Systematic Innovation

e-zine

Issue 172, July 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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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**

Divergence, Iteration & Operational Excellence

The Operational Excellence world abhors waste. Consequently, everyone working within such an environment is trained to sniff it out and eliminate it. When people have their waste-radars switched-on they can be pretty relentless when it comes to finding waste. Especially if it is 'waste' that looks like it would save them from unnecessary hard work personally.

For the most part, 'waste elimination' is a good thing inside organisations. Per previous discussions in the SI ezine, there are three basic kinds of waste:

- 'low-hanging fruit' waste – genuine waste which, when we eliminate it, has no adverse consequences on anything else
- 'waste with consequences' – genuine waste that, unfortunately, when attempting to eliminate it, we find it causes a further problem somewhere else in the system
- 'Dodo waste' – things that we inadvertently and mistakenly thought was waste, but when we eliminated it, some time downstream we realize it wasn't actually waste at all, but rather an essential part of the healthy functioning of the system.

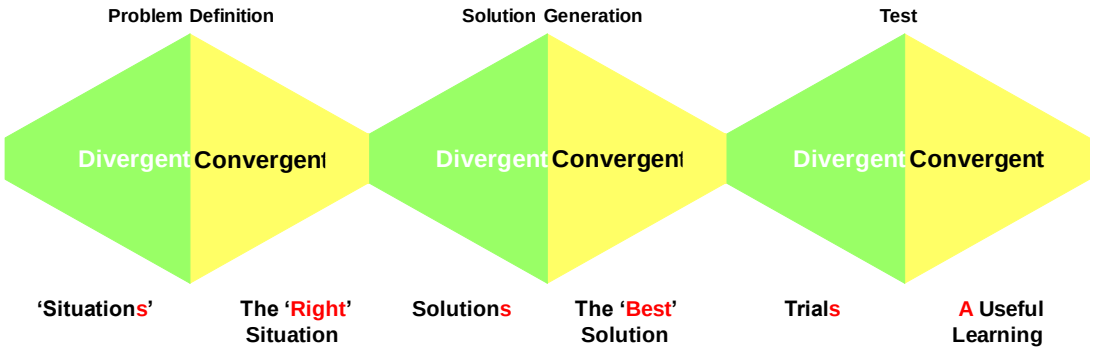
When people from the Operational Excellence world find themselves dropped into the special world of the Learning & Innovation functions of their enterprise, their well-trained waste-radars typically start to light up like Christmas trees. Learning & Innovation is full of 'waste'. Some of it might even actually be waste of the low hanging fruit variety. But, I propose, the vast majority falls into the second and, particularly, the third categories of waste. This article is about these two types of 'waste', how to spot them, and how to try and convince the skeptical OpEx-inculcated people that they're an essential part of the way things happen in Innovation World.

Take problem solving. When waste is spotted within OpEx, it usually triggers a problem solving process. The process generally looks something like this:

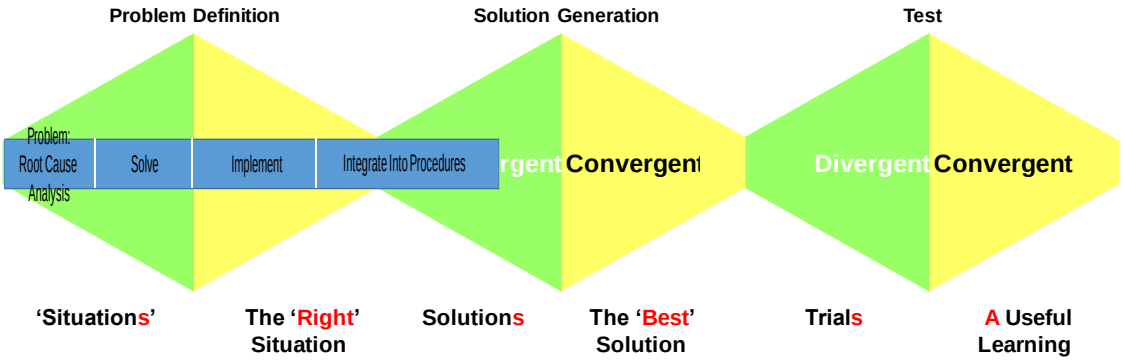
Problem: Root Cause Analysis	Solve	Implement	Integrate Into Procedures

The process is linear, repeatable, and designed for people to follow it and get the system 'back to normal' as soon as possible.

Here's how people in Innovation World will see the exact same waste elimination situation and how they might seek to deal with it:



The Operational Excellence often look at this kind of picture with a mixture of horror and disbelief. If pushed to try and reconcile the differences between the two pictures, they will typically overlay the two 'processes' something like this:



There is no recognition of even the concept of 'divergence' in OpeX world. The very word signifies waste. Divergence means deviating from the focus. Consequently, they tend to make some kind of correlation between the area of each of the boxes in the respective processes and assume that the 'focused' OpEx problem solving procedure will conclude much faster, because it is 'much more efficient'.

During the first 'problem definition' Divergent-Convergent cycle, OpEx people will typically come out with statements like, 'but we already know what the problem is, why would we waste time looking for more?'

Unfortunately, what the Innovation World people know is that what this question actually means is 'but we already know what the *symptoms are*, why would we waste time looking for more?'

The primary motivation in OpEx world is to get rid of the symptom so things can return to normal as quickly as possible. The primary motivation in Innovation World is to make sure we don't waste any precious time working on the wrong problem, and that 'symptoms' are frequently a mask to disguise the real problem.

A similar misconception occurs when we look at the Divergent-Convergent solution generation process.

OpEx people look at the wall of seemingly random Post-It notes, filled with a combination of useless and obvious ideas and conclude, 'why would anyone waste their time generating ideas that are never going to get used?'

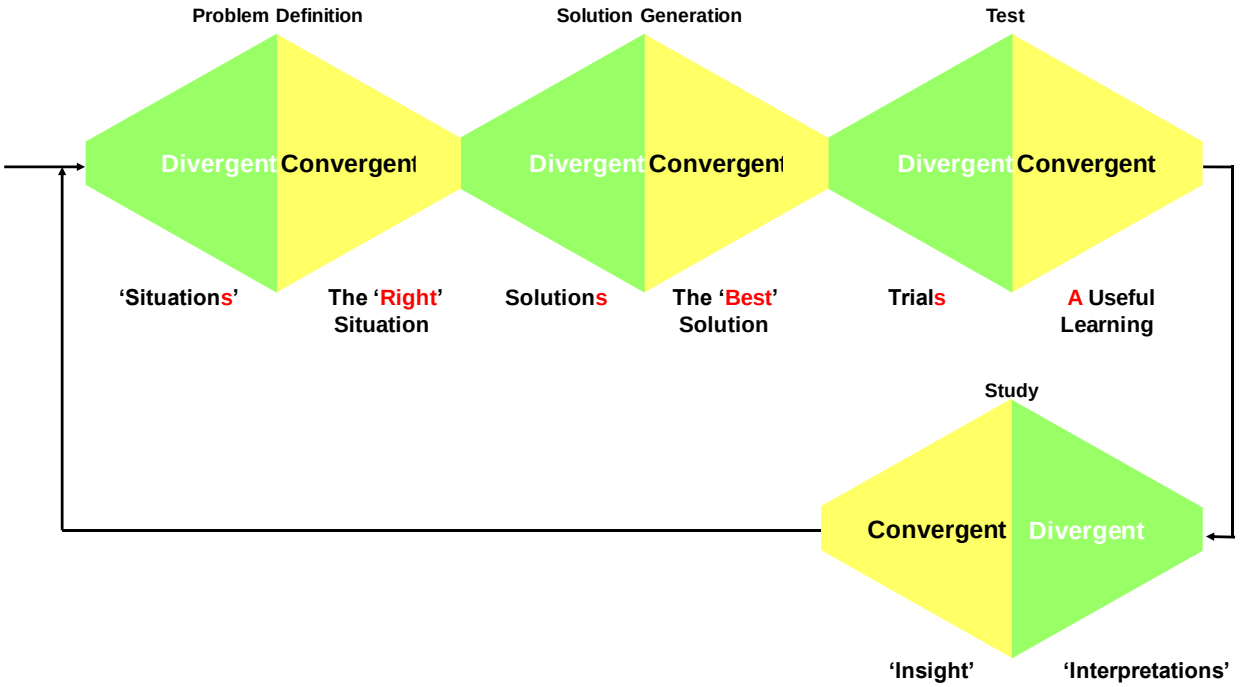
(As an aside, even the Classical-TRIZ community gets drawn into this 'idea-efficiency' argument. One of the reasons I'm convinced – empirical evidence! – that the higher Levels of (MA)TRIZ Mastery a person holds, the worse a problem solver they actually are, is because ARIZ teaches them a similar idea that generating lots of 'random' ideas is not efficient, and that if ARIZ has been used correctly, the one golden answer should magically pop out at the end of the process. This is not just a dumb notion, it is also 180 degrees wrong, as we shall shortly see…)

Innovation World people know that it is useful to generate many solution ideas ('clues') because of a couple of important effects:

- The ideas that sound the wildest and weirdest at the beginning are often the ones that carry the best opportunity to break psychological inertia and jump the solution to a valuable new perspective…

- …albeit, not by itself: the actual final answer is most likely to come about through a combination of partial answers. The 'weird' idea by itself is probably no good, but the 'weird' idea combined with solution clues #27, #74 and #127 makes for a really compelling solution possibility.

Unfortunately, bad as it already appears to the OpEx-oriented viewer, that's not the end of the Innovation World story, because the next thing they're going to want to do is introduce some kind of iteration. Something like this:



If the OpEx people were unhappy about the previous picture, they're likely to go into cardiac arrest when they see this one. Not only does this picture go all the way back to the beginning again, it never ends. The loop goes on forever. (This is why Innovation World rarely draw their modus operandi in this way, and also why, when they work according to the looping principle, they are frequently perceived as 'procrastinators that never deliver'.)

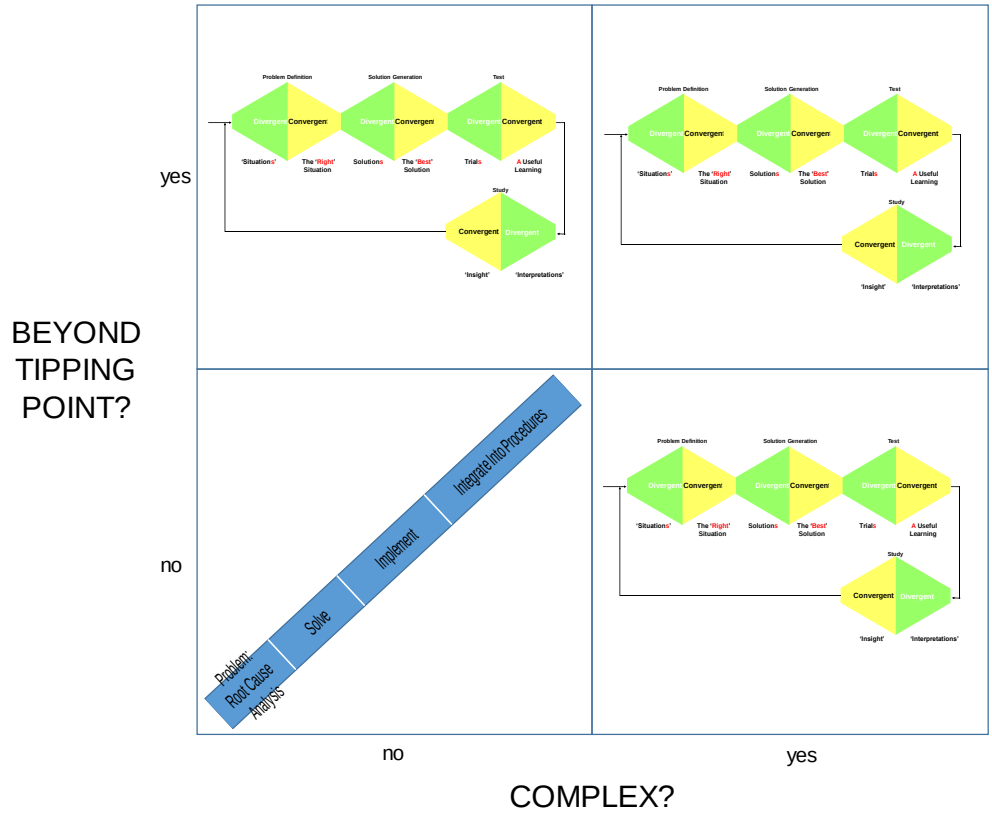
What the Innovation World people know – at least the 'good ones' do – is that the reason for this iterative loop is because when you're making step-changes, you're fundamentally operating in a Complex world (usually at the edge of Chaos), and that the only sensible way to operate when in this kind of emergent, cause-and-effect-loosely-coupled world, is to learn faster than everyone else around you. And that the way to learn the fastest is to do your iterations faster and more effectively than anyone else. i.e. use TRIZ/SI to guide and help manage the Divergent-Convergent cycles at each stage.

So much for the differences in opinion. The important question is who's right? Which is faster, the OpEx no-divergence-all-convergence strategy or the multi-divergent, multi-iterative Innovation World way of doing things? Is Divergence waste? Is iteration waste?

As ever with these kinds of either/or question, the answer is 'it depends'. What it depends on is the following:

1) Is the system complex?
2) Is the system beyond the 'low-hanging fruit' waste elimination stage of its s-curve (i.e. usually a point just after the Tipping Point)

Sounds like time for a 2x2 Matrix to show the fastest and 'right' strategy in each scenario:



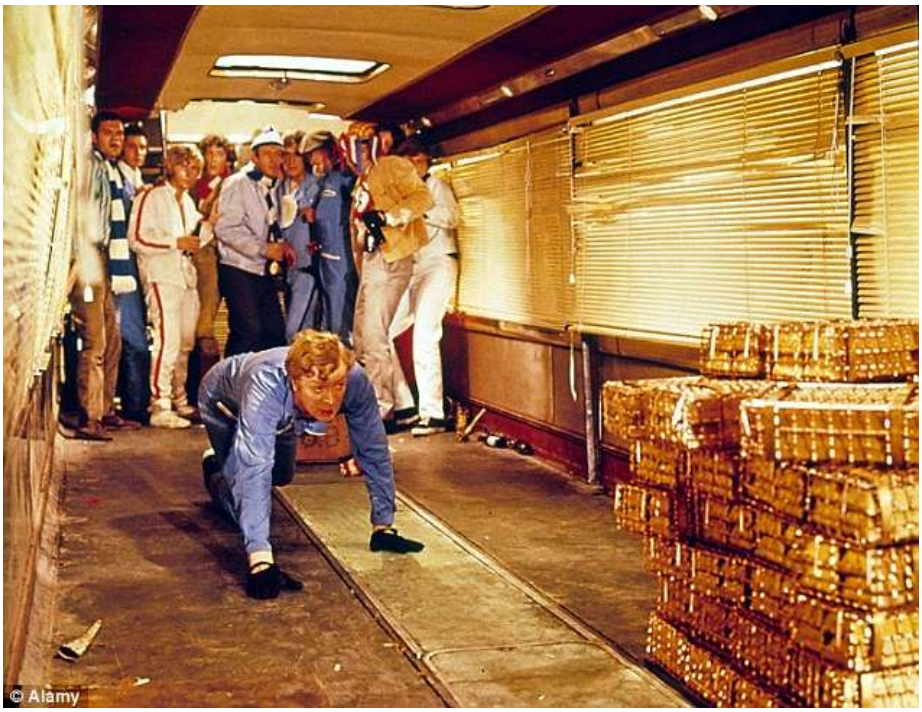
The good news for the OpEx people is that there is a scenario where there way of doing things is the right way to go: the non-complex world of ‘low-hanging fruit’ waste elimination opportunities.

The bad news is that the real world is always in the top-right hand corner of the picture. That plus the fact that multiple years of erroneously assuming it was in the bottom or top left has left most ‘Operationally Excellent’ operations at the wrong end of a very long cul-de-sac. More often than not, somewhere just outside Dodoville.

Case Study: The Italian Job

The Italian Job is a 1969 British caper film, written by Troy Kennedy Martin, produced by Michael Deeley and directed by Peter Collinson. For Brits of a certain age, it has become a cultural icon. In 2004, the film was named the 27th greatest British film of all time. The line "You're only supposed to blow the bloody doors off!" by Caine was voted favourite film one-liner in a 2003 poll of 1,000 film fans, but what people most likely remember about the film is the – quite literally – cliffhanger of an ending: The gang of criminals has escaped with the gold bullion, but during their getaway, their gold-laden coach spins out of control and finds itself teetering on the edge of a cliff:

Leaving the unfortunate criminals facing this scene inside the coach:



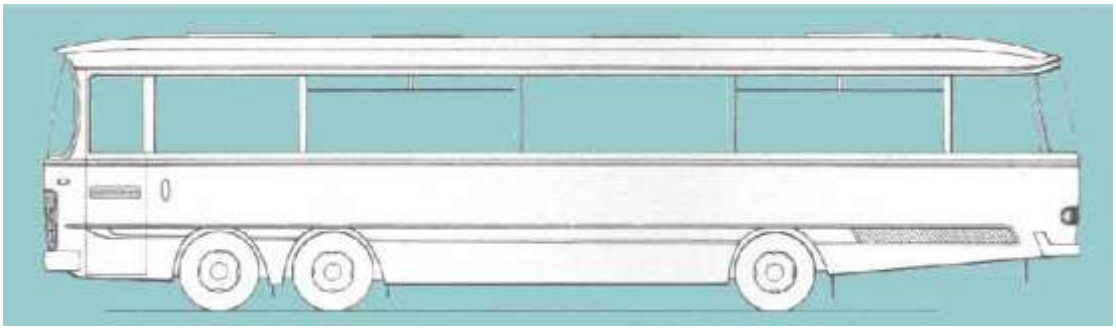
Part of the idea for the cliffhanger was to open up the way for a sequel. Sadly, that never happened and so the viewing public has been left haunted by Michael Caine's final words, 'Hang on a minute, lads, I've got a great idea."

The coach is rocking on a knife-edge, and the moment Michael moves himself any closer to the bullion, the coach is going to tip over the edge of the cliff. Sounds like a problem for TRIZ…

…which probably means starting by thinking about an 'Ideal Final Result'. Fairly straight-forward in this case: the gang swiftly rescues all the gold and continue safely with their getaway…

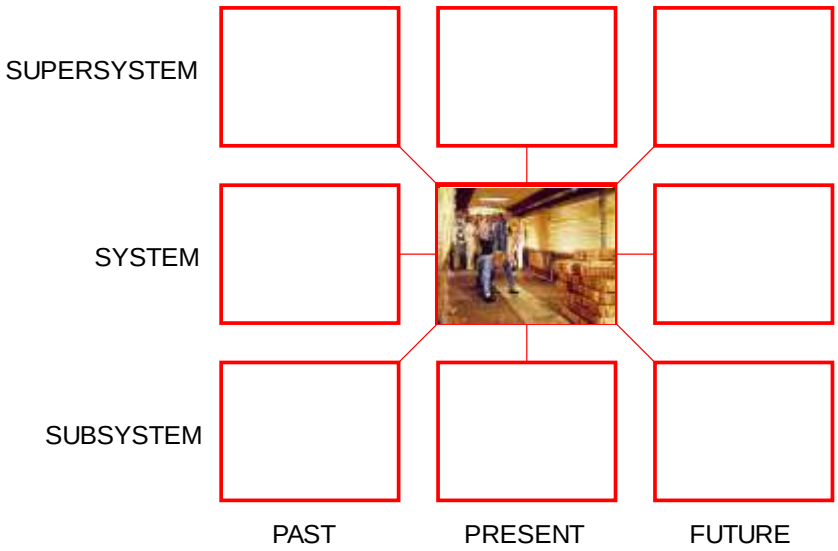
…from where, we probably need to do some knowledge gathering…

…starting with the coach, as it happens a Bedford VAL14s:



…launched at the 1962 Commercial Motor Show, the twin steer concept on 36ft (11m) PSV chassis was the first Bedford chassis designed specifically for bus & coach operation, (hitherto Bedford had produced modified versions of its truck chassis for this purpose). The set back front axles, allowing the entrance door to be positioned ahead of them, making it easier for passengers to get in and out. The coach was powered by a 6.17 litre Leyland 0.400 diesel engine mounted vertically at the front, & driving via a Clark (licence built by Turner) five speed synchromesh gearbox, that in turn drove a propshaft to the rear wheels. The wheels were relatively small - 16 in diameter. The VAL had power steering & a tight turning circle. An exhaust brake was optional to assist the air over hydraulic brakes which, working on small diameter drums, had a tendency to overheat & fade. One feature that made the VAL suitable for the then, new motorway network, was that in the event of a tyre blow-out, the coach would continue to drive normally, & could be brought to a controlled stop.

Beyond that, the problem carries all the hallmarks of a resources problem. Which means the 9-Windows tool, and very likely a definition of 'system' that comprises the interior compartment of the coach:



The ‘present’ is probably best defined by Michael Caine’s current position in the still image from the film: If he tries to move any closer to the gold, the coach tips; if he moves back towards the other members of his gang, the coach becomes more stable. He is, in other words, currently right on the fulcrum point of the balancing coach.

In order to achieve our IFR, we need to re-distribute weight. A good Window to start this search is the Sub-System, Present. Which means looking around the scene inside the coach to see what we have available:

- Michael Caine can retreat to the other gang members.
- There are blinds on the coach windows, these could be taken down and moved towards the gang, starting with the ones nearest to the gang, and then working further along the coach towards the gold.
- Having revealed the coach windows from behind the blinds, the gang could somehow break the glass. For the windows on the ‘land-side’ of the fulcrum, they should break them so the glass falls inside the coach; for the windows on the air-side, the should break them so the glass falls outwards – thus reducing the overhanging weight. If they break the land-side glass first, they have the opportunity to experiment a bit with the method of breaking – using a shoe for example, or the discarded blinds?

How about moving to the Super-System?

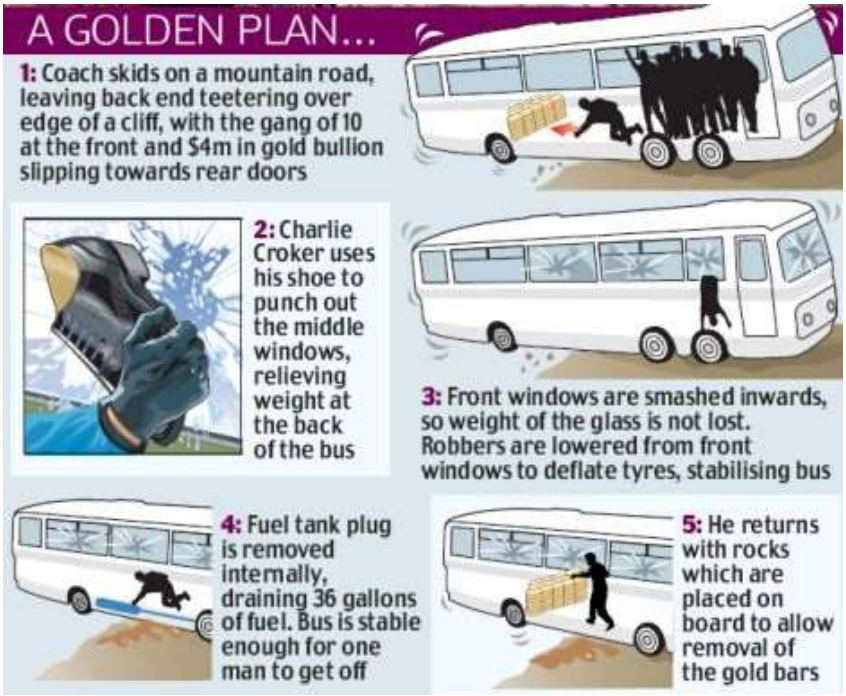
- Having broken the land-side windows, one or more of the gang can be supported so they can lean out of the window and let down the four front tyres. This will help reduce the rocking motion of the coach (albeit at the expense of making it difficult to drive the coach away once they stabilize it).
- The gang can open the skylight above their heads and climb out onto the top of the bus, closer to the front of the coach in order to again re-distribute weight to help stabilize the vehicle. If they remove the skylight, they should retain it in/on the vehicle in order to make use of its weight as a further re-distribution aid.
- If you look at the picture of Michael Caine, just ahead of his left-hand is an access panel. Once the coach has been made more stable, he can move forward to this access panel and open it. What he will find beneath is the coach’s fuel tank. He can then release fuel from the tank, meaning that somewhere around 140kg of weight will be lost from the air-side of the coach. Removing this amount of weight will then make it very easy for Michael to start moving gold bars towards his gang. The more gold gets moved, the more other people will be able to join in the process of moving the gold faster.
- Outside the coach, the environment is full of rocks and other heavy objects. As the gang start removing gold from the coach, they can replace the lost weight with rocks from the area surrounding the vehicle.
- Also outside the coach is the road they have just been travelling along. Once enough weight has been re-distributed in the coach, one or more of the gang-members can flag down other passing vehicles, the bigger they are, the better.

System-Future? (the ‘future’ in the context of our problem, means something like the next 20 to 30 minutes…)

- The coach engine is still running at the time of the incident, so that, should Mr Caine be unable to release the fuel from the tank, the fuel is gradually being consumed anyway. The longer they ‘wait’ the more the vehicle weight re-distributes towards safety as the fuel tank as towards the rear. If one of the gang gets to the driver’s seat, they can in any event press harder on the accelerator pedal to increase the rate of fuel consumption.

- In order to cover their tracks once they've got the gold out of the coach and suitably commandeered a replacement vehicle, it would probably be sensible to encourage the coach to tip over the edge of the cliff. They could do this by either pushing the coach using the new vehicle, or re-distributing the rocks they've place on board so the coach approaches it's tipping point again.
- Or – slightly more risky – the gang could get themselves off the coach, let it tip over the edge, commandeer a passing vehicle, and drive down the mountain to where the coach comes to a rest, and remove the gold from where it now lies.

The preferred solution and sequence of events, will probably look something like this:



All in all, the problem doesn't seem so difficult after all. Maybe that's the real reason they didn't make the sequel?

Not So Funny – Business Innovation Project Generator

Select one word from each column to help define your next business innovation initiative. Your holistically empowered bleeding-edge future starts here:

Adverb	Verb	Adjective	Noun
appropriately	actualize	24/7	action items
assertively	administrate	accelerated	AI
authoritatively	aggregate	accurate	algorithm
coherently	architect	adaptive	alignments
collaboratively	benchmark	alternative	applications
compellingly	brand	an expanded array of	architectures
competently	build	antifragile	bandwidth
completely	communicate	B2B	benefits
continually	conceptualize	B2C	best practices
conveniently	coordinate	B2G	blamestorming
credibly	create	B2X	breadboard
distinctively	cultivate	backend	catalysts for change
dynamically	customize	backward-compatible	channels
efficiently	deliver	best-of-breed	collaboration and idea-sharing
enthusiastically	deploy	bleeding-edge	communities
globally	develop	bricks-and-clicks	content
holistically	disintermediate	bulletproof	convergence
hypothetically	disseminate	business	core competencies
interactively	drive	clicks-and-mortar	customer service
intrinsically	embrace	client-based	data
locally	e-enable	client-centered	deliverables
meaningfully	empower	client-centric	design
monotonically	enable	client-focused	e-business
objectively	engage	collaborative	e-commerce
proactively	engineer	compelling	e-markets
professionally	enhance	competitive	e-tailers
progressively	envision	complex	e-services
rapidly	evisculate	contextualized	experiences
seamlessly	evolve	cooperative	expertise
synergistically	expedite	corporate	functionalities
totally	exploit	cost effective	future
uniquely	extend	covalent	growth strategies
	fabricate	cradle-to-cradle	human capital
	facilitate	cross functional	ideas
	fashion	cross-media	imperatives
	formulate	cross-platform	infomediaries
	foster	cross-unit	information
	generate	customer directed	infrastructures
	grow	customer-driven	initiatives
	harness	customized	innovation
	impact	cutting-edge	intellectual capital
	implement	design-for-x	interfaces
	incentivize	distinctive	internal or "organic" sources
	incubate	distributed	knowledge
	initiate	divergent	leadership
	innovate	diverse	leadership skills
	integrate	dynamic	lean
	iterate	e-business	manufactured products
	leverage	economically sound	markets
	maintain	edge of chaos	materials
	matrix	effective	meaning
	maximize	efficient	meta-services
	mesh	emergent	methodologies

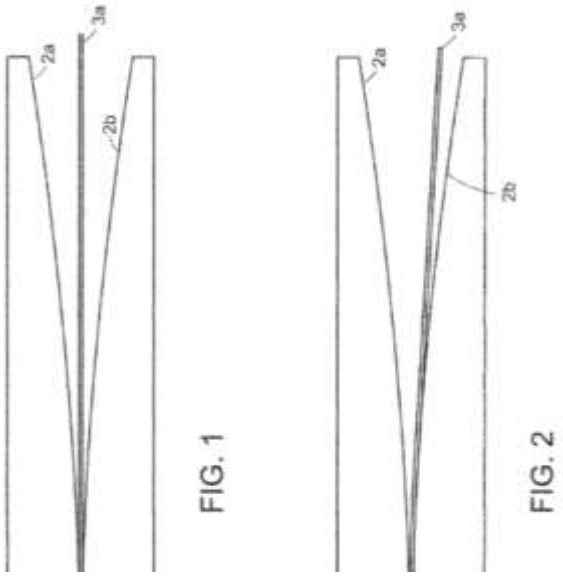
	monetize morph myocardinate negotiate network optimize orchestrate parallel task plagiarize pontificate predominate procrastinate productize promote provide access to pursue recapitalize reconceptualize redefine re-engineer reintermediate reinvent repurpose restore revolutionize scale seize simplify strategize streamline supply syndicate synergize synthesize target transform transition underwhelm unleash utilize visualize whiteboard	emerging empowered enabled end-to-end enterprise enterprise-wide equity invested error-free ethical excellent exceptional extensible extensive flexible focused frictionless front-end fully researched fully tested functional functionalized future-proof global go forward goal-oriented granular high standards in high-payoff high-quality highly efficient holistic impactful inclusive inexpensive innovative installed base integrated interactive interdependent intermandated interoperable intuitive just in time leading-edge leveraged long-term high-impact low-risk high-yield magnetic maintainable market positioning market-driven mission-critical multidisciplinary multifunctional multimedia based next-generation one-to-one open-source optimal orthogonal out-of-the-box pandemic	methods of empowerment metrics mindshare models networks niches niche markets opportunities "outside the box" thinking outsourcing paradigms partnerships pivot platforms portals potentialities process improvements processes products quality vectors relationships resources results ROI scenarios schemas services solutions sources strategic theme areas supply chains synergy systems technologies technology testing procedures total linkage users value vortals web-readiness web services'

		parallel performance based plug-and-play premier premium principle-centered proactive process-centric professional progressive prospective quality real-time reliable resource sucking resource maximizing resource-leveling revolutionary scalable seamless stand-alone standardized standards compliant state of the art sticky strategic streamlined superior sustainable synergistic tactical team building team driven technically sound timely top-line transparent turnkey ubiquitous unique user-centric user friendly value-added vertical viral virtual visceral visionary web-enabled wireless world-class worldwide	

(Please let us know if you spot any missing words… one day this will become a proactively harnessed edge-of-chaos portal for the UK Government.)

(Not to mention, PanSensic tool.)

Patent of the Month – Nonlinear Spring

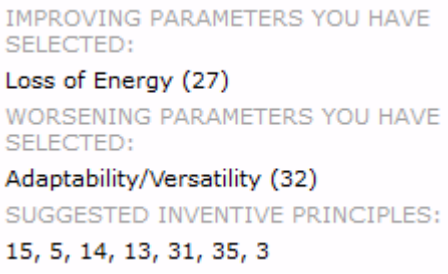


Patent of the month this month is US9,382,960, granted to a trio of inventors at MIT on 5 July. If ever a solution carried the hallmarks of after-the-event obviousness, this invention sets the standard. It's almost impossible to believe the world hasn't derived such a simple solution to such an apparently intractable problem before. Out hats go off to the inventors. Here's what they have to say about the problem to be solved:

Several technological processes such as energy harvesting from ambient vibrations, shock absorption from external loads, and passive control or suppression of mechanical instabilities involve targeted energy transfer from one component of a structure to another. In particular, energy harvesting is the process of using ambient energy sources to generate useful forms of energy such as electricity. The energy in these ambient sources is usually spread over a range of frequencies. Applications of energy harvesting may include MEMs sensors implanted in remote locations. Shock absorption is the process of protecting a primary structure from an ambient force or external pressure load. Applications include passive protection of buildings from earthquake excitations, offshore platforms from water waves impacts, or a delicate instrument from external loads. Passive control of mechanical instabilities in another important area that has recently emerged in the context of targeted energy transfer. Examples may include the suppression of aeroelastic instabilities on wings due to fluttering and the elimination of aeroelastic instabilities in suspension bridges.

In all of these cases, one aims to design elements that are capable of transferring the energy irreversibly and efficiently. In typical applications (especially energy harvesting), the ambient vibration can be described as a stochastic, multi-frequency signal that is often characterized by time-varying features. However, traditional single degree of freedom linear vibration harvesters are efficient only close to their design point; that is, when the excitation frequency matches the harvester's natural frequency. Therefore, linear harvesters respond inefficiently to ambient vibrations. In order to absorb ambient vibrations effectively, it is essential for an energy harvester to be characterized by adaptivity (i.e. the ability to adjust its resonance frequency/ies depending on the input spectrum) and robustness (i.e. the ability to maintain its energy harvesting performance even if the excitation varies significantly).

A nice easy one to map on to the Contradiction Matrix:

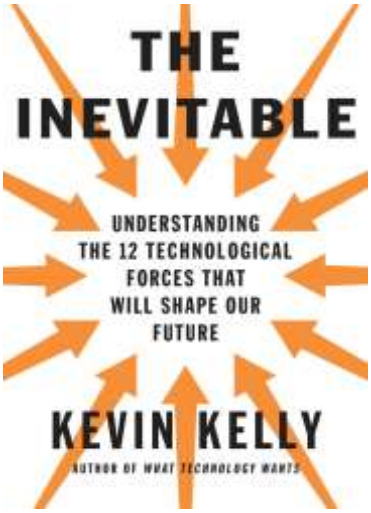


The sketch shown at the top of the article probably gives the game away in terms of the (Principle 14, Curvature) solution. Just in case it didn't, here's what the main Claim from the patent tells us the nonlinear spring comprises:

…a first member further including a first symmetrical member with a left and a right curved surface; a second member displaced parallel to the first member and including a second symmetrical member with a left and a right curved surface, the first and second members having first and second anchor points to receive tensile or compressive forces; and a total of four cantilevered beams including a left and a right cantilever beam projecting out from center regions of both first and second members respectively; and left and right connection structures connecting left cantilever beam ends to each other and right cantilever beam ends to each other respectively.

Not sure about the ultimate merits of the 'symmetrical' part of the story, but that's the niggle of a TRIZ-nerd. A slightly jealous TRIZ-nerd at that. Lovely.

Best of the Month – The Inevitable



Well, it's the new Kevin Kelly, so that should already mean it's worth reading. The Inevitable might just be his most important book yet. The sub-title gives the big hint: '12 technological forces that will shape our future'. Better still, when we scan the chapter titles to see what the 12 forces are, we see they're all expressed as functions. The future is all about functions not solutions… wonder where we heard that one before?

For the record, the 12 Forces are expressed at a quite high level of abstraction – Becoming, Cognifying, Flowing, Screening, Accessing, Sharing, Filtering, Remixing, Interacting, Tracking, Questioning and Beginning – and, like any good function, we do them all already. That said, Kelly is supremely good at putting on his future goggles to speculate on how the delivery of these functions looks set to change in the coming years and decades. For this extrapolation alone, the book is worthy of your time and attention.

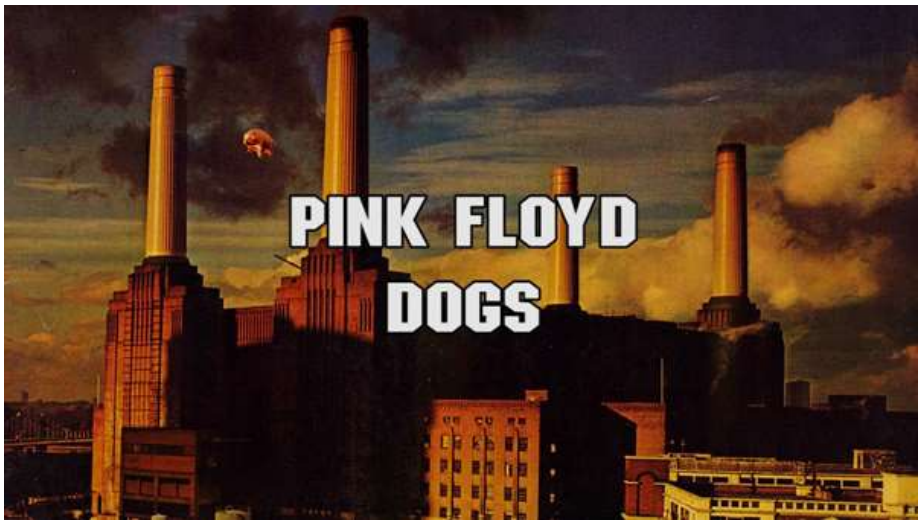
Granted, it's a shame that, like most people outside the TRIZ world, Kelly doesn't appear to have any inclination that 'the future' emerges through the interaction of trends and patterns not through the patterns themselves. If you're going to make any meaningful sense out of the book, in other words, you're going to have to do that job for him. The fact that he's given us a platform from which to begin the job is probably going to end up being the biggest contribution The Inevitable makes.

If the future of books is driven in any way by the 'Flowing' function, then the frozen content of The Inevitable will be freed to advance and evolve as the world evolves. I'm not sure Kelly specifically predicts that, but I'm nevertheless hopefully. Just in case it prompts him or his editor to consider removing the final couple of pages of each chapter, where he tries to extrapolate the force he's just been talking about and talk through a future scenario of how his and our lives might look in the future. To say these extrapolations are toe-curlingly bad is probably the understatement of the year. They're awful. Like a really bad science-fiction book written by someone who's sole exposure to the genre was half-watching 2001: A Space Odyssey when they were twelve. Your best bet is to rip this pages out of the book before trying to read them. I think your respect for Kelly will be left much higher if you do this. I think a future Kevin Kelly will thank you for this act of mercy.

In the meantime, the remaining 90% of the book is well worth your discretionary dollar. Turn the 12 Forces into a future trend conflict map and you might just learn something really, really important. And if that sounds like a prompt for a future ezine article, you're probably right.

SYSTEM ·ATIC INNOVAT· ION

Wow In Music - Dogs



Pink Floyd's song "Dogs" is constructed like no other song of similar length by the leading contemporaneous British rock bands. In its economical use of thematic material and slow rate of change, "Dogs" seems as if it could have lasted for four minutes, but instead runs for seventeen. That's quite a trick. Many large-scale tracks by progressive rock bands of the 1970s maintain variety and direction by featuring virtuosic performances, an eventful tonal scheme, and sophisticated rhythms. Pink Floyd utilizes a different, and arguably subtler, type of virtuosity: an aptitude for arrangement and structure, coupled with proficiency in the studio. These devices balance the band's simpler harmonic and rhythmic language, as well as lesser technical abilities, and are largely responsible for the success of "Dogs."

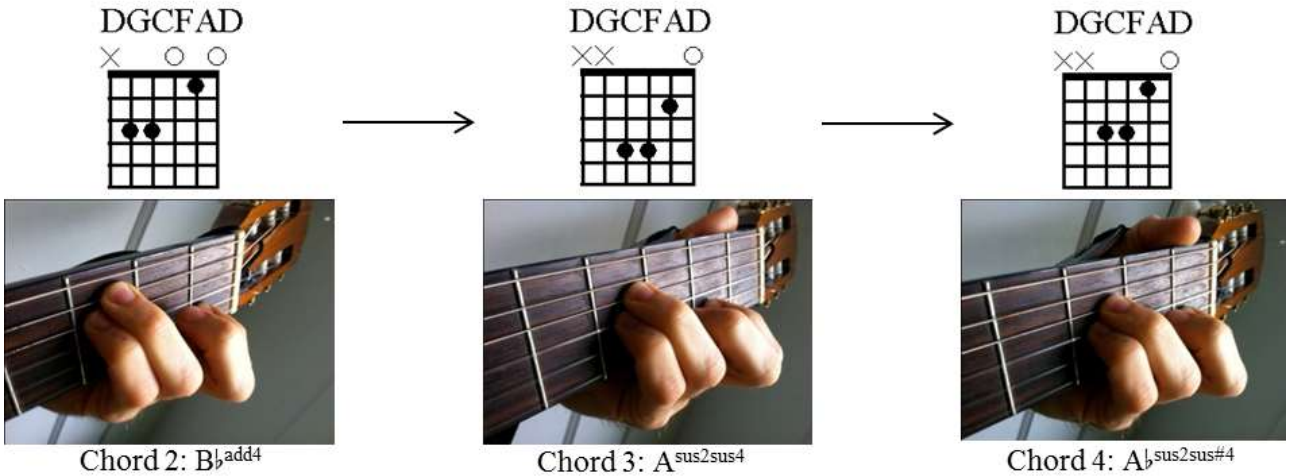
For years an unvaried song that refused to end, "Dogs" was transformed in the studio through a long arrangement process into a diverse, detailed composition.

Unit	Exposition												Free interlude	Recapitulation								
Section	A							B	C					A'						B'	Coda	
Harmonic cycle	1	2	3	4	5	6	coda		1	2	3	4	1-4	1	2	3	4	coda				
Time+	0:00	0:38	1:15	1:59	2:25	2:59	3:36	3:43	4:46	5:33	6:47	7:31	7:58	11:40	12:17	12:53	13:28	14:04		14:10	15:22	
Soloist		Gilmour		Guitar solo 1	Gilmour			Electric guitar duet		Guitar solo 2	Gilmour		(keyboard)		Waters		Guitar solo 3			Elec. guitar duet	Waters	
Key lyrics		The businessman's ruthless way of life		"You get the chance to put the knife in"		Life gets harder and harder	"All alone, dying of cancer"				Getting old and dying		"Dragged down by the stone"		Despair from the businessman's viewpoint		"You believe at heart everyone's a killer"			Life summary, ending: "Dragged down by the stone"		
Meter	4/4					2/2		4/2	4/2				6/4	4/4				2/2		4/2	4/2	
Tempo	♩=52-62												♩=35	♩=52-65								
Chord progression	6 cycles of the "Dogs" progression						Dm	B section prog.	4 cycles of C section prog.				4 cycles of the "Dogs" prog.	4 cycles of The "Dogs" progression				Dm		B section prog.	10 cycles of coda prog.	
Drum & bass pattern	none	four strokes					Quasi-tempo	♩+♩+♩+♩	none			♩+♩+♩+♩	♩+♩	four strokes						♩+♩+ ♩+♩	♩+♩+♩	
Instrument-ation	2 a. gtr organ	Gilmour 2 e. gtr organ (a. gtr) D&B	Gilmour (only in A3 and A5) 1 e. gtr 2 a. gtr kbd D&B					3 e. gtr 1 a. gtr kbd FR D&B	2 a. gtr FR barks bass		Gilmour (doubled) (only on C3, C4) 1 e. gtr 2 a. gtr FR "barks" effect D&B		kbd (solo&pads) barks voice's echo drums	2 a. gtr organ effects	Waters (only on A'2 and A'3) 1 e. gtr (additional 2 e. guitars at the end of the solo) 2 a. gtr organ D&B					3 e. gtr 1 a. gtr kbd FR D&B	Waters doubled and harmonized 1 e. gtr 2 a. gtr kbd D&B	

SYSTEM·ATIC INNOVAT·ION

Although more than half of the track is based on a single 4-chord harmonic progression, its construction and versatile treatment create a sense of variety and freshness. The inclusion of a free interlude within “Dogs” offers a contrast to—and thus relief from—the tight form, while its asymmetric harmonic structure creates a sense of progression throughout this extended section. The multiple guitar solos and duets calibrate the energy of the song, define each of its sections, and produce a strong sense of direction. Repeated melodic and harmonic motifs strengthen the song’s cohesiveness as well as its directionality by accumulating tension that resolves only at the end of the exposition and of the entire song, finally allowing a sense of relaxation. Lastly, the arrangement fosters an integral bond between lyrics and music, while each stanza receives a personalized musical arrangement and central lines spark instrumental sections that enrich the imagery. The song’s design and meticulous arrangement thus grant it such a tight structure that it is hard to believe how long it’s taking to get to the resolution.

While most Pink Floyd songs consist of relatively simple chords, three of the four in the core progression of “Dogs” are complex, dissonant (Principle 12 (inverted)) chords that blur the authority of the tonic: see chords 2, 3, and 4:



Chord 2: B♭^{add4} Chord 3: A^{sus2sus4} Chord 4: A♭$^{sus2sus\#4}$

Chord 1 is a tonic with added 7th and 9th, which is relatively common. Chord 2 simultaneously includes a third (D) and a fourth (E♭), an uncommon clash in rock music that results in an unstable feeling. Since E♭ is foreign to the home key of D minor, it erodes its authority. Chord 3 is a dominant with a suspended fourth (D) and a suspended second (B♮) that creates a cross-relation with the B♭ in the previous chord. Chord 4 is based on A♭, and like the preceding chord, it lacks a third and includes two dissonances: a suspended augmented fourth (D) and suspended second (B♭). This unusual chord gravitates toward the dominant due to two chromatic neighbor tones of A (Bb and Ab), and it thus resembles an inverted “German” augmented-6th chord (G♯–B♭–D–F) that does not resolve.

Repeated progressions in rock songs tend to be circular in nature: the last chord in each cycle resolves at the beginning of the following cycle, so that a continuous flow is maintained. The “Dogs” progression is different: its last chord calls for a resolution that never arrives, and the bass line goes from A♭ back to D, producing a dissonant leap of a tritone and preventing a sense of completion. As shown in the above chord sequence, this aimless journey of the bass also produces a grating counterpoint with the topline of the guitars. All of these aspects combine to create a claustrophobic, Sisyphean progression that is doomed, again and again, to end abruptly without resolution and start over immediately. This progression well illustrates the paranoia and helplessness expressed in

the text, both recurring motifs in Waters' writing. Incidentally, this stifling feeling also reflects the physical environment where the song was recorded: according to Mason, the underground Britannia Raw Studies took on the "claustrophobic qualities of a nuclear bunker".

At the same time, the entire chord progression functions as one coherent unit, thanks to the tonic note D, which is common to all four chords. D is the bass of the first chord and an upper pedal point in the following three chords, the result of an open D string, which is the highest string within the current tuning. This pedal point is especially prominent due to its voicing as the highest note in each of the chords, as well as to the unique (Principle 3) timbre of the open string. The progression is likely a result of guitar technique: the last three chords are produced by a very similar left-hand fingering and make use of open strings:

The "Dogs" progression is successful for two reasons. First, it maintains (Principle 12) tension through extended portions of the song, which balances the (Principle 20) heavy repetition of the progression and differentiates it from the common four-chord progression in standard-length songs. Second, its claustrophobic nature illustrates Waters' vision of workers in the capitalist world, trapped in their lives with no way out and crying out "How can I find my way out of this maze?"

For me, the band never hit a higher high than Dogs. Pulling off a 17-minute piece of music staying solidly inside one key and four largely dissonant chords might just be the magic trick of all time.

Harmonic Entity	A 0:00	B 3:43	C 4:46	D (based on A) 7:58	A' 11:40	B' 14:10	Coda 15:22
Meter	4/4	4/2		6/4	4/4	4/2	4/2
Tempo	♩=52-62 (gradually accelerates)			♩=35	♩=52-65 (gradually accelerates)		
Key	Dm						

Check out the full Dogs story at:
http://www.mtosmt.org/issues/mto.15.21.2/mto.15.21.2.cohen.html

Investments – Pee Power

One of the public urinals installed this year at Glastonbury, the United Kingdom's largest music festival, can generate enough electricity to light the cubicle's LED tubes. The urinals use a system developed by scientists at the University of the West of England (UWE), Bristol.

"The technology in the prototype is based on microbial fuel cells (MFC), which, like batteries, has an anode and a cathode," explains Irene Merino, who is a researcher on the team thanks to a grant from the Bill and Melinda Gates Foundation and works alongside another Spanish worker, Daniel Sánchez.

The cells are installed inside a container which collects the urine, currently only from male users due to the design of the urinals. Inside, bacteria colonise the anode electrode and act as a catalyst, decomposing the organic material in the pee.

This decomposition releases both protons, which travel from the anode to the cathode across a semipermeable membrane, and electrons, which travel through an external electrical circuit. To complete the cycle, an oxygen reduction reaction also takes place in the cathode. The process generates enough energy to power light bulbs or LED tubes.

"Our project is aimed at developing countries, with a view to improving or incorporating sanitary facilities. In addition to producing electricity, the system reduces chemical oxygen demand (COD); in other words, it also serves to treat the urine," Merino emphasises.

At present, the researchers have carried out two field tests: one at the campus of their university, with limited numbers of participants, and another at Glastonbury festival, where last year it was tested by around a thousand users per day. The findings have been

published in the journal *Environmental Science: Water Research and Technology*. More cells, more milliwatts.

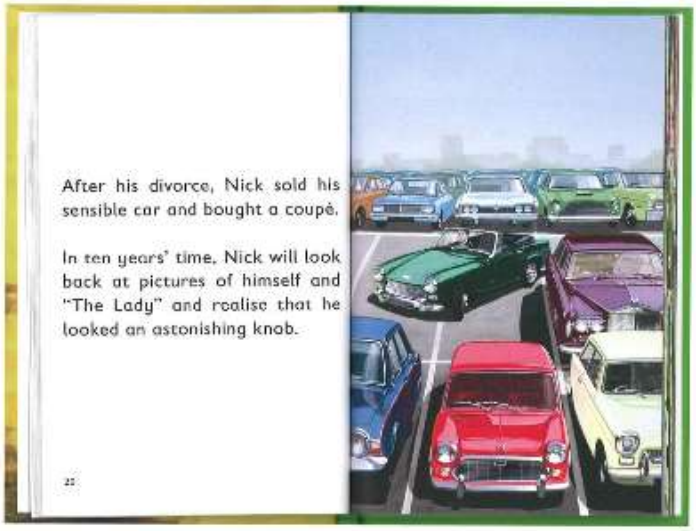
In both experiments, the electricity generated was used to illuminate the interior of the cubicle where the urinal was installed. The university campus prototype contained 288 MFC cells and generated an average of 75 milliwatts, whereas the Glastonbury prototype included 432 cells and generated 300 mW. COD removal was above 95% with the campus device and around 30% at the festival.

Now, in collaboration with Oxfam and other organisations, the researchers are planning to test these urinals in India or in some regions of Africa. Specifically, at refugee camps, in communities, at schools and in public toilets that lack lighting. "The ultimate purpose is to get electricity to light the toilets, and possibly also the outside area, in impoverished regions, which may help improve the safety of women and children, in countries where they have to use communal toilet facilities outside their homes," concludes Ioannis Ieropoulos, the Director of the Bristol BioEnergy Centre (BRL, UWE), who leads the research.

Read more:

Ioannis Andrea Ieropoulos, Andrew Stinchcombe, Iwona Gajda, Samuel Forbes, Irene Merino-Jimenez, Grzegorz Pasternak, Daniel Sanchez-Herranz, John Greenman. **Pee power urinal – microbial fuel cell technology field trials in the context of sanitation**. *Environ. Sci.: Water Res. Technol.*, 2016; 2 (2): 336 DOI: 10.1039/C5EW00270B

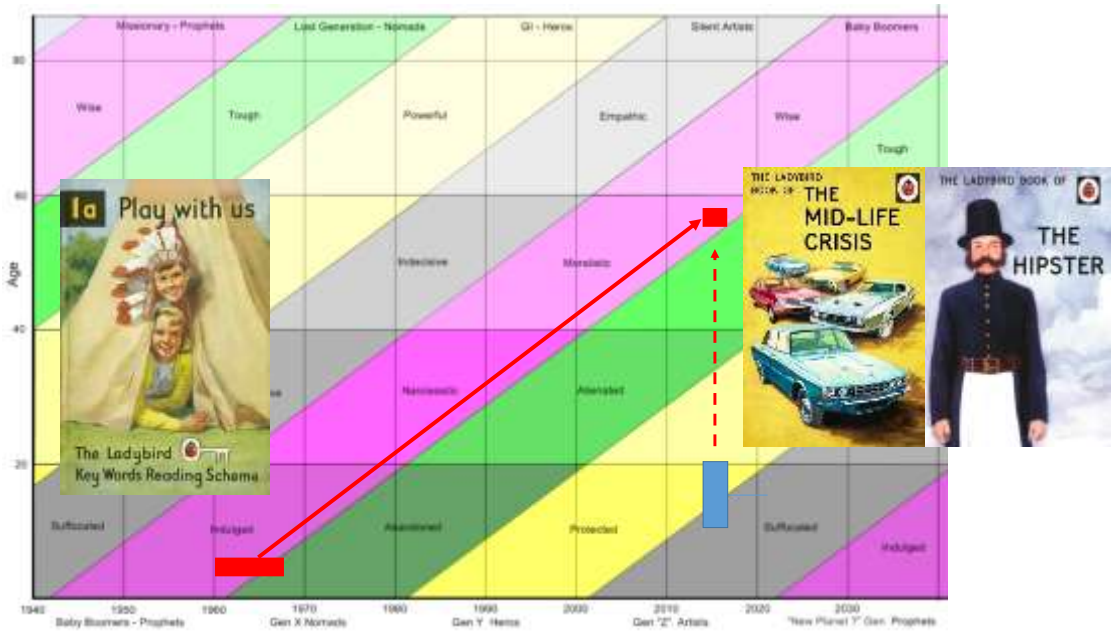
Generational Cycles – Ladybird Books For Adults



The biggest selling books in the UK for Christmas 2015 were a range of titles from a spoof series of books updating the Ladybird book series more normally aimed at primary school children. The two biggest sellers were 'How it Works: The Husband' and 'How it Works: The Wife', most likely because either husband purchased a copy for wife, wife purchased a copy for husband, or, most likely of all, kids bought for mum and/or dad.

Other books in the series, which have been 'specially planned to help grown-ups with the world about them' include The Ladybird Book of the Mid-Life Crisis (sample page pictured above), The Ladybird Book of the Hangover, The Ladybird Book of Mindfulness, The Ladybird Book of the Shed, The Ladybird Book of Dating and The Ladybird Book of the Hipster.

The large clear script, the careful choice of words, the frequent repetition and the thoughtful matching of text with pictures all enable grown-ups to think they have taught themselves to cope. Featuring original Ladybird artwork alongside spikily funny, brand new text, the books tap beautifully into a late wave of Baby Boomer nostalgia. Something like this:



Nearly every British Baby Boomer learned to read using the Ladybird Key Words Reading Scheme. Now, fifty years later, most of them have mastered the art (Brexit voters excepted!), but… what to read now their own kids are growing up and avoiding leaving home? The Ladybird Book of the Hipster is the answer:

Hipsters like to collect old things which are unfashionable, because that makes them fashionable.

Vintage washing-up bowls are highly prized, because they look neither retro nor valuable, and are therefore both.

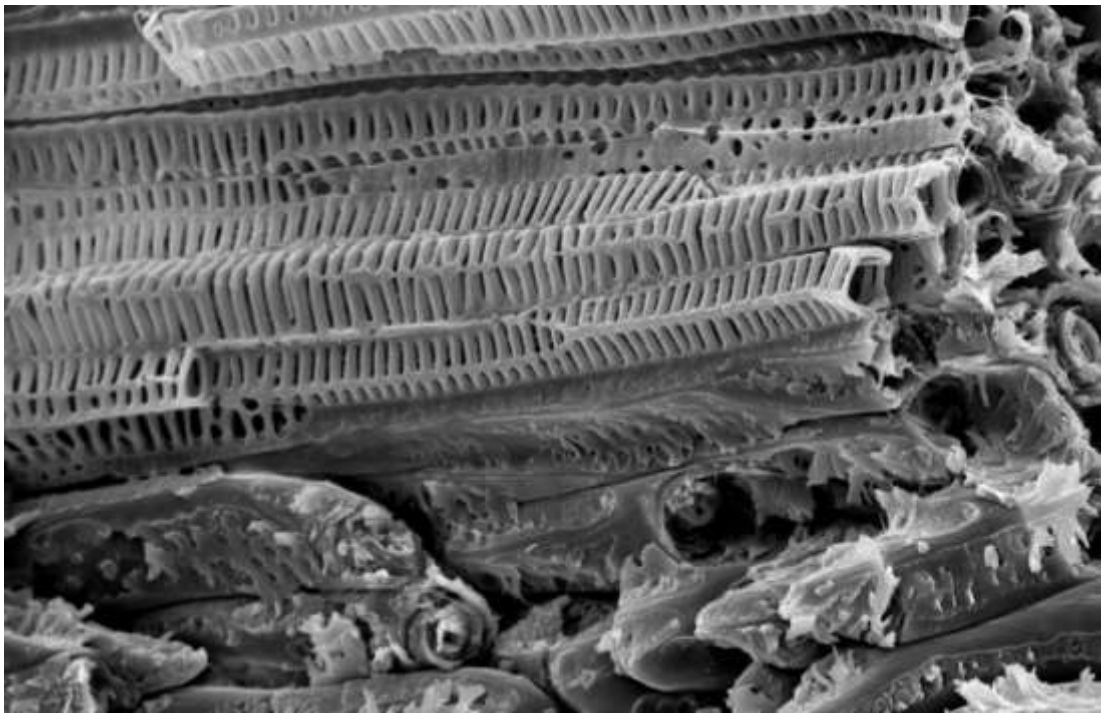
8

Perhaps not surprisingly, the slightly cynical tone of the new books has come from arch-Gen-Xer authors, Jason Hazeley and Joel Morris. Call it 'revenge of the Nomads' – a masterclass in sucking money from both Boomers and GenY Heroes. Almost genius…

…soon to be matched by the imminent re-invention of the Famous Five books…

I think my Christmas 2016 shopping list is sorted.

Biology – Coconut Shell



Coconut palms can grow 30m high, meaning that when the ripe fruits fall to the ground their walls have to withstand the impact to stop them from splitting open. It's a contradiction that looks something like this:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Reliability/Robustness (35)

WORSENING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Stationary Object (4)

SUGGESTED INVENTIVE PRINCIPLES:

28, 24, 3, 10, 35, 7, 4, 17

The fruit needs to survive (Reliability/Robustness) despite the fact that it may be falling a large distance (Length Of Stationary Object).

To protect the internal seed, the coconut has a complex (Principle 7, Nested Doll) structure of three layers: the outer brown, leathery exocarp, a fibrous mesocarp and a tough inner endocarp surrounding the pulp (collectively, Principle 3, Local Quality) which contains the developing seedling. As part of a larger project on "Biological Design and Integrative Structures," researchers at the Plant Biomechanics Group of the University of Freiburg have been working with civil engineers and material scientists to investigate how this specialised structure could be applied in architecture.

The researchers used compression machines and an impact pendulum to investigate how coconuts disperse energy. "By analysing the fracture behaviour of the samples and combining this with knowledge about the shell's anatomy gained from microscopy and computed tomography, we aimed to identify mechanically relevant structures for energy absorption" says plant biomechanist Stefanie Schmier.

Their investigations found that within the endocarp layer -- which consists mainly of highly lignified stone cells- the vessels that make up the vascular system have a distinct, (Principle 17, Another Dimension) ladder-like design, which is thought to help withstand bending forces. Each cell is surrounded by several lignified rings, joined together by (Principle 17, Another Dimension again) parallel bridges. "The endocarp seems to dissipate energy via crack deflection" says Stefanie. "This means that any newly developed cracks created by the impact don't run directly through the hard shell." It is thought that the (Principle 4, Asymmetry) angle of the vascular bundles helps to "divert" the trajectory of the cracks. The longer a crack has to travel within the endocarp, the more likely it is that it will stop before it reaches the other side.

The distinct angle of the vascular bundles in the endocarp could be applied to the arrangement of textile fibres within functionally graded concrete, to enable crack deflection. "This combination of lightweight structuring with high energy dissipation capacity is of increasing interest to protect buildings against earthquakes, rock fall and other natural or human-made hazards" says Stefanie.

It’s almost like biomimetics. Whether the coconut read the Contradiction Matrix or the Matrix read the coconut is still under debate.

Short Thort

"Success sometimes may be defined as a disaster put on hold. Qualified. Has to be."
Nadine Gordimer

"The most dangerous ideas are not those that challenge the status quo. The most dangerous ideas are those so embedded in the status quo, so wrapped in a cloud of inevitability, that we forget they are ideas at all."
Jacob M. Appel, Phoning Home

News

IRDG
We are very happy to announce that Darrell will be presenting a keynote address and follow-up seminar at the Industry Research & Development Group annual conference in Dublin. The main theme this year is intrapreneurship and management of innovation projects. The event takes place on 20 October. Check out irdg.ie for more details and to book a place.

New Business Matrix
Expect to see the new fold-out sheet available in the SI shop this month. Work has also begun on the creation of a Dutch version, thanks to good friend Gertjan Otto at Innovative Partners in the Netherlands. More details on the timing of that work as the work approaches completion.

AMIRA
It looks like we'll be conducting a pair of PanSensic Big Data workshops for the mining industry in Australia at the end of November as a part of our visit to the country for the InnoMeto conference. More details on the website shortly.

India
Darrell's August trip to India will now take place August 3-7. All of the days have now been committed to client work. Next trip is looking like late October.

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

- Industrial – SI Train-the-Trainer programme
- FMCG – Invent-to-Order Study
- Pharma – SI Certification Workshops
- Pharma – Patent 'Invent Beyond' Project
- O&G – Innovation Strategy Project
- Retail – PanSensic Study
- Automotive – Domain Project
- FMCG – Innovation Culture Workshops
- ICT – IP Strategy Study