Systematic Innovation

e-zine

Issue 175, October 2016

In this month's issue:

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

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

Physical Contradictions & 27 Windows

The physical contradiction aspects of the TRIZ method have become something of an orphan relative to other parts of the toolkit. Other tools have had lots of care and attention devoted to their upkeep and evolution in a changing world, whereas physical contradictions seem to receive a curt shrug of the shoulders from most. Maybe that might be because – as I know I've heard some original TRIZ researchers claim – the current form of the tool is already perfect. But then again…

Take the part of the process when the user has identified what they think might be a physical contradiction – "I want to focus light close up and I want to focus light in the distance". In order to start the process of transition from problem to solution, the user is asked to think about three separation principles: can you separate the different requirements in space? Can you separate them in time? Can you separate them on condition?

These three strategies can be tested by asking 'where?', 'when?' and 'if?' questions. *Where* do you want to focus light close up? *Where* do you want to focus light in the distance? If the two answers are revealed to be different – "I want to focus light in the distance while looking up; I want to focus light close you while looking down" – then you have a good indication that, yes, this contradiction is amenable to, in this case, separation in space.

But from that point onwards, things seem to get somewhat blurry (if you'll pardon the spectacle pun). Isn't the looking-up/looking-down difference also about separation in time – "I want to focus light close *when* I'm looking down" – and also separation on condition – "I want to focus light close *if* I'm looking down (and reading)"?

More to the point does it matter? If I ask the three separation questions and they all reveal positive results, doesn't that just mean I have more solution options? Doesn't it mean we can progress to brainstorming through a long list of Inventive Principles faster?

I think the answer to all three questions is 'yes'. Yes, we have more options, and yes we can start brainstorming faster. But yes it also matters that the where, when and if questions are unfocused and confusing. Is it good to get more options or is it better to have a clearer understanding of the problem? (Trick question – you should know by now that any question with the word 'or' in it is the wrong question.) The real point should be that we want the best of both worlds. If we're able to solve a given physical contradiction by genuinely being able to use all three of the separation strategies, then great, but if we're engineering the answer to the where, when and if questions using merely semantic arguments, we're probably not doing ourselves any favours in terms of either understanding the real problem, or generating the most effective answers.

Case in point, sticking with the spectacles problem, bi-focals represent a common solution to the separation-in-space form of the physical contradiction problem, and switching between two pairs of glasses – one for reading and one for driving – is a common solution to the separation-in-time form of the contradiction, but we are only sensibly able to say one solution is better than the other depending on our specific context.

And 'context' here is the main issue to be addressed I believe. Is separation in space, time or condition better? It depends. And the best way to determine the dependency, we now think is to make use of the 9-Windows tool. Or rather a modified version of the long-

established tool. The reason for the modification being that in its usual form the system-operator only allows us to explore the time and space dimensions:

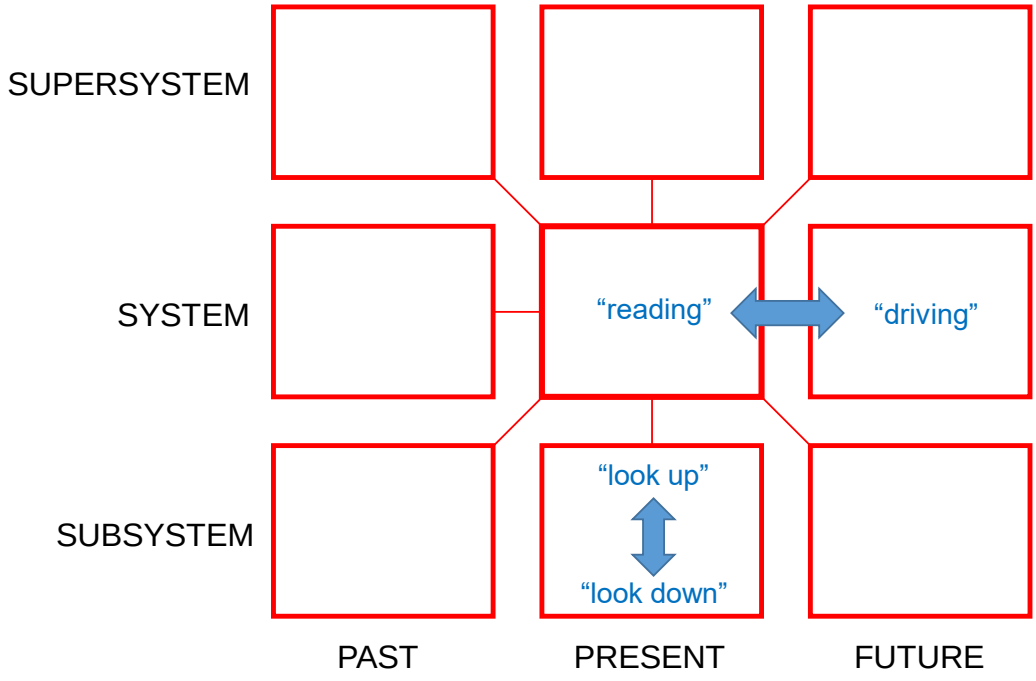

Figure 1: 9-Windows Tool As A Physical Contradiction Separation Strategy Identifier

Looking for separation-related differences within and between pairs of windows offers a very thorough and structured means of identifying possible ways of separating two different physical contradiction conditions. But what about the 'separation on condition' possibility? How do we represent that using the 9-Windows?

Thinking about this question suggests that the 9-Windows are missing a dimension. We might hypothesize from the SI Pillars, that it might have something to do with 'Interface'. In other words, the 'between's:

We want A if condition B.
We want -A if condition C.

Identifying what B and C are requires us to think about all of the possible conditional differences between what are in effect two measurements. So what to measure? And specifically, what is it we should be looking to measure that are different to 'space' and 'time' dimensions?

Measurements require systems. And systems require the presence of 'fields'. Of which there aren't that many types:

Type of Field	**Sub-categories**
Mechanical	Gravitational, Frictional, Inertial, Centrifugal, Coriolis, Tension, Compression, Elasticity, Reaction, Vibration
Hydraulic/Pneumatic	Hydrostatic, Hydrodynamic, Aerostatic, Aerodynamic, Surface Tension
Thermal	Conduction, Convection, Radiation,

	Static Temperature Gradient, Total Temperature Gradient, Expansion, Insulation
Pressure	Static Pressure, Total Pressure, Static Pressure Gradient, Total Pressure Gradient, Buoyancy, Lift, Magnus, Vacuum, Supersonic Shock Wave
Electrical	Electrostatic, Electrodynamic, Electrophoretic, Alternating, Inductive, Electromagnetic, Capacitative, Piezo-electric, Rectification, Transformation
Chemical	Oxidation, Reduction, Diffusion, Combustion, Dissolution, Combination, Transformation, Electrolytic, Endothermic, Exothermic
Biological	Enzyme, Photosynthesis, Catabolic, Anabolic, Osmotic, Reproductive, Decay, Fermentation
Magnetic	Static, Alternating, Ferro-magnetic, Electro-magnetic
Weak Nuclear Attraction	
Strong Nuclear Attraction	
Optical	Reflection, Refraction, Diffraction, Interference, Polarisation, IR, visible, UV
Acoustic	Sound, Ultrasound
Olfactory	

Perhaps these are the things we need to be looking for in order to test the ‘separation on condition’ option.

We want (the lens to be clear) if (UV level is below a threshold level).
We want (the lens to be dark) if (UV level is above a threshold level).
(As is the manner in which photochromic lenses usually work.)

Or:

We want (to focus close) if (IR signal is reflected in direction A).
We want (to focus distance) if (IR signal is reflected in direction B).
(As is the manner in which eye-tracking technologies usually work.)

The point being that the list of fields offers up a comprehensive set of conditional ‘if’ separation questions. The only remaining question – perhaps – is how best to structure a possible search through this list of fields?

Here’s the model we’ve been testing for the last few months. Although loathed to call it ’27-Windows’ that’s effectively what it is. The third dimension is all about ‘interfaces’ and we believe the three interface-related windows that need to be looked through and between are:

- Intra – conditional field differences *within* elements of a system

- Inter – conditional field differences between elements of a system
- Extra – conditional field differences between elements within a system and those beyond it

Here's what the 27-Windows might look like:

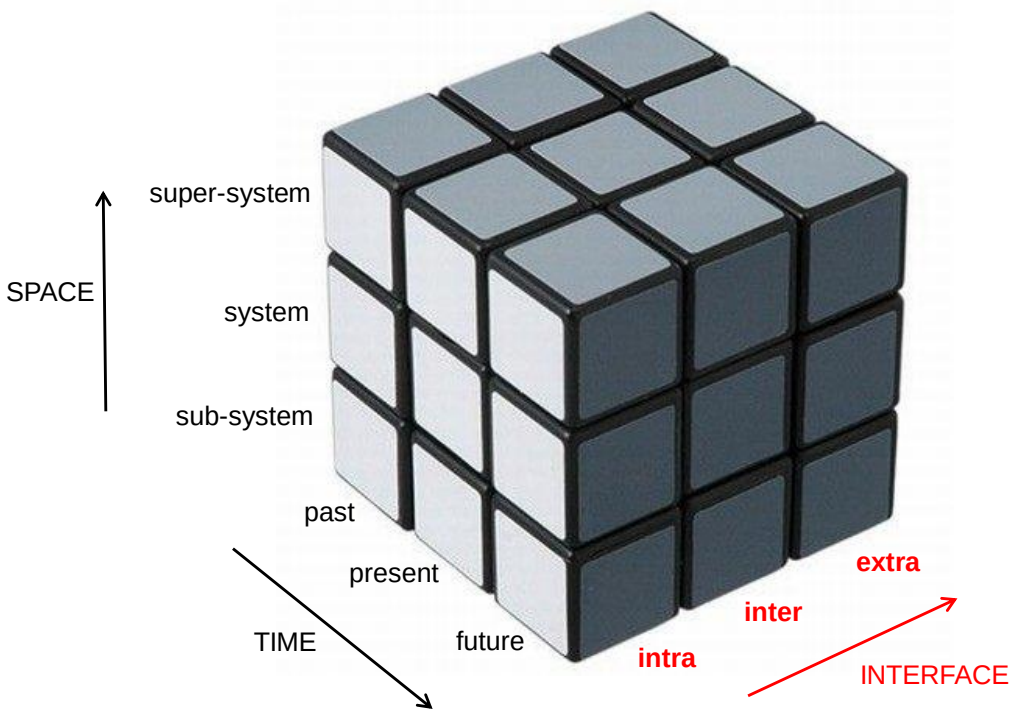

Figure 2: 27-Windows

If nothing else, early evidence of using the model tells us it satisfies the 'comprehensive' test. If you're really looking for 'the best' solution to a problem, it's the best way we've yet found to find it. The only problem – there's always the 'next contradiction', right? – is that experience with just 9 windows tells us that people get bored long before they've reached the ninth one, so what chance they will make it all the way to 27?

Every contradiction, of course, has a solution. We just need to have a desire to solve it. If we end up with better solutions this time, we might bring some more discipline to the process next time.

Here's an example: there's a long-standing problem in the textile industry: textiles are soft and flexible, and so it's very difficult for a robot to accurately and consistently sew different pieces together. That's why whenever you see photos of a textile manufacture factory, it's full of rows and rows of people guiding the pieces to be joined into the sewing machine. The textile industry looks like this because no-one has thought to try and solve the physical contradiction: we want the fabric to be stiff and flexible.

As soon as you allow yourself permission to contemplate solving this problem, it's possible to find yourself a very simple separation in time opportunity as shown in Figure 3. Once you've found this, you've given yourself the opportunity to solve the problem by dipping the fabric in a (water-soluble) stiffener prior to sewing, and then washing the stiffener off again after the garment is sewn. On several levels, it's a very nice solution. No more armies of seamsters and seamstresses; a few of them re-deployed to coating and washing stiffener into and out of the fabric. This is what the company, 'Sewbo' is proposing as their revolutionary solution to the industry. It's a step change right enough, but, having given

yourself permission to tackle the ‘stiff and flexible’ physical contradiction, was ‘separation in time’ the only or ‘best’ separation strategy to use?

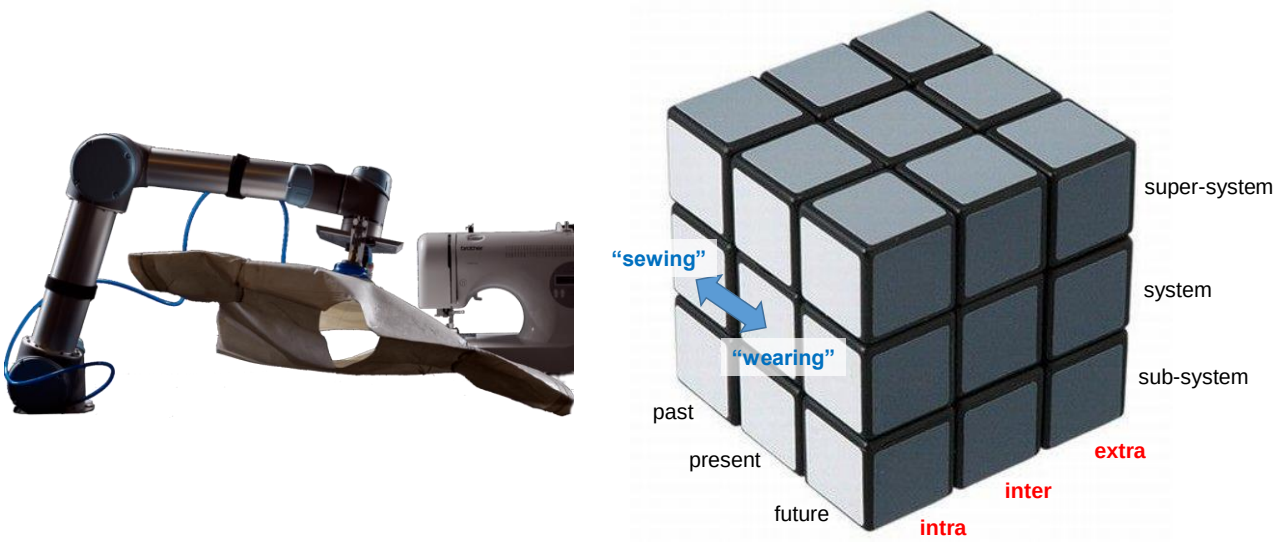

Figure 3: Sewbo Physical Contradiction Separation-In Time Opportunity

Answer: I don’t think so.
I think there are several much more elegant solutions in some of the other windows. Your challenge for the month, is to look through one or two of them and see what you can come up with… the future of the global textile industry is in your hands. No pressure.

Evolving The Use Of Senses Trend

The ‘Increasing Use Of Senses’ Trend has been a longstanding member of the family. The main reason for its inclusion is to remind users of the five basic (‘VAKOG’) human senses (Figure 1), and to think about whether any that are currently not being used within or around a system could usefully be introduced to add new value.

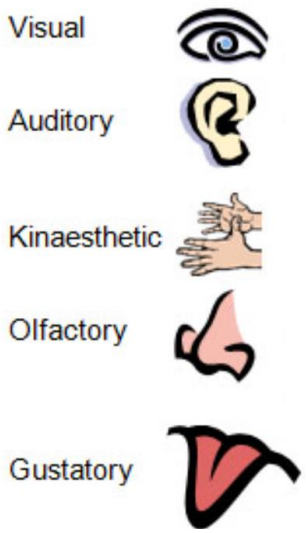

Figure 1: The Five ‘VAKOG’ Human Senses

We’ve always tended to restrict ourselves to this core of five senses because they are the most frequently used (and ‘usable’) when engineering systems. Or at least systems designed to interact with human or other life-forms. It’s always been known that there are many other senses, but it has only recently become meaningful to list them in the intended context of the Trends. Now, we can increasingly make use of two distinct forms of ‘senses’. The first are what we might choose to label the ‘extended’ senses – senses that we can see tangible evidence of within the natural world, The second, now being made possible by the interactions between different systems (natural and engineered), are what we might think of as an emerging class of ‘meta-senses’. Let’s have a look at both of them in more detail. Starting with the ‘Extended’ Senses:

The Fifty Four ‘Self-Evident’ Natural Senses and Sensitivities (Reference 1)

The Radiation Senses

1. Sense of light and sight, including polarized light.
2. Sense of seeing without eyes such as heliotropism or the sun sense of plants.
3. Sense of color.
4. Sense of moods and identities attached to colors.
5. Sense of awareness of one's own visibility or invisibility and consequent camouflaging.
6. Sensitivity to radiation other than visible light including radio waves, X rays, etc.
7. Sense of Temperature and temperature change.
8. Sense of season including ability to insulate, hibernate and winter sleep.
9. Electromagnetic sense and polarity which includes the ability to generate current (as in the nervous system and brain waves) or other energies.

The Feeling Senses

10. Hearing including resonance, vibrations, sonar and ultrasonic frequencies.
11. Awareness of pressure, particularly underground, underwater, and to wind and air.
12. Sensitivity to gravity.
13. The sense of excretion for waste elimination and protection from enemies.
14. Feel, particularly touch on the skin.
15. Sense of weight, gravity and balance.
16. Space or proximity sense.
17. Coriolus sense or awareness of effects of the rotation of the Earth.
18. Sense of motion. Body movement sensations and sense of mobility.

The Chemical Senses

19. Smell with and beyond the nose.
20. Taste with and beyond the tongue.
21. Appetite or hunger for food, water and air.
22. Hunting, killing or food obtaining urges.
23. Humidity sense including thirst, evaporation control and the acumen to find water or evade a flood.
24. Hormonal sense, as to pheromones and other chemical stimuli.

The Mental Senses

25. Pain, external and internal.
26. Mental or spiritual distress.
27. Sense of fear, dread of injury, death or attack.
28. Procreative urges including sex awareness, courting, love, mating, maternity, paternity and raising young.
29. Sense of play, sport, humor, pleasure and laughter.
30. Sense of physical place, navigation senses including detailed awareness of land and seascapes, of the positions of the sun, moon and stars.
31. Sense of time and rhythm.
32. Sense of electromagnetic fields.
33. Sense of weather changes.
34. Sense of emotional place, of community, belonging, support, trust and thankfulness.
35. Sense of self including friendship, companionship, and power.
36. Domineering and territorial sense.
37. Colonizing sense including compassion and receptive awareness of one's fellow creatures, sometimes to the degree of being absorbed into a superorganism.
38. Horticultural sense and the ability to cultivate crops, as is done by ants that grow fungus, by fungus who farm algae, or birds that leave food to attract their prey.
39. Language sense, used to express feelings and convey information in every medium from the bees' dance to uniquely human articulation, stories and literature.
40. Sense of humility, appreciation, ethics.
41. Senses of form and design.
42. Sense of reason, including memory and the capacity for logic and science.
43. Sense of mind and consciousness.
44. Intuition or subconscious deduction.
45. Aesthetic sense, including creativity and appreciation of beauty, music, literature, form, design and drama.
46. Psychic capacity such as foreknowledge, clairvoyance, clairaudience, psychokinesis, astral projection and possibly certain animal instincts and plant sensitivities.

47. Sense of biological and astral time, awareness of past, present and future events.
48. The capacity to hypnotize other creatures.
49. Relaxation and sleep including dreaming, meditation, brain wave awareness.
50. Sense of pupation including cocoon building and metamorphosis.
51. Sense of excessive stress and capitulation.
52. Sense of survival by joining a more established organism.
53. Spiritual sense, including conscience, capacity for sublime love, ecstasy, a sense of sin, profound sorrow and sacrifice.
54. Sense of homeostatic unity, of natural attraction aliveness as the singular essence-diversity attraction dance of all our other senses

Meta-Senses

One of the beautiful things about the inter-connected, inter-dependent planet we all now inhabit, is that the inter-connections between systems begin to open up access to what we might think of as 'meta-senses'.

Ask many people for their opinion about the most important innovations of the last couple of decades and GPS is likely to be one of the first answers you here. Rarely do innovations grow to become so ubiquitous in such a short period of time. Now we all know where we (and those near and dear to us) are on the planet. This is much more than any kind of natural sensing of Coriolis forces or the Earth's magnetic field. Geo-location is all about knowing coordinates. And once we know the coordinates of one place, we can 'know' how to navigate from that place to the next. Geo-location is what we might think of as a 'meta-sense'. As is 'geo-navigation'. As is knowing when your future perfect life-partner is currently in the café down the road. And knowing what his or her favourite drink might be.

Figure 2: Geo-Location As A Meta-Sense

The ultimate point of these extended and meta senses is that it is increasingly important that prospective innovators extend their portfolio of search options. We've consequently extended the Use Of Senses Trend to look like the graphic shown in Figure 3.

We're not so sure about the left-to-right sequence of the new form of the Trend. The emergence of the meta-senses, for example, may well mean that it is much easier for an innovator to add a meta-sense to their solution than, say, adding a gustatory feedback loop. In which case the seventh stage of the Trend might be reached before the fifth. The sequence shown in the Figure, however, probably does the best job of at least defining a

search sequence – start with the VAKOG senses; then the extended list, then the meta-senses.

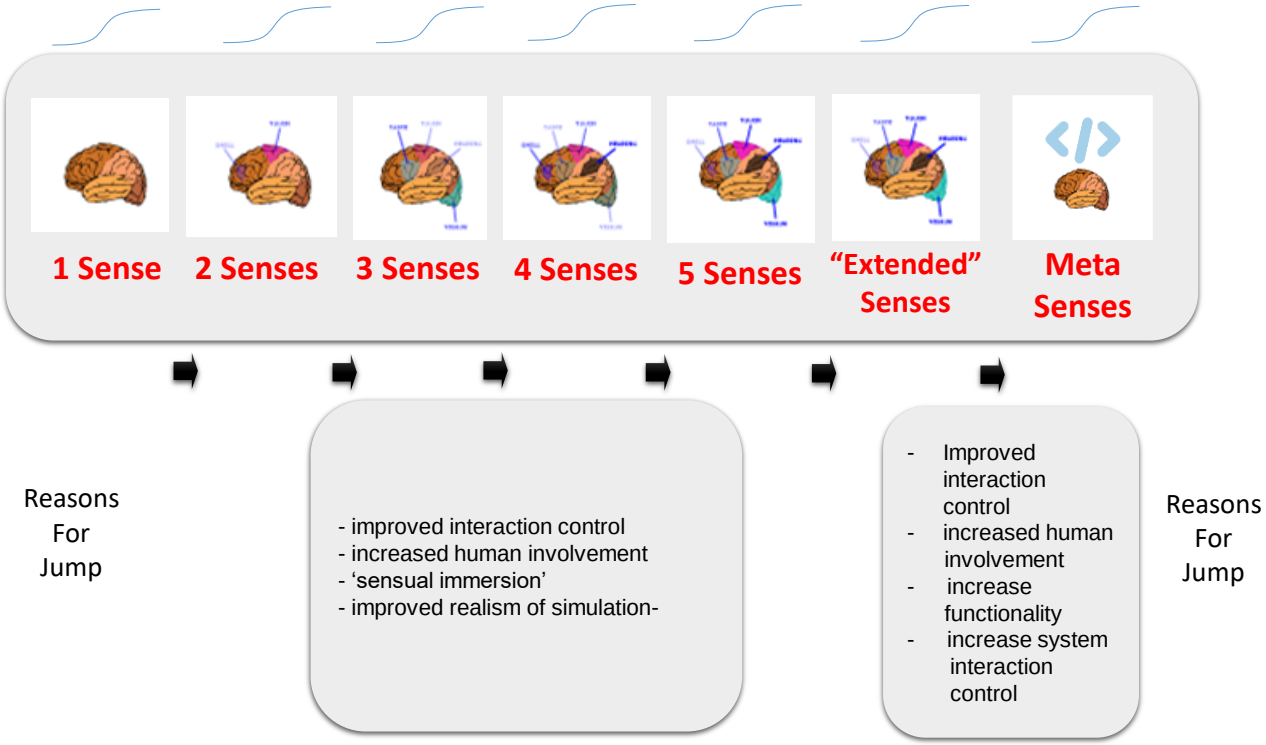

Figure 3: Re-Thinking The 'Use Of Senses' Trend

Reference

1) http://www.ecopsych.com/insight53senses.html

Not So Funny – Extreme Duct Tape

Any fule knows that duct-tape is the ultimate engineering material. And a good friend of TRIZ. Inventive Principle 30, the Dynamization trend… everything it seems points in the direction of duct-tape being a panacea for all problems. We've featured duct-tape in this section of the ezine before. But, oh, how the world moves on. Now it's gone structural…

What works above ground, will no doubt work better below…

And properly above ground. ‘Duct-tape’ and ‘aerospace’, two words you never thought you’d see in the same sentence. Oh foolish you…

Funnily enough, only four of these solutions are really, really dangerous.

But, if you really want to explore the limits of possibility, I think this one has to be the winner. World’s most exacting structures?

In case you miss it, the key word is ‘Vancouver’.

Oh, and ‘dam’…

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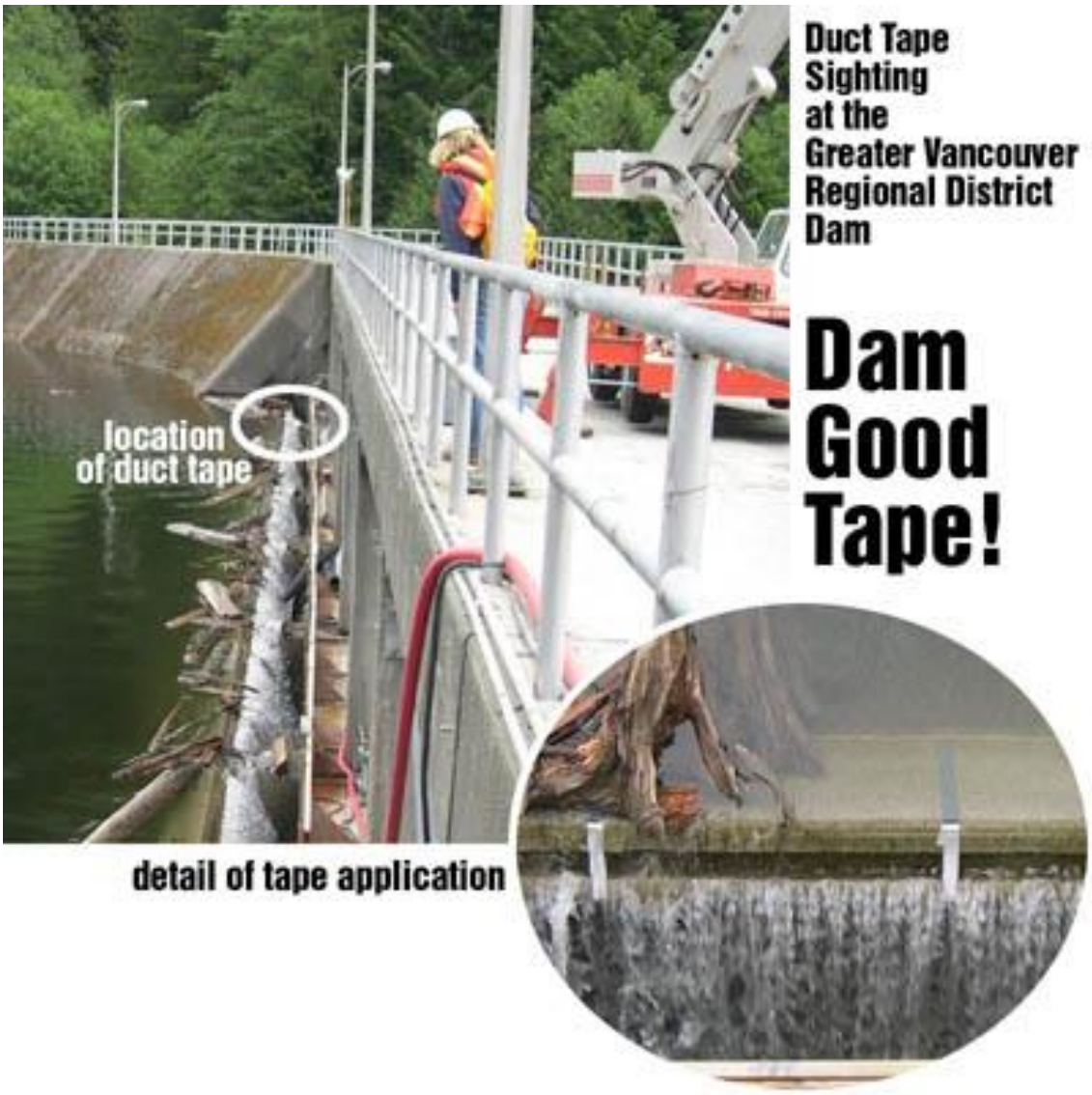

Just when you thought no-one understood anything from first principles any more.

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Patent of the Month – Thermo-Electric Conversion Material

Patent of the month this month takes us on a journey to Japan and a trio of inventors at the Kyushu Institute of Technology. US9,461,228 was granted on 4 October. Here's what the background description part of the invention disclosure has to say about the problem to be solved:

Recently, a thermoelectric power-generating technology for which the system is simple and can be down-sized has been specifically noted as a power recovery technology for unharnessed exhaust heat energy that is generated from fossil fuel resources and others used in buildings, factories, etc. However, thermoelectric power generation is, in general, poorly efficient in power generation, and therefore, studies and developments are being actively made for improving power generation efficiency in various companies and research institutes. For improving power generation efficiency, it is indispensable to enhance the efficiency of thermoelectric conversion materials, and for realizing it, it is desired to develop materials having a high electrical conductivity comparable to that of metals and having a low thermal conductivity comparable to that of glass…

As described above, investigations for improving power generation efficiency are needed while, on the other hand, thermoelectric conversion devices that are now produced are poor in mass-productivity and the power generation units therein are expensive. Consequently, for further disseminating the devices in use in large areas, for example, in installation thereof on the wall surface of buildings, production cost reduction is imperative. In addition, thermoelectric conversion devices that are produced at present are poorly flexible, and therefore flexible thermoelectric conversion devices are desired.

Given the situation, [prior art solution 1] discloses, for the purpose of improving power generation efficiency and for efficient production, a method for producing a thermoelectric conversion device that comprises a step of applying a solution to be a material of a p-type or n-type organic semiconductor material, onto a support having patterned insulator layer to the surface thereof by coating or printing thereon followed by drying it. However, the method requires patterning that includes alignments to be repeated plural times, such as screen printing or the like, and therefore the step is complicated and, as a result, the takt time is long, therefore providing a problem of rising costs.

On the other hand, in [prior art solution 2], an investigation is made, using a composition prepared by dispersing, as a thermoelectric conversion material, bismuth telluride in an epoxy resin as a binder, and forming the composition into a film by coating, thereby producing a thin-film thermoelectric conversion device. However, this requires a sintering process at a high temperature not lower than the decomposition temperature of the binder resin, and therefore still has a problem in that the flexibility of the produced film could be on the same level as that in the case of forming a film of bismuth telluride alone.

The desire for simultaneously high electrical conductivity and low thermal conductivity is one of those holy-grail challenges that, when solved, will open up a whole series of exciting opportunities. While it's not clear that this invention is quite the holy grail, it very definitely seems to offer up a significant step in the right direction. Here's what they've done:

A thermoelectric conversion material, comprising: a support; and a thin film formed by drying a thermoelectric semiconductor composition which comprises thermoelectric semiconductor fine particles and a conductive polymer, wherein the thin film is formed on the support, and the thermoelectric semiconductor fine particles are annealed particles.

And here's how that corresponds to what TRIZ/SI and the Contradiction Matrix might have had to say on the electrical-not-thermal subject:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Energy used by Stationary Object (17)

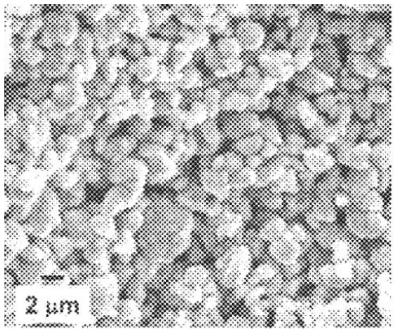
WORSENING PARAMETERS YOU HAVE SELECTED:

Temperature (22)

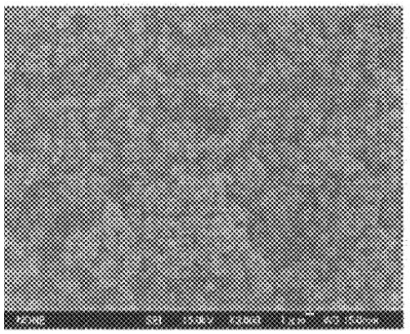
SUGGESTED INVENTIVE PRINCIPLES:

3, 2, 35, 19, 21, 36

Principle 3 looks like the one…



Particles…



…and thin film….

…sandwiched together.

Simple when you know how.

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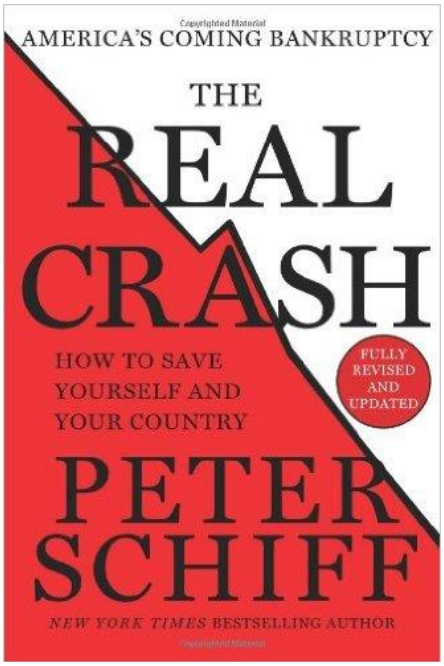
Best of the Month – The Real Crash/The Crash Of 2016



Two choices for everyone this month. Well, actually, they're both the same book, just written by two different authors coming from two different ends of the political spectrum.

A few years ago, if you heard any of the SI team discussing the GenerationDNA topic, you no doubt heard us talk about an 'inevitable' impending US economic melt-down triggered by demographic trends. First it was all going to kick-off in 2012. Then 2013. Then 2014. Then we stopped talking about it. Something was going wrong with the model. Now, thanks to Thom Hartmann (in the blue corner) and Peter Schiff (in the red corner) we know why. By printing money to bail out bankers ever since 2008, and by spending that money to artificially keep the Dow Jones looking positive since 2011, the US Fed has been operating on the erroneous assumption that it's possible to bluff your way through a bubble. On one level, the logic is quite appealing: markets are driven by confidence – if investors feel confident, they will keep investing – so let's artificially create that confidence until such times as the real investors transform the perception into a reality. One a more practical level, however, building bouncy castles in the air is never a very sustainable solution. The longer the charade continues, the worse the inevitable crash will be. And now we've had several years of that charade, the whole shebang is teetering on the edge of a very steep precipice.

Both authors arrive at the same basic set of conclusions: doom. The fact that two people from such different ends of the spectrum independently draw the same conclusions should perhaps offer a fairly high degree of confidence that the prediction is a safe bet. That's the depressing part of the story. If you're the sort of person that gets depressed by these kinds of thing.

Those of a more surrealistic nature might like to read the two books back to back. Both authors have a go at tracing back through recent history in order to establish the 'root cause' of the current problem, and both reach completely different conclusions. Both then have a go at suggesting post-crisis solutions. And again both make completely different recommendations: government needs to get bigger, says Hartmann, no, says Schiff, the crisis is the perfect opportunity to make it smaller. We need a period of austerity. No we

don’t we have to spend our way back to normality. The Republicans caused the problem. No, the Democrats did. After a while it gets quite funny.

Both of them, of course, are wrong in both their diagnosis and suggested remedies. They’re wrong looking back because they both operate on the erroneous belief that there is such a thing as a ‘root cause’. When we’re talking about the world’s biggest economy, we’re talking about the world’s most complex system, and no complex system possesses any kind of root cause to any kind of problem. The current situation emerges as a result of a conspiracy of causes, most of them completely beyond the control of any politician or economist.

Then, remedy-wise, they both also come at the problem from a classic either/or perspective. Debating the ‘right’ size of Government is an exercise in pure futility. The right answer in this kind of contradiction situation is a Government that is both ‘big and small’ – the US needs all the attributes of ‘big’ that are useful in the prevailing context, and all of the attribute of small that are also useful. Same thing with austerity, regulation and job creation: the real solution is to solve the contradiction. Otherwise, we merely set the boom-bust pendulum swinging faster.

Anyone reading the book through that kind of TRIZ-like ‘why don’t you solve the contradiction you idiots?’ lens might find themselves a little frustrated at first, but on the other hand, both authors tell a rattlingly good story. And for that reason alone they’re both worth reading. If you’re able to keep two books on the go at the same time, even better would be to get a copy of both and read them in parallel. Bring the TRIZ lens to bear while you’re reading either, however, and you might just come up with a strategy or two to make sure you come out of the impending trouble and strife stronger and better than we all are right now.

Strap yourself in people, whether you’re left, right or ‘third way’, the rockiest ride of our lives is nigh.

Wow In Music – Jump

So here's the scene. You're one of the world's hottest guitarists and, after five massively successful albums with your band, you're on top of the world. You're on top of the world and you're bored.

So you put the guitar down and start playing around with a synthesiser. You come up with what you think is a killer riff. You take it to the rest of the band. They hate it. Where's the guitar gone? The fans will crucify us. The killer riff gets put on the shelf.

Two years later you let your producer have a listen to it while the rest of the band are out of the studio. He loves it. The producer says, 'leave it with me, I'll convince them to do something with it'. He forces the singer to listen to it over and over again during an open-top car journey around LA. Finally, the singer gets it.

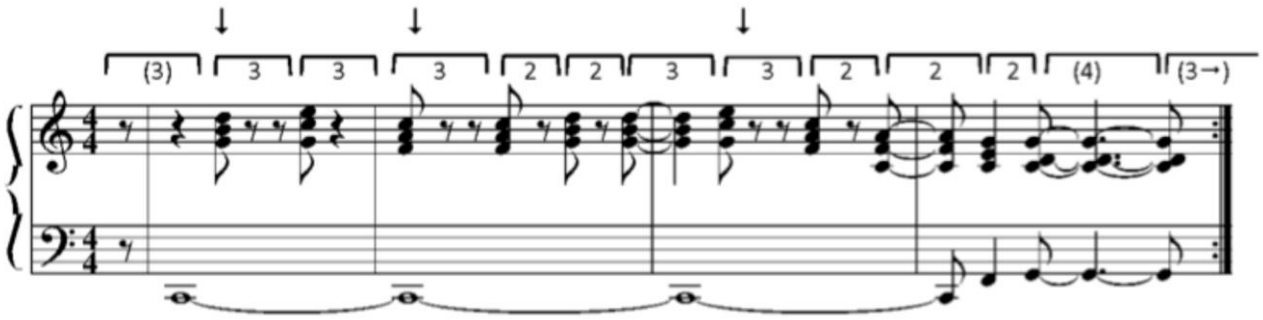
The resulting song becomes your first Number One hit single. And takes the band to a whole other level of mass popularity. The guitarist is Eddie Van Halen and the song is Jump. The synthesiser riff becomes an all-time classic. Within the first couple of bars, not only do you know precisely what song it is, you're up on your feet playing air-synthesiser and generally making a dancing-fool of yourself.

Why is the riff so memorable?

Rhythmic dissonance. More precisely rhythmic grouping dissonance at the beat level. Syncopation. A specific kind of syncopation. One that music theorists might call a 'tresillo'. Or, in the case of Jump, a double tresillo. The double-tresillo rhythm is common in jazz from the mid-twentieth century onwards and in rock and related genres from the 1970s onwards. The pattern begins and ends in alignment with the 4/4 meter but is out of phase in the middle, creating tension within the body of the phrase.

In Jump we hear it in the synthesizer rhythm. The double tresillo pattern displaced backward by an eighth note with a silent initial triple grouping, followed by a truncated version of the pattern that shifts to duple groupings after only two triple groupings. The rhythm aligns with the meter only on the weak beat 2 of the first and third bars, and on the

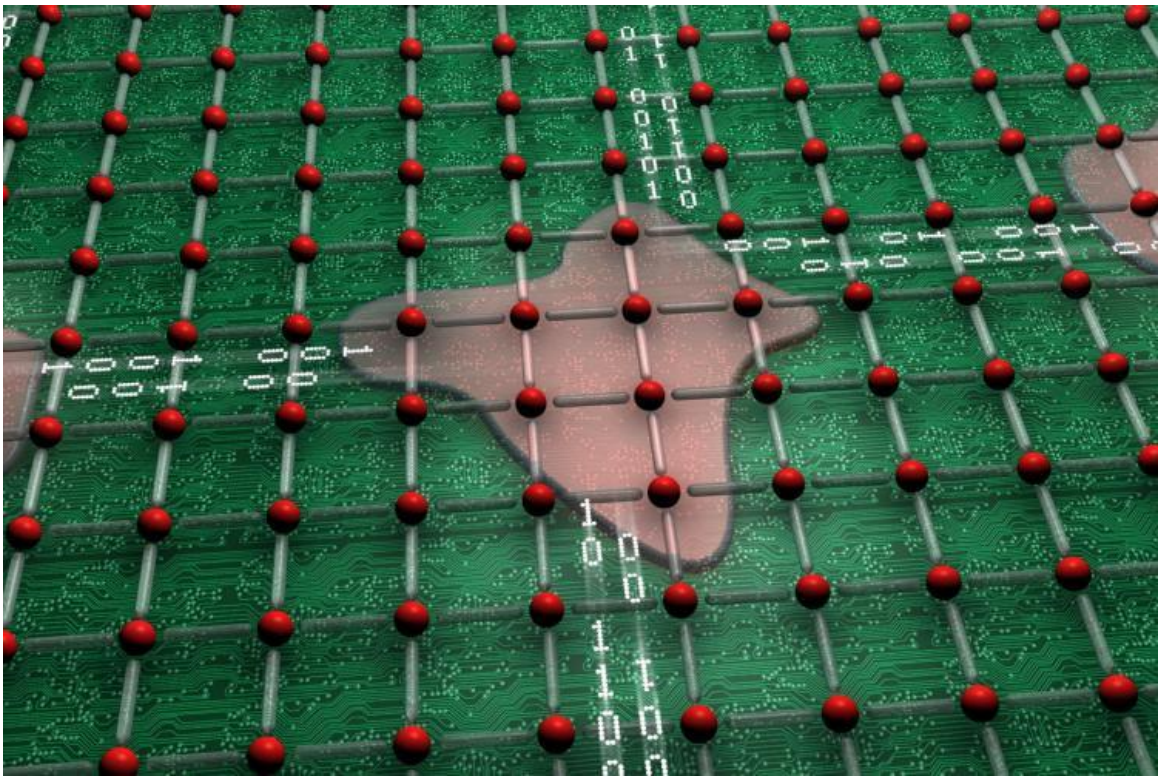
downbeat of the hypermetrically weak second bar; thus the pattern is significantly more unstable than the usual double tresillo. It still functions within the 4/4 metric frame but the net result of all the dissonance is it is nigh on impossible to sit still when you hear it. And no matter how many times you hear it, the surprise catches you by surprise.



Ditto, when you step back and think about it, how can it be that one of the world's hottest guitarists is now better known for his synthesizer riff?

I get up, and nothing gets me down.
You got it tough. I've seen the toughest all around.
And I know, baby, just how you feel.
You've got to roll with the punches to get to what's real

Investments – Self-Organising Nano-Materials



Researchers studying the behavior of nanoscale materials at the Department of Energy's Oak Ridge National Laboratory have uncovered remarkable behavior that could advance microprocessors beyond today's silicon-based chips.

The study, featured on the cover of *Advanced Electronic Materials*, shows that a single crystal complex oxide material, when confined to micro- and nanoscales, can act like a multi-component electrical circuit. This behavior stems from an unusual feature of certain complex oxides called phase separation, in which tiny regions in the material exhibit vastly different electronic and magnetic properties.

It means individual nanoscale regions in complex oxide materials can behave as self-organized circuit elements, which could support new multifunctional types of computing architectures.

"Within a single piece of material, there are coexisting pockets of different magnetic and/or electronic behaviors," said ORNL's Zac Ward, the study's corresponding author. "What was interesting in this study was that we found we can use those phases to act like circuit elements. The fact that it is possible to also move these elements around offers the intriguing opportunity of creating rewritable circuitry in the material."

Because the phases respond to both magnetic and electrical fields, the material can be controlled in multiple ways, which creates the possibility for new types of computer chips.

"It's a new way of thinking about electronics, where you don't just have electrical fields switching off and on for your bits," Ward said. "This is not going for raw power. It's looking to explore completely different approaches towards multifunctional architectures where integration of multiple outside stimuli can be done in a single material."

As the computing industry looks to move past the limits of silicon-based chips, the ORNL proof-of-principle experiment shows that phase separated materials could be a way beyond the "one-chip-fits-all" approach. Unlike a chip that performs only one role, a multifunctional chip could handle several inputs and outputs that are tailored to the needs of a specific application.

"Typically you would need to link several different components together on a computer board if you wanted access to multiple outside senses," Ward said. "One big difference in our work is that we show certain complex materials already have these components built in, which may cut down on size and power requirements."

The researchers demonstrated their approach on a material called LPCMO, but Ward notes that other phase-separated materials have different properties that engineers could tap into.

"The new approach aims to increase performance by developing hardware around intended applications," he said. "This means that materials and architectures driving supercomputers, desktops, and smart phones, which each have very different needs, would no longer be forced to follow a one-chip-fits-all approach."

A long way to go still, but I suspect we'll be hearing more about this technology in the coming months and years. Get in early!

Read more:

Andreas Herklotz, Hangwen Guo, Anthony T. Wong, Ho Nyung Lee, Philip D. Rack, Thomas Z. Ward. **Multimodal Responses of Self-Organized Circuitry in Electronically Phase Separated Materials**. *Advanced Electronic Materials*, 2016; 2 (9): 1600189 DOI: 10.1002/aelm.201600189

Generational Cycles – Scream I-IV

Back in the early 1990s it felt like no-one went to watch horror movies any more. They were all the same. Same formula, same rubbish never-to-be-seen-again actors. Same soundtrack. Same gore. People no longer went to the cinema to watch a horror movie, they stayed home and watched a direct-to-video re-make of a franchise started in the 70s or 80s. Dull as a bucket of fake-blood infused ditchwater. And then 1996 happened.

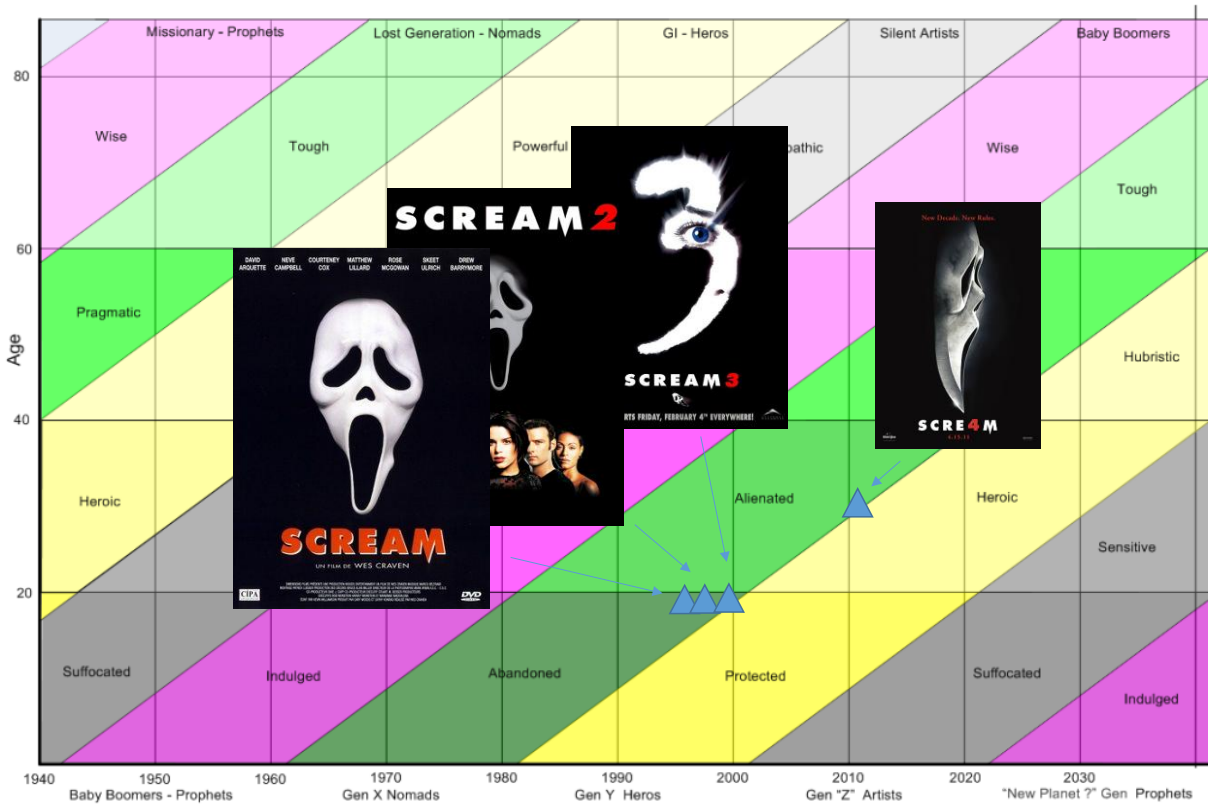
Wes Craven's *Scream* was credited with revitalizing the horror genre.

First up, *Scream* became notable for breaking the bad-actor rule. It's use of established and recognizable actors which was uncommon for horror films at the time. Scream made it the norm. Good actors suddenly aspired to work in horror films. Script-writers had an incentive to write better scripts. It was almost like a virtuous cycle. For a while at least.

The series, particularly the first two films, received significant critical acclaim. *Scream* achieved the feat by combining a traditional slasher film with humor, awareness of horror film cliché and a clever plot. *Scream* was one of the highest-grossing films of 1996 and became, and remains, the highest grossing slasher film in the world. Its success was matched by *Scream 2* (1997) which not only broke box-office records of the time but which some critics argued was actually superior to the original. *Scream 3* (2000) fared worse than its predecessors, both critically and financially, with critics commenting that it had become the type of horror film it originally parodied in *Scream*.

The producers, it seemed, learned a lesson with the third movie in the franchise. Or rather they forgot one. If the trick was revealing the cliché, you can't allow yourself to become the cliché. There's no such thing, the producers discovered as a double-bluff in cliché-land. They decided to lay low for a decade. Then, in 2011, they could resist the temptation no longer and Scream 4 was released. It's main review comment was, 'suddenly, it's the horror thriller that, like, your parents are excited about'. Which was far closer to the truth than the reviewers perhaps could ever know.

Here's what happens when we plot the four films onto a GenerationDNA map:



The first three in the series were, like most horror movies, aimed at the late-teen market. In the period 1996 to 2000 this meant the end of the becoming-Alienated Nomad generation, Generation X. The Scream movies, with their smart stab at revealing previous clichés, proved to hit the nail on the head as far as 'authenticity-seeking' Nomads were concerned. The movies – the first two at least – were 'authentic fakes' in that they revealed all the tricks of the genre. The cast members spoke to each other about the tricks. It was done brilliantly.

But not for the third in the series. Maybe it was because the Nomads were being replaced by the very different Generation Y 'Heroes'. Or maybe because by the time you've played the trick twice, it's no longer possible to be authentically fake a third time?

The 2011 film, according to our analysis wasn't made for the traditional teen audience at all. Rather it was sold as a nostalgia trip for the 30something-and-settling-down Nomads. Case in point: the main star of the film was Courtney Cox – perhaps the ultimate darling of the Nomad generation thanks to her other role in Friends. The big idea was that Scream fans wanted to see how Courtney had moved on in life. Or, as it turned out, hadn't:

Courtney Cox in Scream…

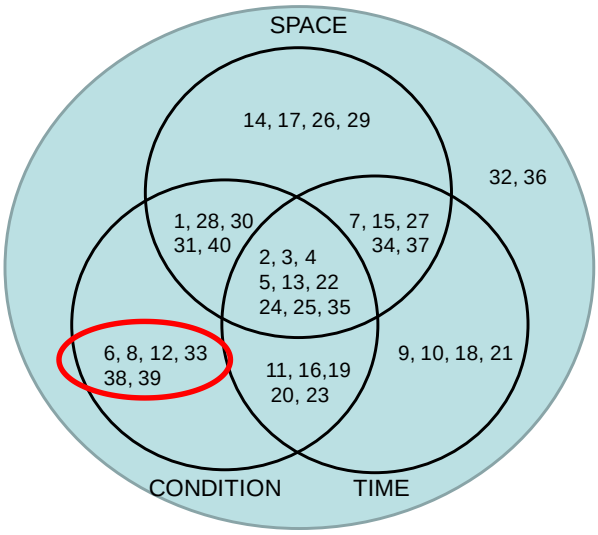
…and in Scream 4, 15 years later

Biology – Long-Eared Bat

Here's a classic physical contradiction problem if ever there was one. You're a bat, so you rely quite a lot on your hearing to locate food. That food also has the unfortunate propensity to be able to fly around and manoeuvre quite quickly. You want ears to hear, but you don't want ears because they cause drag and impede your ability to catch the food.

It's a contradiction probably most amenable to being solved by separation on condition. The condition of relevance being speed. Drag is only a problem at high speed (the force being proportional to speed-squared). When the bat is conserving energy, listening for prey, big ears are exactly what's needed, and then, when moving quickly towards said prey after it has been located, requires small ears.

Here's what the physical contradiction solution diagram tells us about the most likely solution strategies for 'separate on condition' problems:



And here’s what researchers at Lund University in Sweden have just discovered:

“Contrary to what researchers previously assumed, Christoffer Johansson Westheim and his colleagues show that long-eared bats are helped in flight by their large ears.

"We show how the air behind the body of a long-eared bat accelerates downwards, which means that the body and ears provide lift. This distinguishes the long-eared bats from other species that have been studied and indicates that the large ears do not merely create strong resistance, but also assist the animal in staying aloft," says Christoffer Johansson Westheim.

“Another discovery made during the experiments and never previously described in research is how the bats generate forward motion when flying slowly. The forward motion is generated when the wings are held high and away from the body at the end of each beat.

"This specific way of generating power could lead to new aerodynamic control mechanisms for drones in the future, inspired by flying animals," says Christoffer Johansson Westheim.

“The experiments were conducted in a wind tunnel in which trained bats flew through thin smoke to reach a stick with food on it. Meanwhile the researchers aimed a laser beam at the smoke behind the bats and took pictures of the illuminated smoke particles. The researchers measured how the smoke moved to calculate the forces generated by each beat of the bats' wings.”

Closing the loop with the physical contradiction problem, the lift-generating shape of the bat’s ears represents a very elegant illustration of Inventive Principle 8, Anti-Weight, in action.

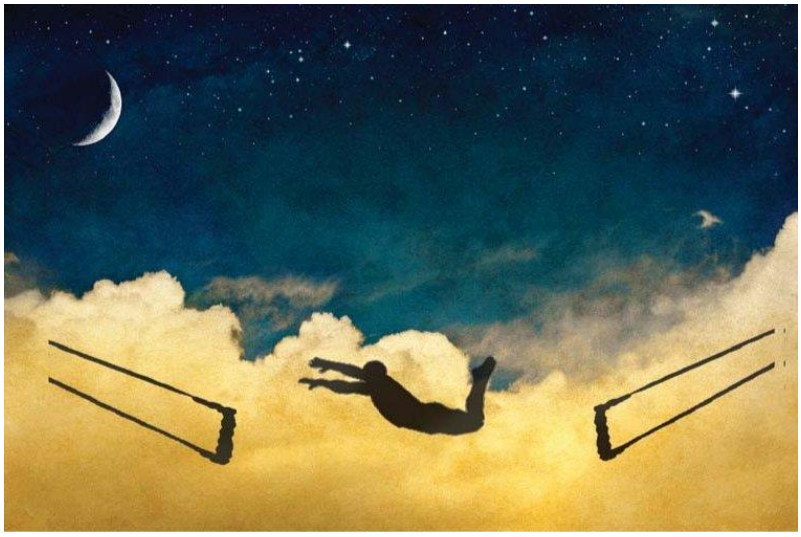
Have a look at the bats in flight here: https://www.youtube.com/watch?v=YhEkperhZMQ

And read more here**:**

L. Christoffer Johansson, Jonas Håkansson, Lasse Jakobsen, Anders Hedenström. **Ear-body lift and a novel thrust generating mechanism revealed by the complex wake of brown long-eared bats (Plecotus auritus)**. *Scientific Reports*, 2016; 6: 24886 DOI: 10.1038/srep24886

Short Thort

“What art is, in reality, is this missing link, not the links which exist.
It's not what you see that is art; art is the gap.”
Marcel Duchamp



“The things you let go will someday teach you how to fly.”
Jenim Dibie

News

University Of Buckingham MSc

Well, it was a long time coming, but we’re very happy to announce the formal approval and launch of the new ‘Lean Design & Systems Innovation’ Masters degree at the University of Buckingham in the UK. The first cohort will embark on the journey from March 2017. We are expecting to be able to run the Systematic Innovation Certification programme in a fully-integrated fashion so that anyone completing the SI theory will accrue 30 Credits towards their MSc. Successfully complete the three completed projects and they will accrue another 45… only 105 more needed to get the Degree! More details on its own page on the SI website, and shortly too on the Buckingham website.

Mexico

We are happy to announce that Darrell will be returning to Mexico in 2017 for a series of workshops. 21st Century TRIZ, Systematic Service Innovation, Patent Bulletproofing, and TrenDNA are the likely topics. March 20-25 and April 24-29 are the two scheduled weeks. More details in the coming weeks.

Dutch Business Matrix

Within weeks of the English version of the new Business Matrix being released, along comes the Dutch version. Many thanks to good friend Gertjan Otto for organising everything. Get hold of your copy at www.innovativepartners.nl.

IMechE

We are happy to announce that our series of public one-day TRIZ Introduction workshops convened by the Institution of Mechanical Engineers will continue through 2017. Expect dates in May and November at least. Check out the IMechE.org website for details.

New Projects

This month's new projects from around the Network:

NGO – PanSensic Customer Feedback Analysis Study
FMCG – Domain Evolution Potential Study
FMCG – PanSensic Product Launch Study
FMCG – PanSensic Consumer Study
Healthcare – PanSensic Dashboards
Automotive – SI Certification Workshops
Government – TrenDNA/PanSensic Study
Financial Services – TrenDNA Study
Industrial – Problem-Solving Workshops