meant they'd be happy to ask for forgiveness after they'd done some more work, rather than permission before they went any further.

Everyone seemed to look at each other. I don't think anyone was convinced. So I asked to understand a bit more about the SVP. We'd talked a little bit during the day about the Mental Gears and Generational archetypes aspects of TrenDNA, albeit in the context of the consumer rather than the SVP, but as soon as I asked the group to speculate on where he (it was a 'he') sat on the spectrum, everyone quickly agreed that he was a Baby Boomer at the Moralistic stage of life, and whether it was the role he was in, or his natural character type, his thinking style was best characterized as the Blue, 'Order' mode. Which meant, here was someone who wasn't particularly enamoured of change of any kind, never mind an unproven new product idea. The group themselves, by the way, I noticed was predominantly younger GenXers ('alienated') with a small sprinkling of older GenYs ('hero's').

So, the problem, I speculated aloud to the group, is that we have the desire to proceed with our beautiful new design solution, and what's stopping us is that the boss we'll need to get the project signed off won't like it? Everyone nodded.

When I asked 'why won't he like it?' everyone seemed to look at one another and shrug their shoulders. 'Because that's what he's like' was the only vaguely coherent answer that I could squeeze out of the group.

Rather than try and dig deeper into what already looked like quite uncomfortable territory for everyone, I decided to put the Matrix+ software up on the screen and click on the

'Business & Management' button to open up that part of the toolkit. I then plugged in the following in to the software:

```
IMPROVING PARAMETERS YOU HAVE  
SELECTED:  
RD Spec/ Capability/ Means (1)  
WORSENING PARAMETERS YOU HAVE  
SELECTED:  
RD Interfaces (5) and Support Interfaces  
(20)  
SUGGESTED INVENTIVE PRINCIPLES:  
3, 11, 13, 2, 24, 5, 33, 9, 38, 26, 25
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Figure 1: Trying To Stop Lack Of Boss Buy-In From Hazarding The Project

Even though the group had only really seen the Inventive Principles for the first time earlier in the day, and only in their technical context, I suggested they spend a few minutes thinking about some of the suggested Principles in the context of the SVP and how the group might convince him that their proposed solution was worth pursuing.

When we got the groups back together, it didn't feel like we'd made much progress. There were a few Principle 11, Beforehand Cushioning, thoughts (make up a prototype before asking for any money so he could see more clearly that the idea was viable; pre-warn him of the seriousness of the problem; make a contingency plan to go to another SVP), and, a little bit tongue in cheek I thought, about using Principle 2 to 'Take Out' the SVP altogether.

It felt to me like we hadn't really done full justice to Principle 3 or 13. Principle 3 in particular can be a difficult one for newcomers to really get to grips with, but the fact that it sat right at the top of the priority list for this kind of problem suggested to me at least, that we couldn't just ignore it. Right at the heart of the 'Local Quality' provocation is the idea of looking for things that are currently homogenous and then making anything that is somehow non-homogenous. 'What is homogenous in our current situation?' I re-prompted the group.

Silence. Then, after I figured I wasn't allowed to say anything else until someone else broke a lull that was quickly beginning to sound quite eerie, a quiet voice popped up with, 'his attitude is always the same'. Which in turn prompted someone else to say, 'he always has to be right'. Then, someone else again, 'he always expects the solution we come up with to be perfect, to meet his expectations of how things should be. What we do never seems good enough.'

'So how can we make these 'always' non-homogenous?' I said.

More silence. Then a tentative, 'put in a deliberate mistake'.

The words hung in the air. People looked at other people. Someone nodded, 'put in a deliberate mistake... so that he has something he can correct... so that he feels like he's done his job'.

My turn to nod, 'so what about Principle 13? What could we turn around the other way?'

A smaller gap this time before the replies start to flow. Among them this, 'what if we made the prototype as if it came from one of our competitors? We make our prototype then put their name on it. See what he thinks about that.'

Thinking back on the words, I'd say it sits right up there with the best examples of a Principle 13 idea I've ever heard. It's completely counter-intuitive, but at the same time makes complete sense. How do you get someone who's always skeptical about whether something that will work to be convinced? Answer: convince them someone's already done it. Who's the most likely 'someone' they'd be convinced by? Answer: the competitor they have the most respect for.

Ultimately, what I like about these two solution clues – aside from the fact that I now know they worked beautifully in this particular case – is that they're both initially counter-intuitive, but the deeper you look into why they might work, the more you realize they tap in to some human traits that, if not universal, do seem to fit very closely with any kind of Order thinking moralist:

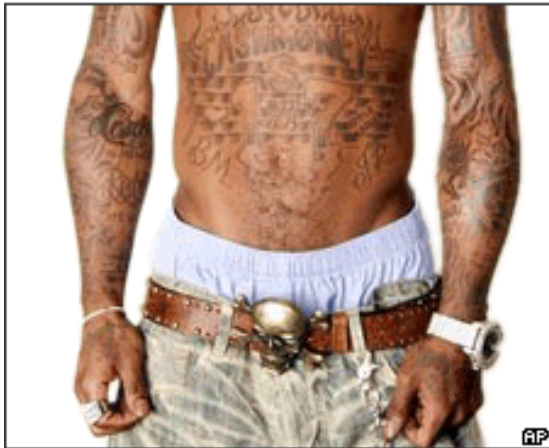
Deliberate (Principle 3) Mistakes – people in positions of authority like to think that they're earning their money, that their position is justified and that they're 'earning their keep'. If someone comes along with the already perfected solution, there is no opportunity to exercise these traits. So include something that allows them to do what, in the backs of their minds, they 'need' to do. I've seen this work, now I think about it, in a host of situations – patent agents that make deliberate mistakes in the invention disclosures they author in order to allow the Examiner to reject something; sales people that make deliberate mistakes when dealing with customers so they have the opportunity to demonstrate 'great customer service' by putting them right; teachers making deliberate mistakes to give the students that uncover them a confidence boost - they're all the same. People like to feel they made a contribution and show how smart they are, so give the opportunity to do so.

Making Something Look Like It Came From A Respected Other (Principle 13) – if we have to go out on a limb and do something before anyone else, there's always a feeling that we might have got something wrong. When an idea is 'obviously' good and it comes with the (apparent) added validation that someone else did it before us, we overcome this hurdle to the extent that, even when the ruse is exposed, the positive feeling remains, and we have a very important implanted memory – 'when we thought we'd been beaten to this solution by a competitor, it felt really bad'.

Two strategies. Potent individually; dynamite together.
Sun Tzu would have been proud!

Not So Funny – Trouser Height

Trendy teenager

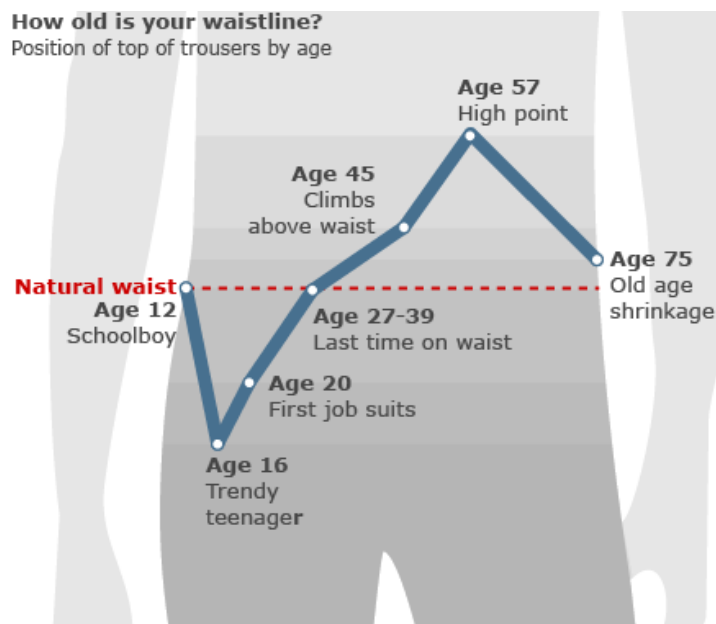


Senior high



In our never-ending quest to uncover new trends, we were recently alerted to what seems to be a universal pattern of behavior regarding men and the way they wear their pants. And especially how that behavior changes as a function of age.

A survey from UK retailer, Debenhams suggests that a man's waistband rises and falls throughout his life. Trousers bottom out at the age of 16 with below-the-hip styles and peak at 57, just seven inches below the armpit. Here's what the Debenhams research revealed:



Young boys may wear their trousers at their natural waist while being dressed by their parents, but they generally don't return to this style until they reach their late 20s, and some form of sanity returns after their puberty and mate-finding years... years when the often bizarre rules of fashion overtake common sense.

Personally, I grew up at a time and place in history when the fashion gurus had decided to make the girl-wooing job as hard as possible by insisting on high waisted pants (a la Saturday Night Fever) that were practically Amish in their modesty imbining properties:

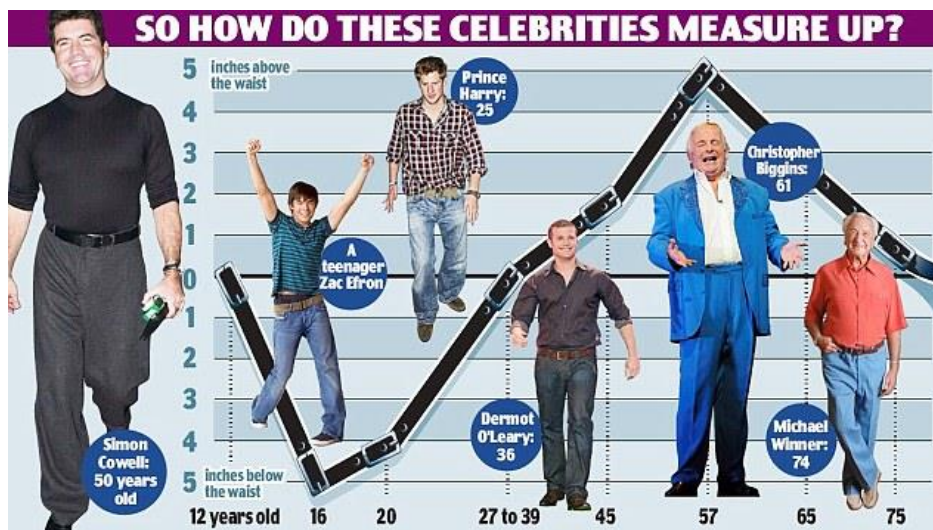


A few years ago, we had something like the opposite behaviour, such that it was nigh on obligatory to have six inches of Calvin Kleins exposed above the trouser waist-line.

Fashion history shows this teen-to-settling-down period waist-height oscillation to be a regular pattern. In Henry VIII's time, men wore trousers called "cannons", whose bulkiness around the thigh drew the eye. The first true trousers in Western Europe - pantaloons - were high-waisted and used light-coloured fabric to elongate a man's figure. The invention of elastic braces in the 1840s meant that trousers continued to be kept hiked up, although waistcoats prevented waistbands from being seen. But even with the waistbands hidden from prying eyes, this ushered in a problem that continues until today: Men don't know where to wear their trousers.

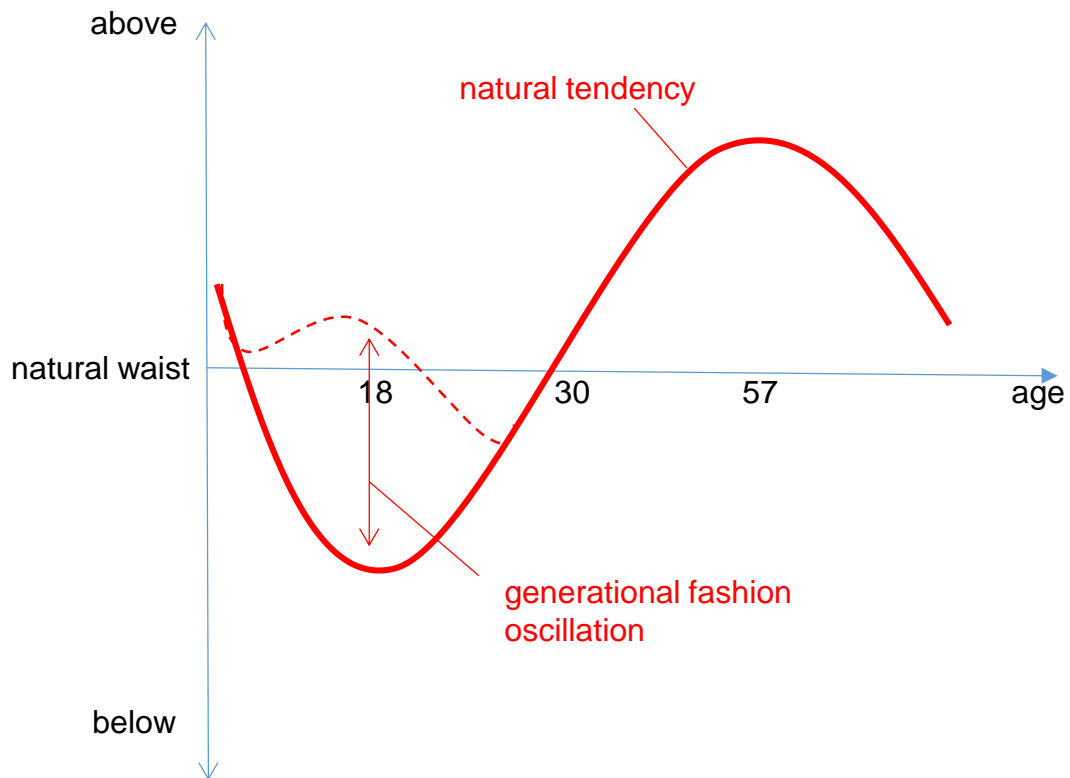
By the turn of the 20th Century, with the advent of baggier lounge-style suits, the waistline dropped, ushering in a century of yo-yoing waistlines. At their lowest point came Alexander McQueen's "bumsters" (revealingly low-cut trousers) and hip-hop music in the 1980s and 1990s influenced people to wear their trousers on their hips... or even lower.

This perception of where trousers should sit is at the root of the current mockery of Simon Cowell, Britain's face of the so-called natural waist. But according to the Debenhams study, Mr Cowell, at age 50, is a bit old to wear his trousers there. "It just looks odd," the Debenham's representative said. Fashion tradition is also on Mr Cowell's side. It dictates that trousers be worn on the "natural waist", the narrowest part of the body between the chest and hip.



Ultimately, our extensive research now concludes that the Debenham's research is somewhat flawed. Rather than there being one waist-height oscillation pattern, there are

actually two: one looks something like their height-versus-age profile. The other involves a sub-oscillation in the teen-woing years. The right picture, we think, should therefore looks something more like this:



It's important to get these things right, we think. Especially when it reveals the good news, for those with teenage sons at least, that, all that exposed underwear will quite naturally begin to be re-covered in the next few years.

Patent of the Month – Ultrasonic Imaging

Patent of the month this month takes us to a pair of inventors working for Halliburton Energy Services and a measurement problem related to borehole operations. US8,576,660 was granted on November 5. In a nice succinct background section, the inventors describe the problem as follows:

It is often desirable to determine the thickness of a pipe in a well and the properties of materials that surround the pipe, or the well. For example, it may be desirable to determine whether the exterior of a pipe is in contact with fluids or solids, and if so, what type of fluids or solids. Thinning of a pipe due to corrosion may indicate a potential collapse of the pipe. In a downhole context, it may be desirable to determine whether the pipe is tightly bonded to surrounding cement. These are just some examples of when it may be desirable to measure (or even image) through a pipe, or solid tubing wall.

One method for performing such measurements employs an acoustic transducer. Unfortunately, existing technology is limited to pipes having walls less than 0.9 inches thick.

So, from a conflict perspective, we very quickly see the problem: we want to measure the thickness of a pipe, and we can't because the walls are too thick. Here's how we might best map that conflict pair onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Ability to Detect/Measure (49)

WORSENING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Stationary Object (4)

SUGGESTED INVENTIVE PRINCIPLES:

28, 26, 37, 24, 10, 32, 2, 39

The solution description is not quite so straightforward, but here goes:

It has been discovered that fundamental reverberation mode measurements of thick-walled casings would require high power, low frequency transducers with a long listening time. Many transducers do not function as accurately at low frequencies, and long listening times produce more signal noise. Ultrasonic measuring systems that operate at the fundamental reverberation mode (i.e. the frequency at which the wavelength is twice the casing thickness) are feasible only for casings having thicknesses below about 0.8 inches. For example, a frequency of 236 kHz may produce the fundamental reverberation mode for a casing that is 0.474 inches thick, but a casing that is 0.948 inches thick may require a frequency of 118 kHz, which is a frequency that is so low that the signal strength for the reverberation portion of the wave becomes a problem. Additionally, the requirement for a long listening time results in slower data acquisition speed and more noise.

Instead of decreasing the frequency of a wave to operate at the fundamental reverberation mode for a thick casing, embodiments of the present disclosure increase the frequency of a wave to operate at a high order reverberation mode, which is a non-unitary integer multiple of the fundamental reverberation mode. For example, rather than operating at the fundamental reverberation mode by selecting a wavelength of 1.896 inches for a casing that is 0.948 inches thick, an embodiment of the present disclosure may select a wavelength of 0.948 inches, one half of the wavelength of 1.896 inches required for the fundamental reverberation mode. Because the wavelength is reduced through division by two, the frequency is increased through multiplication by two. Multiplying the low frequency of 118 kHz required for the fundamental reverberation mode by two results in a frequency of 236 kHz, a mid-range frequency that does not share the signal strength problems associated with the low frequencies around 118 kHz. Because the wavelength of the wave equals the thickness of the casing, when the reflected portion of the wave travels twice

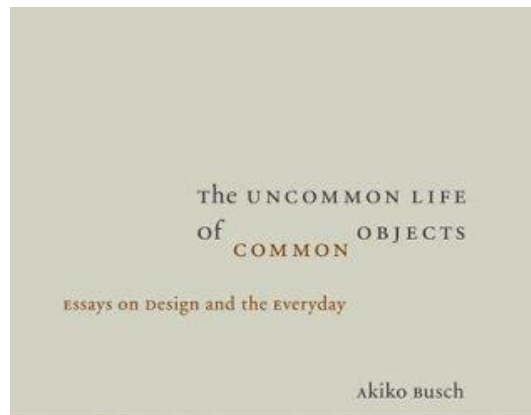
the distance of the thickness of the casing, the reflected portion of the wave completes two full periods of the wavelength. Completing two full periods creates constructive interference, which produces a stronger receive signal at the acoustic scanning tool 100. If the frequency required for the fundamental reverberation mode is multiplied by three, the reflected portion of the wave completes three full periods in each round trip through the casing.

Clear now?

How about if we say the frequency multiplication and the 'creative interference' represent examples of Inventive Principles 26 ('Copying') and 37 ('Relative Change')?

Subtle, maybe, but nevertheless we think this represents a great example of making better use of available resources: the thing that most designers would have looked to do in this kind of situation was add more power to try and signal strength. As the inventors at Halliburton manage to show us, a far better way is to manipulate the existing information such that it does more work for us for free.

Best of the Month – The Uncommon Life Of Common Objects



Truth be told, I only picked this book up because I saw a big pile of them in a remainder bin in a book shop at a price that made me think, maybe the shop would be better off just giving everyone that stepped in to the store a free copy. I wasn't sure I'd ever read it, but when I found myself in the middle of a trip and nothing else left to read in my travel bag, I figured I'd give it a go. Since then, I've trawled through the on-line book world and bought everything else that Akiko Busch has written. Hopefully to restore some kind of karmic balance.

The basic premise of the book – which, I'm now ashamed to think, came out in 2004 without me knowing anything about its existence – is that there are certain artifacts and products that cut right to the centre of the emotional and intangible aspects of our lives, and that if we understand them better, we'd be able to obtain a better grasp of how intangible drivers impact on the rest of our lives.

And so we get taken on a beautifully written, insight-laden trip around a world of design that spans the obvious (cameras, telephones) through to the sorts of non-obvious things that, it turns out, come to have a profound impact on how we 'really' come to see the world. Things like baby strollers, cereal boxes, vegetable peelers, medicine cabinets and, per the cover of the book, white lawn chairs. Never has the mundane been revealed to offer up so much that is so potentially profound.

Best of all, the contradiction word sits right at the heart of all the whole story How each artifact contributes to either the resolution or not of each one can reveal an awful lot about our unspoken behaviours: such as whether a baby faces the person pushing the stroller or the world, or how our medicine cabinets simultaneously reflect both our deepest fears and aspirations, or the role our refrigerators play in the success or otherwise of family

communications (and why fridge poetry magnets are so pervasive and 'high tech' solutions tend to fail!)

Each artifact and each contradiction is the subject of its own mini essay, each quite zen-like in their brevity. I read the book from cover to cover in a matter of a couple of hours. But then I've since gone back and re-read each, some already several times, and, as is the case with any really well written book, to find each re-reading revealing something I didn't pick up on last time. Borderline genius I'd say.

Not to mention how, when I read how contradiction sits right at the heart of meaning, not only did I nearly fall off my chair, but it's caused me to rethink a whole bunch of my assumptions about the work of the designer and how designers of all persuasions need to get better at listening to those unspoken customer voices.

Conference Report – UK TRIZ Forum 5



UK TRIZ Forum #5

Clevedon, 1 November 2013

“Stalk The Flaw;
Live The Flaw;
Break The Flaw.”

The very best of UK TRIZ and Systematic Innovation research, development and deployment

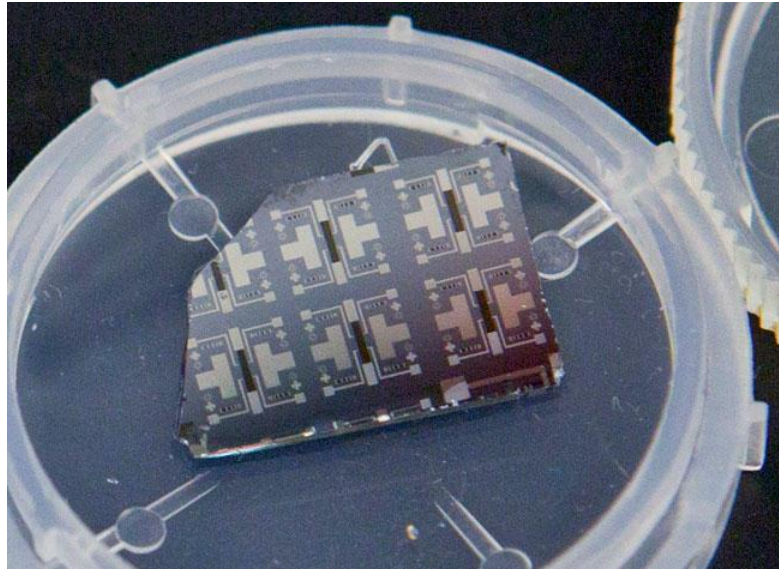
0830 - 0900	Registration & Coffee	
0900-1030	Ellen Domb	The Future Of TRIZ: An International Perspective
	Adi Kavitzky	Deployment Of TRIZ In The Advertising & Marketing Worlds
	Darrell Mann	PanGenics: TRIZ, Music Composition & Healthcare
1030-1100	Coffee	
1100-1245	Ellen Domb, Tim Brewer, Joe Miller	Crowdsourced and Crowdfunded Business Models Viewed as Complete (Technical) Systems
	Tim Brewer, Ellen Domb	Using the TRIZ System Operator to Compare Traditional Product Development to Crowdsourced Product Development
	Paul Howarth	PanSensics: Automated Mass Capture Of Conflicts & Contradictions
	Paul Filmore	Applying TRIZ to Graphic Design using Genetic Algorithms
1245-1345	Buffet lunch	
1345-1515	Paul Frobisher	Review of the effectiveness of the top 6 TRIZ tools
	Ian Mitchell	Moving from Inventive Principles and Trends to Solving problems with Standard Solutions
	John Cooke	The future of the product development process – a TRIZ perspective
1515-1530	Tea break	
15300-1620	Panel Session	Innovation Prospects For The Next Ten Years
1630	Close	

“Education is not the filling of a pail, but the lighting of a fire.” W.B.Yeats



No thanks to Darrell – who was called away from the UK at the last minute to attend to a client emergency – the 5th and very likely final UK TRIZ Forum took place on 1 November. If you weren't there, all you need to know can be found in Dr Ellen Domb' blog article. Which you can find here: <http://trizrealworld.blogspot.com>.

Investments – Synaptic Transistor



Materials scientists at the Harvard School of Engineering and Applied Sciences (SEAS) have now created a new type of transistor that mimics the behavior of a synapse. The novel device simultaneously modulates the flow of information in a circuit and physically adapts to changing signals.

It doesn't take a Watson to realize that even the world's best supercomputers are staggeringly inefficient and energy-intensive machines. Our brains have upwards of 86 billion neurons, connected by synapses that not only complete myriad logic circuits; they continuously adapt to stimuli, strengthening some connections while weakening others. We call that process learning, and it enables the kind of rapid, highly efficient computational processes that put Siri and Blue Gene to shame.

Exploiting unusual properties in modern materials, the synaptic transistor could mark the beginning of a new kind of artificial intelligence: one embedded not in smart algorithms but in the very architecture of a computer. The findings appear in the latest *Nature Communications*.

"There's extraordinary interest in building energy-efficient electronics these days," says principal investigator Shriram Ramanathan, associate professor of materials science at Harvard SEAS. "Historically, people have been focused on speed, but with speed comes the penalty of power dissipation. With electronics becoming more and more powerful and ubiquitous, you could have a huge impact by cutting down the amount of energy they consume."

The human mind, for all its phenomenal computing power, runs on roughly 20 Watts of energy (less than a household light bulb), so it offers a natural model for engineers. "The transistor we've demonstrated is really an analog to the synapse in our brains," says co-lead author Jian Shi, a postdoctoral fellow at SEAS. "Each time a neuron initiates an action and another neuron reacts, the synapse between them increases the strength of its connection. And the faster the neurons spike each time, the stronger the synaptic connection. Essentially, it memorizes the action between the neurons." In principle, a system integrating millions of tiny synaptic transistors and neuron terminals could take parallel computing into a new era of ultra-efficient high performance.

While calcium ions and receptors effect a change in a biological synapse, the artificial version achieves the same plasticity with oxygen ions. When a voltage is applied, these ions slip in and out of the crystal lattice of a very thin (80-nanometer) film of samarium nickelate, which acts as the synapse channel between two platinum "axon" and "dendrite" terminals. The varying concentration of ions in the nickelate raises or lowers its conductance -- that is, its ability to carry information on an electrical current -- and, just as in a natural synapse, the strength of the connection depends on the time delay in the electrical signal.

Structurally, the device consists of the nickelate semiconductor sandwiched between two platinum electrodes and adjacent to a small pocket of ionic liquid. An external circuit multiplexer converts the time delay into a magnitude of voltage which it applies to the ionic liquid, creating an electric field that either drives ions into the nickelate or removes them. The entire device, just a few hundred microns long, is embedded in a silicon chip. The synaptic transistor offers several immediate advantages over traditional silicon transistors. For a start, it is not restricted to the binary system of ones and zeros.

"This system changes its conductance in an analog way, continuously, as the composition of the material changes," explains Shi. "It would be rather challenging to use CMOS, the traditional circuit technology, to imitate a synapse, because real biological synapses have a practically unlimited number of possible states -- not just 'on' or 'off.'"

The synaptic transistor offers another advantage: non-volatile memory, which means even when power is interrupted, the device remembers its state. Additionally, the new transistor is inherently energy efficient. The nickelate belongs to an unusual class of materials, called correlated electron systems, that can undergo an insulator-metal transition. At a certain temperature - or, in this case, when exposed to an external field - the conductance of the material suddenly changes.

"We exploit the extreme sensitivity of this material," says Ramanathan. "A very small excitation allows you to get a large signal, so the input energy required to drive this switching is potentially very small. That could translate into a large boost for energy efficiency."

The nickelate system is also well positioned for seamless integration into existing silicon-based systems: "In this paper, we demonstrate high-temperature operation, but the beauty of this type of a device is that the 'learning' behavior is more or less temperature insensitive, and that's a big advantage," says Ramanathan. "We can operate this anywhere from about room temperature up to at least 160 degrees Celsius."

For now, the limitations relate to the challenges of synthesizing a relatively unexplored material system, and to the size of the device, which affects its speed. "In our proof-of-concept device, the time constant is really set by our experimental geometry," says Ramanathan. "In other words, to really make a super-fast device, all you'd have to do is confine the liquid and position the gate electrode closer to it."

In fact, Ramanathan and his research team are already planning, with microfluidics experts at SEAS, to investigate the possibilities and limits for this "ultimate fluidic transistor."

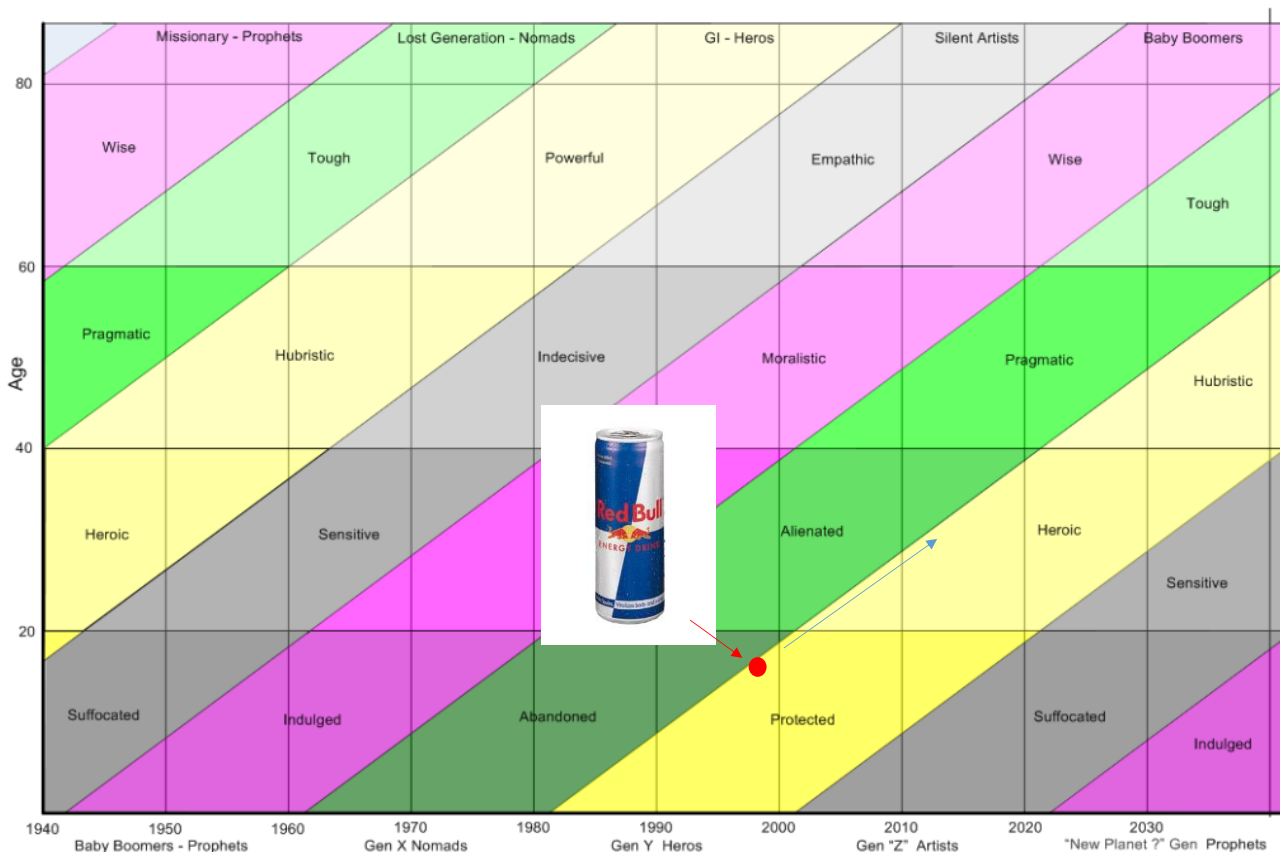
Read more here:

Jian Shi, Sieu D. Ha, You Zhou, Frank Schoofs, Shriram Ramanathan. **A correlated nickelate synaptic transistor.** *Nature Communications*, 2013; 4 DOI: [10.1038/ncomms3676](https://doi.org/10.1038/ncomms3676)

Generational Cycles – Red Bull

Red Bull is the most popular energy drink in the world, with 5.2 billion cans sold in 2012. It entered the United States via California in 1997, and has since become an iconic Generation Y brand. If there was ever such a thing as a heroic drink for a Heroic generation cohort, Red Bull is it. Heroes are a very upbeat, can-do group and anything that purports to 'give them wings' to take them to higher peaks is tapping in to inherent resonant modes for a substantial proportion of the cohort. Whether by luck or by judgment (probably closer to the latter given that the drink was first created in Austria in 1987 and thus had a pretty long incubation period where it wasn't really on the radar screen of any consumer), the company made use of a key moment in generational behaviour change.

Plot the 1997 US launch date and target teen audience onto the Generations Map and things begin to get a lot clearer:



The important feature on the picture is that the drink launch coincided with a generational shift from (abandoned) GenX teens to the first of the (protected) GenYs. In other words the launch coincided with the emergence of a cohort of youngsters looking for something that differentiated them from the previous generation.

So how does an energy drink like Red Bull fit with the idea of a 'protected' youth? The answer relates to the fact that a part of all of our teenage years is concerned with what we might think of as 'escape' from the control of parents and in particular the desire for 'freedom'. Or, put another way, whatever your mum and dad disapproved of was very likely to be what you were drawn towards. Y teenagers needed something to help them rebel, and Red Bull fit the bill very nicely.

What's interesting looking forward is that we are due for another generational shift in our teenage population equivalent to the shift that Red Bull tapped in to around 2016-2017: a whole new cohort of (as yet unnamed) Artists that will also be looking for something that will give them 'escape' and 'freedom'. Albeit something that, given their 'suffocated' upbringing and the shifting societal mood towards teenagers, is very likely to be squashed very quickly.

Interestingly, market research shows that as Generation Y Red Bull drinkers become parents to the upcoming Artist generation, even though they might drink Red Bull themselves, they are very unlikely to let their kids consume the product.

On the plus side for Red Bull, when the teen Artists start to rebel, they'll likely look in the direction of what their parents don't want them to consume. On the negative side, a) parents and society will very quickly squash the rebellion, and b) if it was cool for parents, it automatically won't be cool for the kids. Which, taken together, implies to us that unless Red Bull can significantly re-invent themselves in the next 3 to 4 years, they're going to be in for a pretty rough ride.

For the rest of us, the emerging opportunity is to find the product or service that captures the imagination of the soon-to-rebel Artists. The window of opportunity is coming, and the clock is ticking.

Biology – Glasswinged Butterfly (*Greta oto*)



The central-American Glasswinged Butterfly is one of the most spectacular butterflies on the planet. This isn't because of its bright coloration or unique shape, however, but rather its one glaring [and fabulous] characteristic: its wings are almost completely transparent.

Most butterflies have very tiny scales which cover the wing membranes. These scales are what give monarch butterflies their orange and black hues or morpho butterflies their vivid blue coloring. Unlike these butterflies, between the veins of the Glasswinged Butterfly there are no scales – just translucent membranes – which means the wings allow you to look straight through them. That's why the Spanish name for these butterflies is 'espejitos' which literally translates to 'little mirrors.'

The membranes, when positioned in just the right way, will refract light so that incredible, breathtaking colors are shown in the butterfly's wings as shown above. It's akin to a clear soap bubble catching the light and exposing its vast array of colors within. When in flight, however, it's nearly impossible to spot the butterfly since its wings are basically clear.

So, clearly (sorry!) the resolution to the conflict driving the ability to avoid predation is the use of transparency. Better known to TRIZ users as Inventive Principles 32B, 'change the transparency of an object or its surroundings. Here's how we might best solve the basic conflict onto the Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Productivity (44)

WORSENING PARAMETERS YOU HAVE SELECTED:

Ability to Detect/Measure (49)

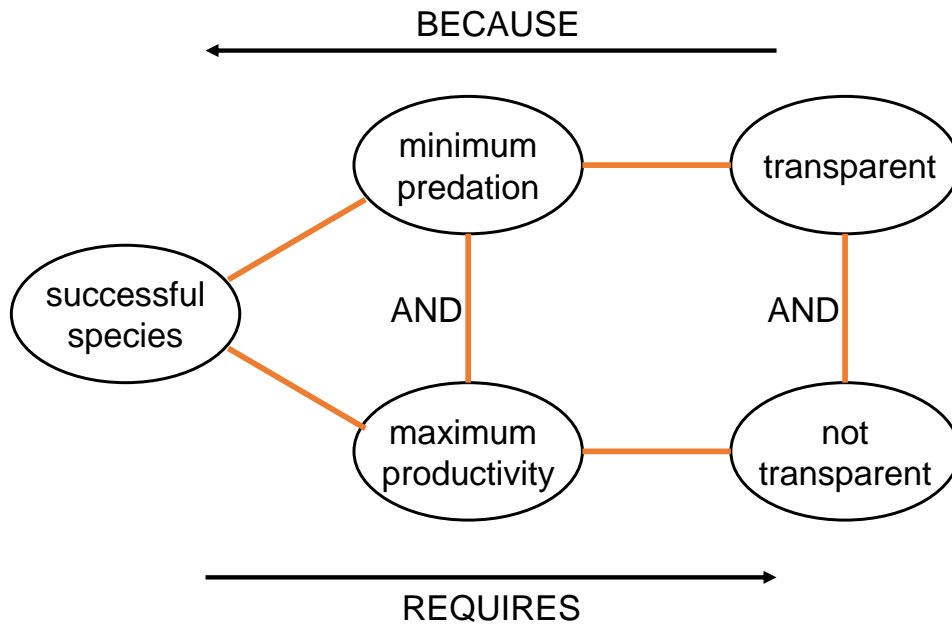
SUGGESTED INVENTIVE PRINCIPLES:

4, 32, 37, 25, 28, 18, 35, 24, 13

Good to see that Principle 32 is right up there close to the top of the list.

Digging a little deeper into the story, we might also observe – per the related SI 'Increasing Transparency' Trend – that once a system evolves to achieve transparency, there is a subsequent evolution stage which incorporates transparency that is switchable.

In effect that's what *Greta oto* has evolved: it can be transparent to avoid detection by predators, and brightly coloured to attract mates. Here's what that might look like on the Contradiction Mapping Template:

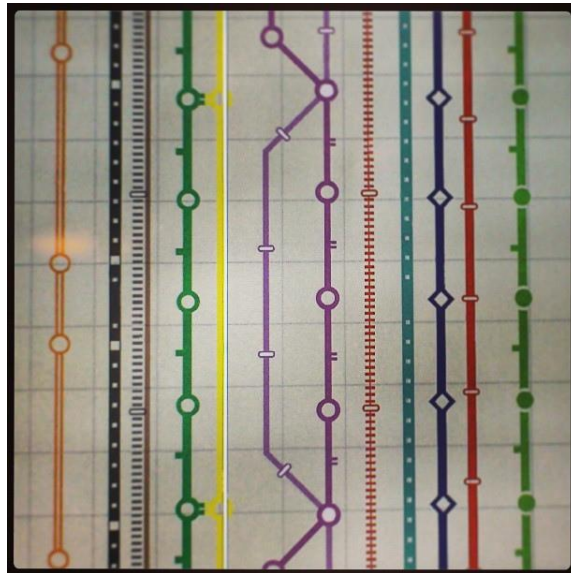


Solving the physical contradiction transparent-and-not-transparent is basically achieved using a separation in on condition strategy: the butterfly benefits from transparency if danger is close by, and colouring if a mate is close by. Switching between the two occurs 'simply' by orienting the membranes at an appropriate angle relative to the available light.

Active transparency rules!

Short Thort

*“You have to take risks.
We will only understand the miracle of life fully
when we allow the unexpected to happen.”*
Paulo Coelho



*“Every day I go to my study and sit at my desk and put the computer on.
At that moment, I have to open the door.
It's a big, heavy door.
You have to go into the Other Room.
Metaphorically, of course.
And you have to come back to this side of the room.
And you have to shut the door.”*
Haruki Murakami

News

BunnyPenny

Anyone that has purchased anything from us this year will no doubt have encountered Cara (aka 'BunnyPenny'). Having saved up all of her holiday entitlement for the year in order to spend the last month of the year (very sensibly) in the Southern Hemisphere, the UK office will be operating on a restricted hours basis until the New Year. Anyone thinking of ordering books or software for their loved ones (Christmas is coming!) will definitely have their orders processed, but there might be a slight delay relative to our usual service. We apologise in advance.

PanGenic Music

In our ongoing efforts to 'walk the talk' when it comes to innovating rather than merely talking about innovation, we are happy to announce the formation of a new company, set

up with the aim of commercializing some of our music-industry related step changes. Anyone that has had the misfortune to visit our website this year will know (for various administrative reasons far too boring to go into here) we've been having a pretty rough time when it comes to keeping everything up to date and relevant. Fingers-crossed, we will have several new sites up and running in the coming weeks and months, one of which – www.schoolroom.org.uk – will describe some of the exciting things were about to do in this PanGenic Music initiative.

World Wildlife Fund Projects

We have been given the tremendous opportunity to work with WWF in SE Asia on some of their design challenges. Several candidate projects have been identified and we're in the process of connecting up with university engineering departments to create a number of win-win-win arrangements whereby the Fund gets real solutions to some of their most pressing problems, students get to learn some SI tools and work on something real as they work towards their qualification, and – hopefully – we get some great case studies to talk about. If anyone out there in academia land would like to join the initiative, please get in touch with Darrell in the first instance.

GenerationDNA Workshop

In the changing world of public workshops, it looks like the only one that makes any kind of economic sense, in the UK at least, is the one-day event we run on the generational-cycles part of TrenDNA. With that in mind, we'll be scheduling our next GenerationDNA workshop to take place on Wednesday 12 February next year.

New Projects

This month's new projects from around the Network:

- Automotive – 'Wicked Problem' clinic sessions
- Utilities – SI Certification workshop series
- Utilities – ICMM study
- Construction – 'Invent To Order' project
- O&G – Turnkey development project
- Government – IP Quality measurement project
- FMCG – Long term technology strategy support
- FMCG – PanSensic consumer analysis
- Healthcare – ICMM workshops
- Medical Devices – Evolution Potential exploitation workshop