Systematic Innovation

e-zine

Issue 207, June 2019

In this month's issue:

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

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Send them to **darrell.mann@systematic-innovation.com**

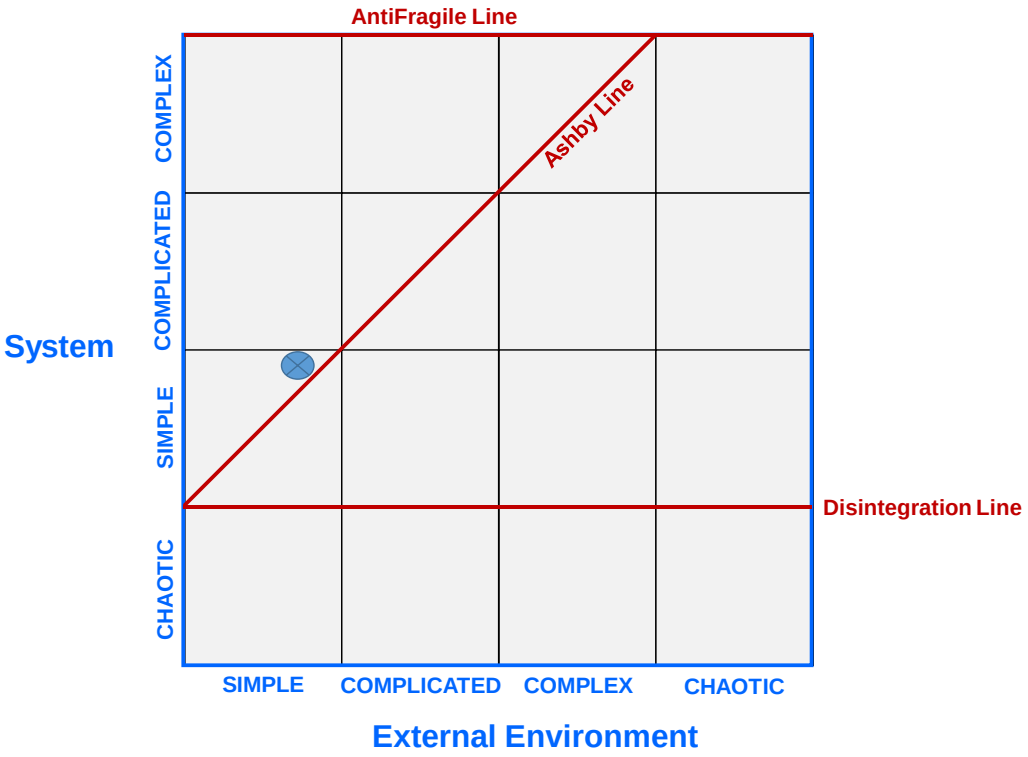
Case Study: Boeing 737 Max

I worked fifteen years in the aerospace industry at the start of my career. Safety was everything, something that united the whole industry. When planes fall out of the sky it is not good news for anyone. Therefore, the moment an incident occurs, it is investigated rigorously and the findings spread across the industry to ensure that a repeat will never happen. This is the way to build the world's safest industry.

But then, of course, the innate human desire for 'more' sooner or later pushes systems towards dangerous cliff edges. We don't know the full story of the two Boeing 737 Max accidents, the first, Lion Air flight 610 on 29 October 2018, followed by Ethiopian Airlines flight 302 on 10 March 2019, but we can see that something significant has shifted in the aerospace industry.

The Boeing 737 has a long history. The first 737 entered service in 1968, and, through its many evolutions, is now the biggest selling airliner of all time. The aerospace industry in general, and Boeing in particular have a long and successful track record of evolving their products in order to offer customers better performance, economy and reliability, and so, over the years, there have been several versions of the 737.

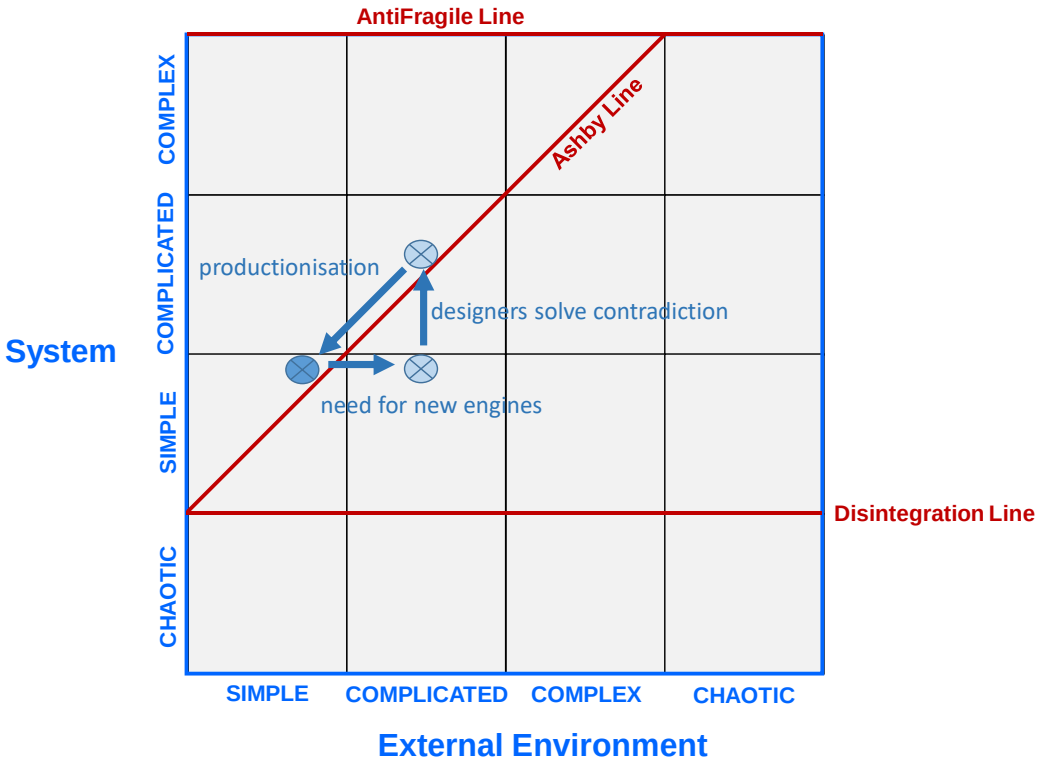
In order to ensure safety, the industry takes very complicated systems ('600,000 components flying in close proximity') and makes them 'simple' for operators by imposing strict constraints on what is and is not allowable for pilots to do. In terms of our Complexity Landscape Model (CLM), for a modern airline, the world looks like this:



One of the early evolutions of the Boeing 737 arrived with the advent of much more fuel efficient high-bypass-ratio turbofan engines. This new generation of engines offered the potential to save a substantial amount of fuel, but at the expense of having a bigger overall size than the pencil-like low-bypass-ratio engines they replaced:

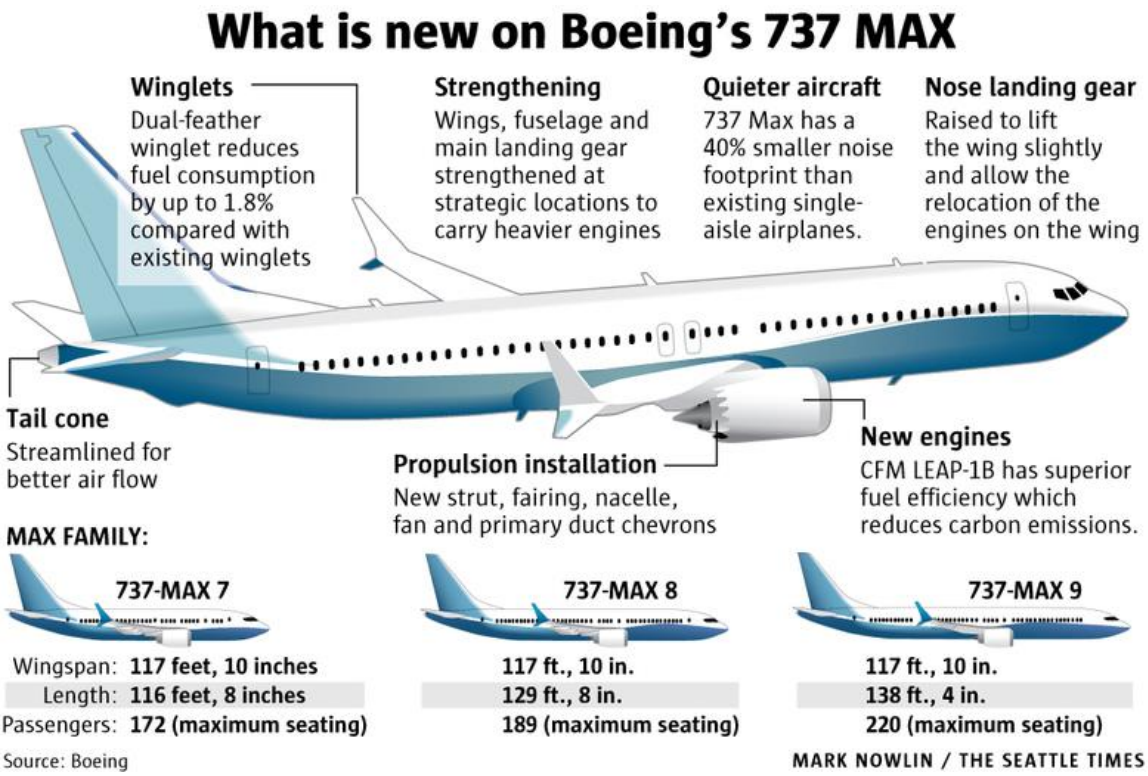
100/200 Series **300 Series**

These bigger diameter engines created a complicated problem for the 737 design team: how to fit them in the space under the wing without having to re-design the wing or the undercarriage. The answer, now widely familiar as an illustration of Inventive Principle 4, Asymmetry, was to design the 'squashed' engine nacelle. Here's what the development of that new solution looked like from a Complexity Landscape Model perspective:



…the need for the new, higher diameter, engines created a complicated problem. When the designers successfully solved the contradiction associated with this problem the required made use of complicated design tools and methods. And then, once the problem had been solved and validated through a series of qualification trials, the productionised solution would be effectively no different from the operator perspective.

The latest, Max, evolutions of the 737, in theory at least, created a similar CLM development programme trajectory. Firstly a desire to improve performance triggering a series of complicated engineering challenges…



Yet again, the desire for increased fuel efficiency saw the creation of bigger, heavier engines, and yet again there was a desire to not make big changes to the undercarriage or wing design. This time the solution involved moving the engines forward and upward slightly. Principle 17, if you like. One of the consequences of this move was to alter the balance of the aircraft a little bit. Another complicated problem, but one that the engineers were able to solve using changes to the control software of the aircraft.

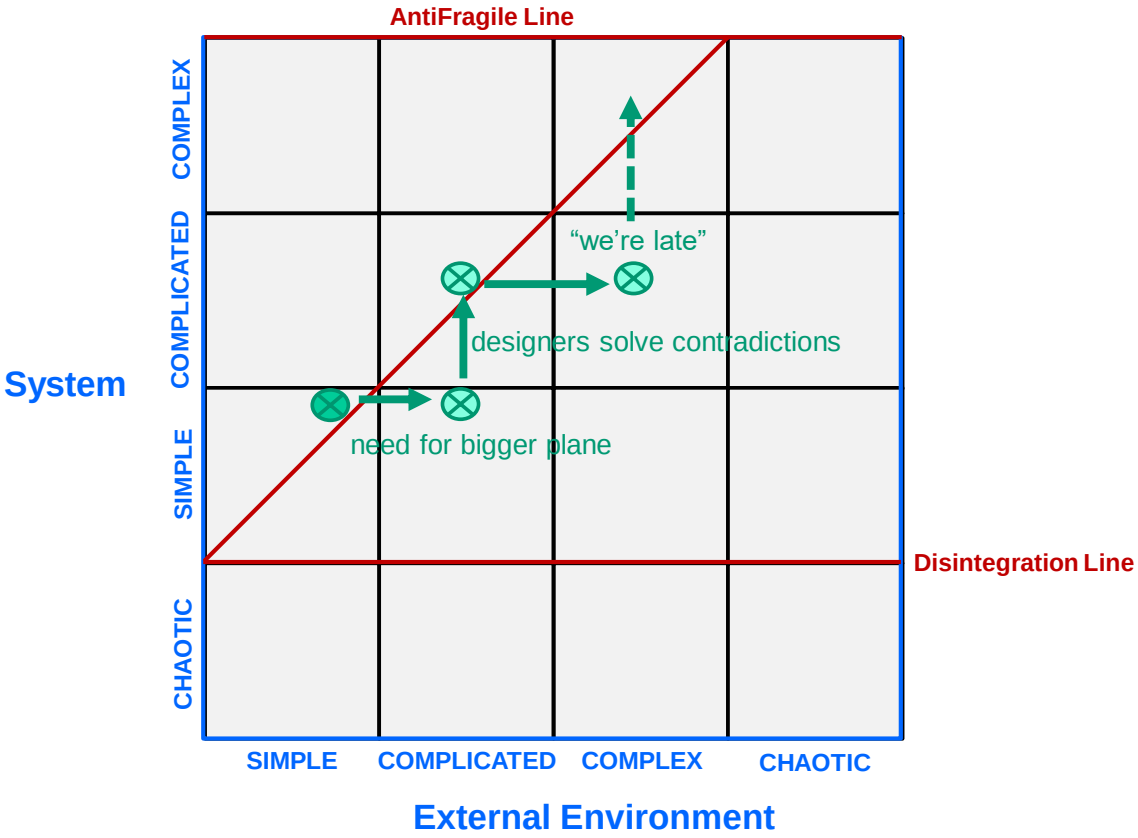
So far so good. Simple, resilient, well understood system, has complicated changes imposed on it, which get solved, and validated… and, hey presto, the new aircraft design returns back to 'simple' from the operator perspective.

Except. Not quite. This time around the business imperative was much greater than in the past. Airbus were winning lots of orders thanks to their new, fuel efficient A320neo, and Boeing were forced to offer airlines a more competitive 737. Costs are always important, but now they became even more so. One constraint put on the engineers was to ensure the flyability of the Max was as near as possible the same as for the 'classic' 737s. This would mean that pilots could be re-trained very easily. Again, complicated problem, but one the engineers seemed to have found a fix for. Another cost constraint then starts to appear: on-time delivery of the new aircraft. As is the way in the airline industry these days, if aircraft are delivered late, airlines benefit from substantial compensation fees.

This time pressure now hits the programme managers. And specifically the cost-schedule-quality iron-triangle. Which two did the Boeing senior managers want? On budget, on time, or to the right quality?

We can't as yet know for sure how the programme managers and their managers chose to tackle this iron-triangle problem. But what we can say for sure is that the problem is no longer a purely technical one. Crucially, the moment we bring humans – most project

managers count as humans, I think – into the equation, a complicated problem has become complex…

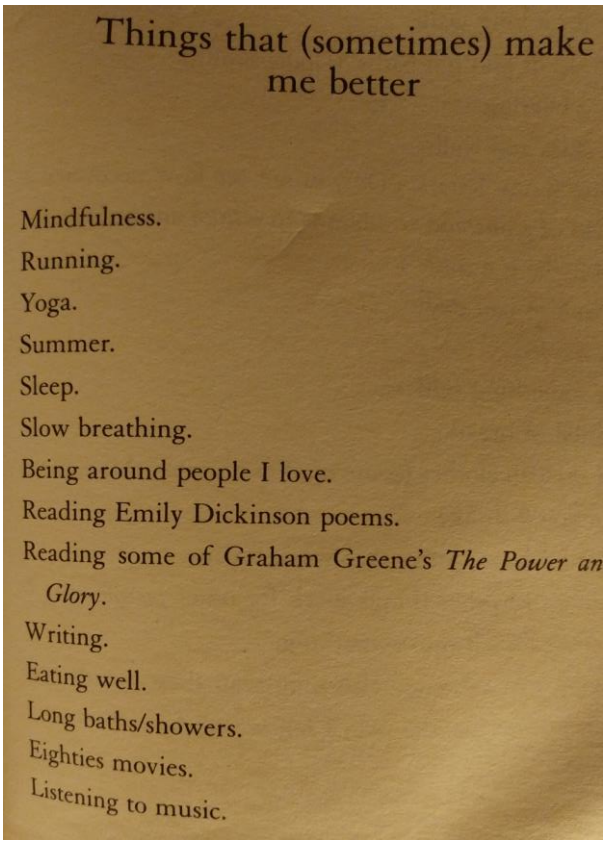


The problem context (environment) having transitioned into the Complex domain, now demands a system capable of dealing with that complexity. The fact that two 737 Max aircraft have fallen out of the sky and killed 346 people tells us that the system did not possess the requisite level of capability.

In the same way that it is very possible to push a technical system across a boundary (from Simple-to-Complicated, for example, or Complicated-to-Complex), it is also very possible that the business and social systems surrounding that technical system can also see similar boundaries being crossed. The premise for building the Complexity Landscape Model was to help organisations to know where and when such boundaries do get crossed. And the reason that premise arose in the first place was our observation that almost none of the world's enterprises or those tasked with leading them had the first clue that such boundaries existed, never mind that they might be being crossed.

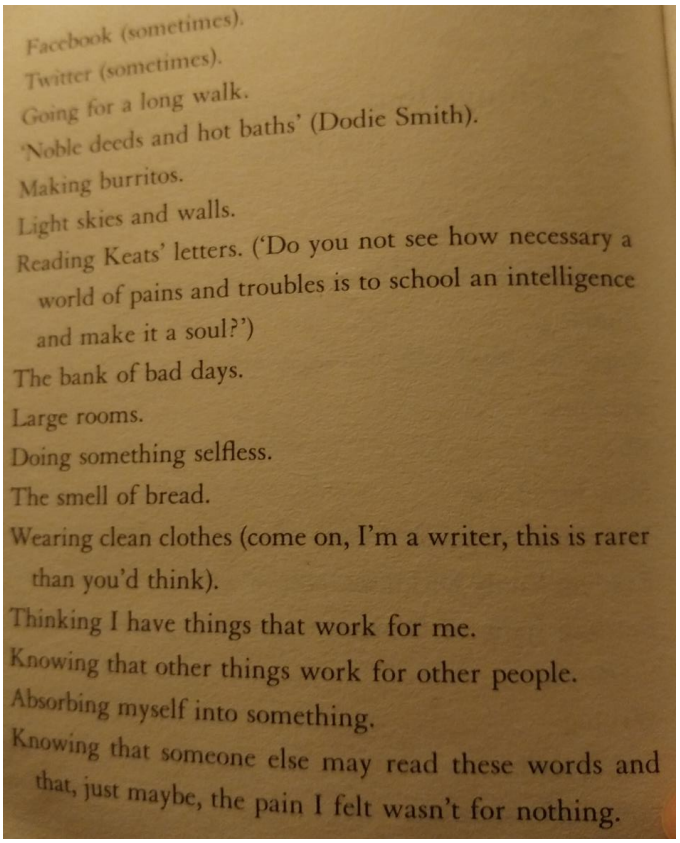
Case Study: (Depression) Leverage Points

From Matt Haig's book, 'Reasons To Stay Alive' (Reference 1):

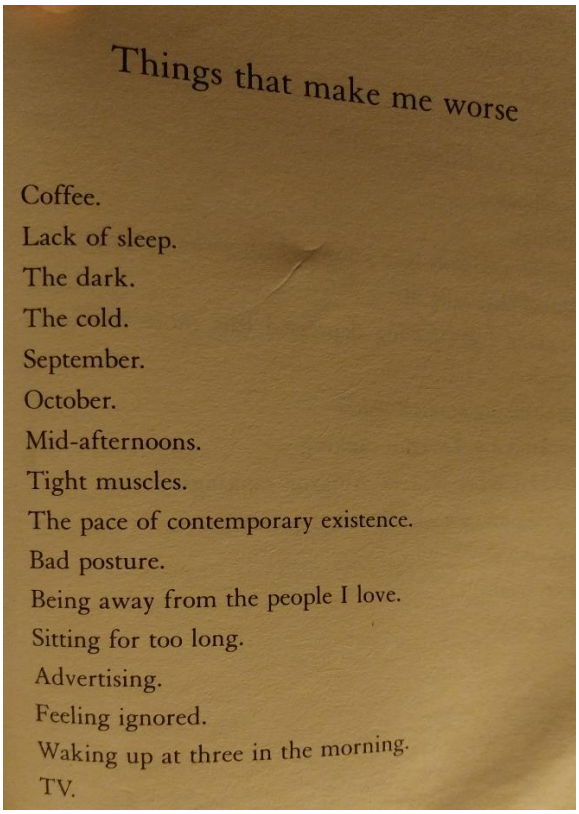


Things that (sometimes) make me better

Mindfulness.
Running.
Yoga.
Summer.
Sleep.
Slow breathing.
Being around people I love.
Reading Emily Dickinson poems.
Reading some of Graham Greene's *The Power an Glory*.
Writing.
Eating well.
Long baths/showers.
Eighties movies.
Listening to music.

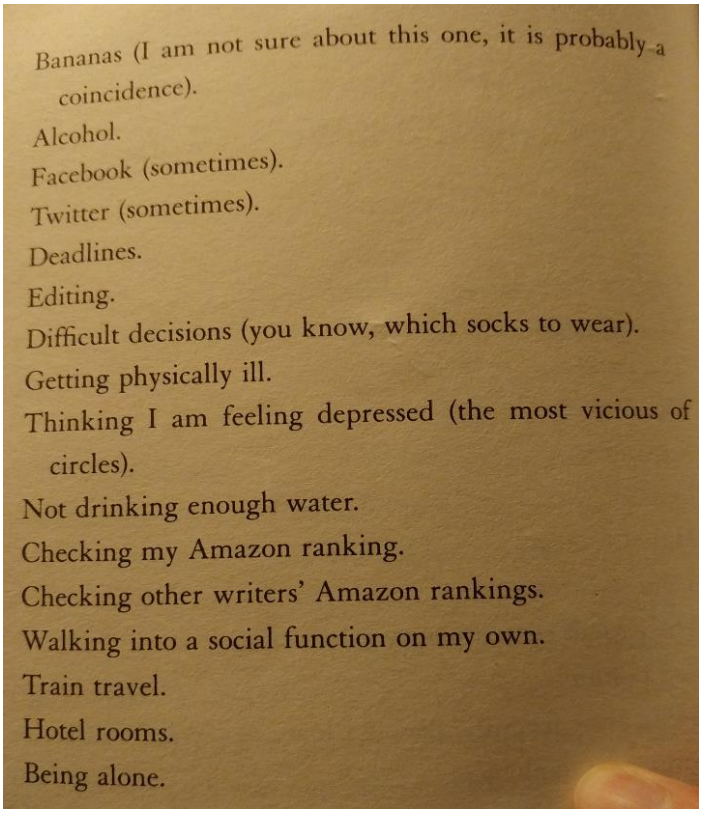


Facebook (sometimes).
Twitter (sometimes).
Going for a long walk.
'Noble deeds and hot baths' (Dodie Smith).
Making burritos.
Light skies and walls.
Reading Keats' letters. ('Do you not see how necessary a world of pains and troubles is to school an intelligence and make it a soul?')
The bank of bad days.
Large rooms.
Doing something selfless.
The smell of bread.
Wearing clean clothes (come on, I'm a writer, this is rarer than you'd think).
Thinking I have things that work for me.
Knowing that other things work for other people.
Absorbing myself into something.
Knowing that someone else may read these words and that, just maybe, the pain I felt wasn't for nothing.



Things that make me worse

Coffee.
Lack of sleep.
The dark.
The cold.
September.
October.
Mid-afternoons.
Tight muscles.
The pace of contemporary existence.
Bad posture.
Being away from the people I love.
Sitting for too long.
Advertising.
Feeling ignored.
Waking up at three in the morning.
TV.



Bananas (I am not sure about this one, it is probably a coincidence).
Alcohol.
Facebook (sometimes).
Twitter (sometimes).
Deadlines.
Editing.
Difficult decisions (you know, which socks to wear).
Getting physically ill.
Thinking I am feeling depressed (the most vicious of circles).
Not drinking enough water.
Checking my Amazon ranking.
Checking other writers' Amazon rankings.
Walking into a social function on my own.
Train travel.
Hotel rooms.
Being alone.

We have a project looking at Post-Traumatic Stress Disorder (PTSD) at the moment. The Director of the National Institute of Mental Health and the Department of Veterans Affairs in the US predicts that 70 percent of soldiers who return from combat in Afghanistan and Iraq, many of whom suffer from depression and PTSD, will not seek treatment in either the military health care system or the V.A. hospitals. Suicide in the Army has reached epidemic proportions. There have been more than 18 mass shootings on military bases since 2008. The combination of these forces on the civilian public mental health system have been described by the director of NIMH as "the gathering of a storm" and are seen by clinicians as approaching catastrophic levels. In concert with this dire prognosis it is entirely appropriate to factor in the extremely long delays at the V.A. hospitals and the epidemic problems they have with inadequate staff. In previous years, the U.S. Army has not given the attention to mental health as it might have warranted. Early approaches included low performance vehicles such as labelling those who sought care as "weak" and negatively stigmatizing cognitive health intervention. Soldiers perceived as "marginally productive" were given a medical discharge or early release. Most commanders simply adopted a hands-off need-help-seek-help approach and the results of which was nearly zero compliance. Today the Army is investing in grossly impersonal online and telephone crisis lines or worse, pre-disposed testing--the result of which could be used to kick soldiers out of the military.

A U.S. Circuit Court of Appeals recently found the Department of Veterans Affairs mental health care system to be unconstitutional because it violated solders' constitutional rights to health care. V.A. hospitals are woefully understaffed with the adequate number of technicians and clinician staff needed to treat its population. By its own predictions, 70 percent of soldiers returning home for Iraq and Afghanistan theaters will not seek care at V.A. hospitals even though an increasing number of them suffer from PTSD and TBI injuries. Currently there is a present need for 28,000 mental health professionals in V.A. medical facilities; and this goal cannot be realistically attained for at least another 10 years! Over the course of the next ten years the present problems and delays at the V.A. hospitals will be exacerbated exponentially.

The subject is new to us. But it didn't take long to be shocked by the poor quality of not just treatment options for PTSD sufferers, but also the thinking around the subject. The entire healthcare sector, it could be argued, is still reeling over recent revelations that PTSD and depression are not about 'imbalances of chemicals in the brain' that are best treated with chemicals to 'right' the balance (Reference 2). Or, at least the chemical-providing pharmaceutical industry is. One of the blinding flashes of the obvious from the Reference 2 world-shaker is that people become depressed when their life circumstances are depressing. Key word: circumstances. Plural. Some circumstances are more important than others, but, when we're dealing with complex situations – and with depression we surely are – it is not so much the circumstances that are important as the relationships between them.

With that in mind, we thought we'd have a go at turning the two Matt Haig lists into a pair of Perception Maps. Admittedly, it would have been better to actually get the man himself to map the 'leads to' relationships, but nevertheless, the answers appear to be insightful in their own right.

Here's the 'things that make me feel worse' map:

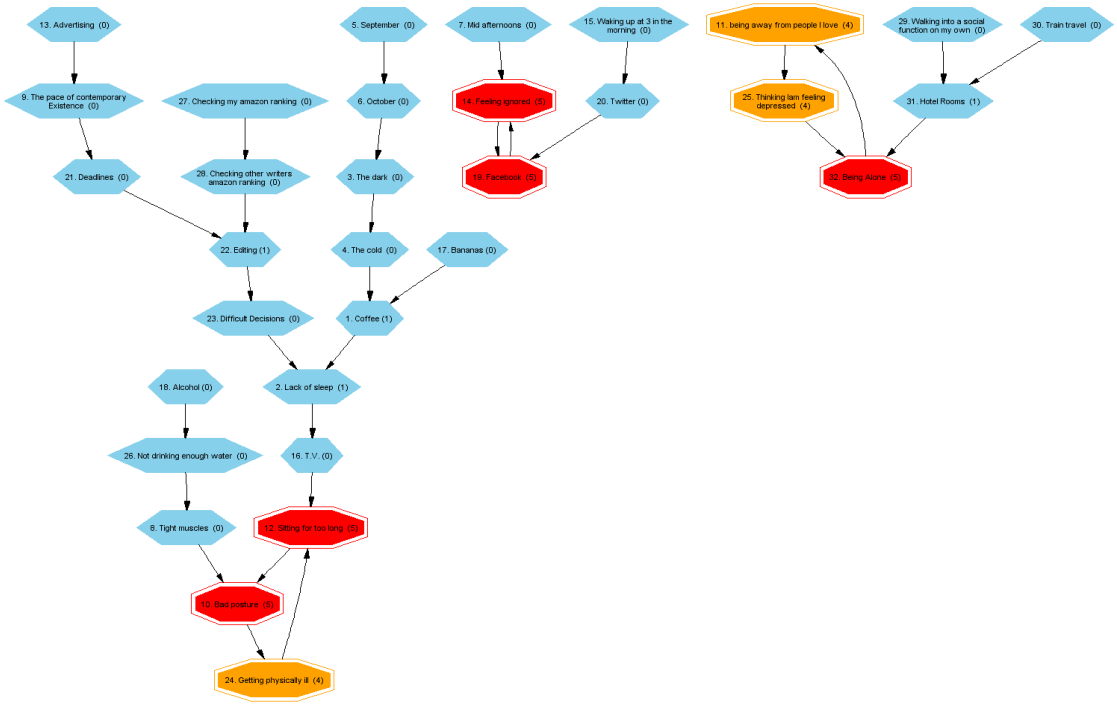


Figure 1: Matt Haig 'Things-That-Make-Me-Worse' Perception Map

The map contains three vicious cycle loops. This is what they look like:

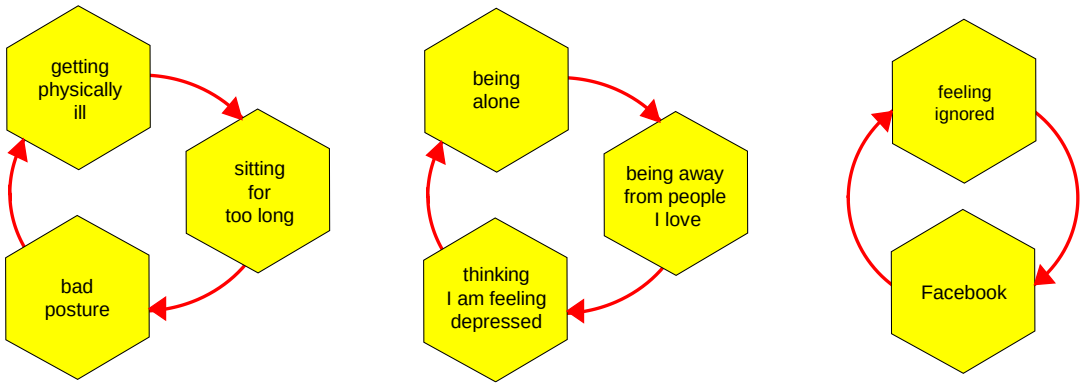


Figure 2: Matt Haig Three 'Things-That-Make-Me-Worse' Vicious Cycles

Assuming these three vicious cycles are representative – again, in the ideal world we get the person making the list to do their own leads-to analysis – they offer up three important clues regarding how to either break out of downward spirals (or avoid them altogether): don't allow yourself to sit for too long, don't spend too much time away from loved ones and avoid Facebook.

The Facebook downward-spiral is one that seems to be increasingly common. Mark Zuckerberg wants people to engage with Facebook in order to feel connected, but all you tend to see when you get there is a surfeit of inauthentic 'liking' and people that aren't actually listening to what you're saying. If you're famous like Matt Haig, I imagine the level of inauthenticity increases exponentially. You go on Facebook to make you feel better and end up drowning in shallowness.

And then, on the other side of the story, here's the 'things that make me better' perception map:

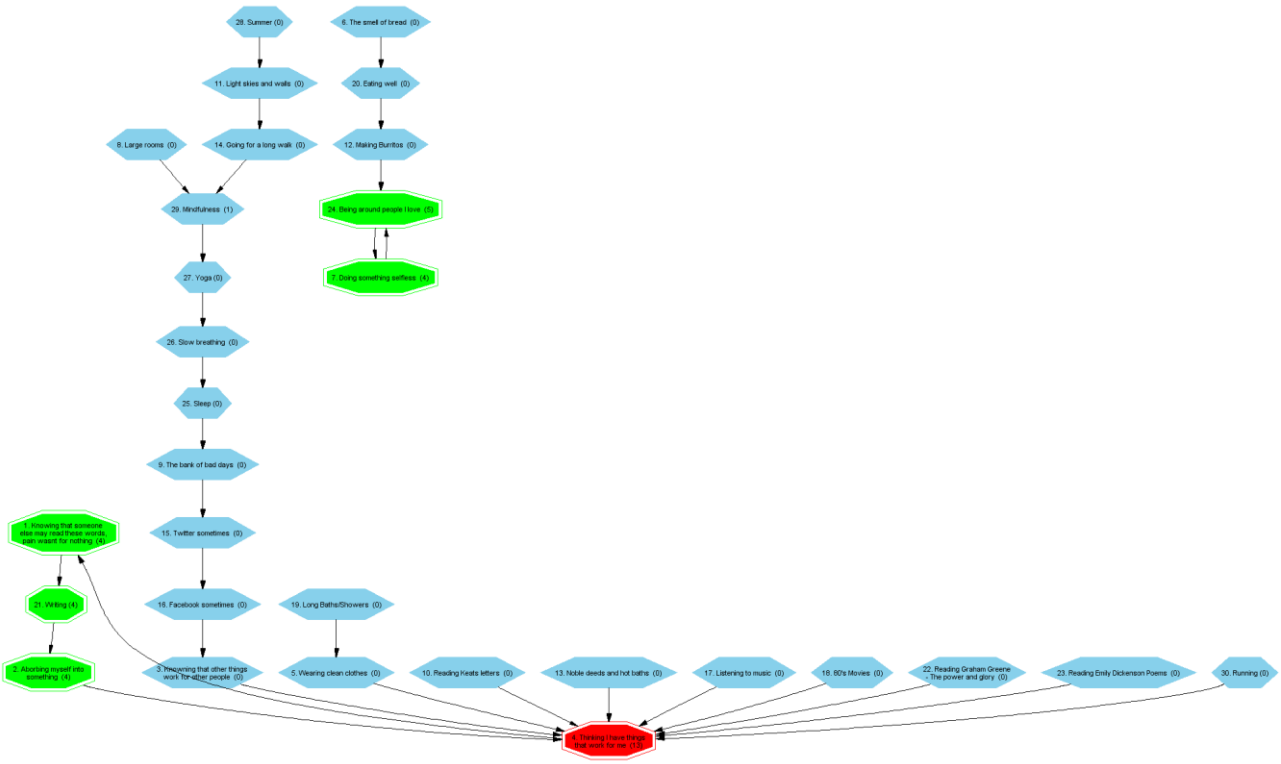


Figure 3: Matt Haig 'Things-That-Make-Me-Better' Perception Map

Quite a different map this time, with lots of items all leading to 'knowing I have things that work for me', and two virtuous cycle loops:

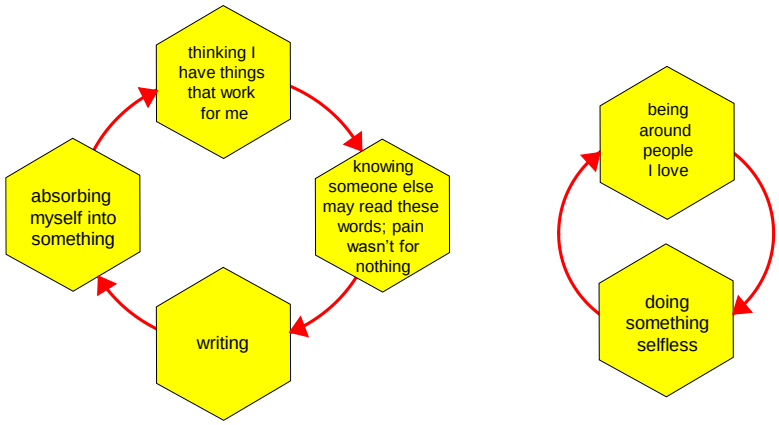


Figure 4: Matt Haig 'Things-That-Make-Me-Better' Virtuous Cycle

With virtuous loops, the key is finding things that trigger and cause the things in those loops to happen. The loop on the left seems to be all about using writing as a means of absorbing yourself in something (i.e. creating a flow state), while the one on the right is consistent with a story from Reference 2 that I've been using a lot recently to describe some of the subtle but profound differences between the East and the West: tell someone from the West to spend a couple of weeks doing whatever they want to make themselves happy, and at the end of the time they will be unhappier than before they started. Conduct the same experiment with someone from the East and they will end up happier. The difference? The Easterner will have spent their two weeks doing things to make *other* people happy, and the Westerner will have spent the two weeks doing things to make *themselves* happier.

Whether there's something general in our version of Matt Haig's two perception maps is debatable. What seems in far less debate however, is the use of the Perception Mapping process to help individuals turn a list of things that make them feel better and a list of things that make them feel worse into something that lets them see what their personal vicious and virtuous cycles are seems like a really simple way to enable people to help themselves. And, maybe, if they felt comfortable doing it, and people could be encouraged to share their pictures with others, we might get a one-plus-one-is-way-greater-than-two multiplier effect. And learn – if TRIZ tells us anything – that rather than being millions of different vicious and virtuous cycles there are actually only a very small number. Then we might really be on to something.

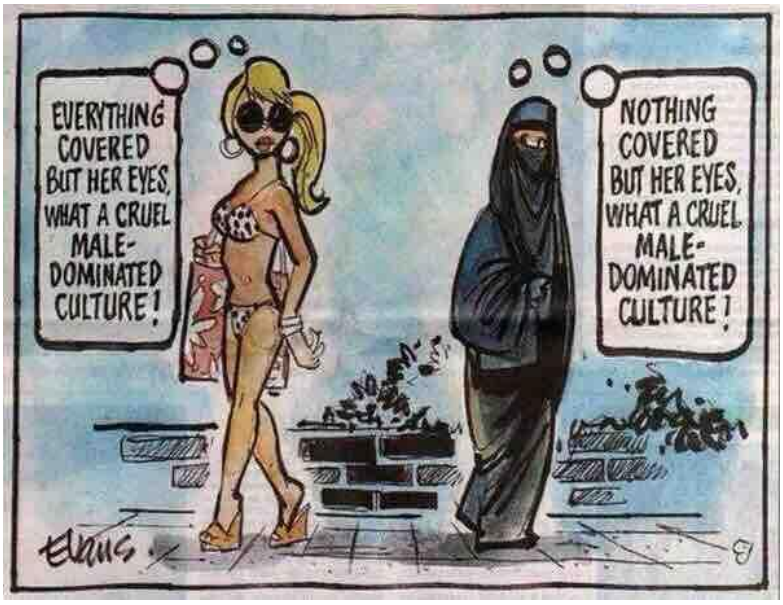
References

1) Haig, M., 'Reasons To Stay Alive', Canongate Books Ltd., 2015.
2) Hari, J., 'Lost Connections: Uncovering The Real Causes Of Depression And The Unexpected Solutions', Bloomsbury Circus, 2018.

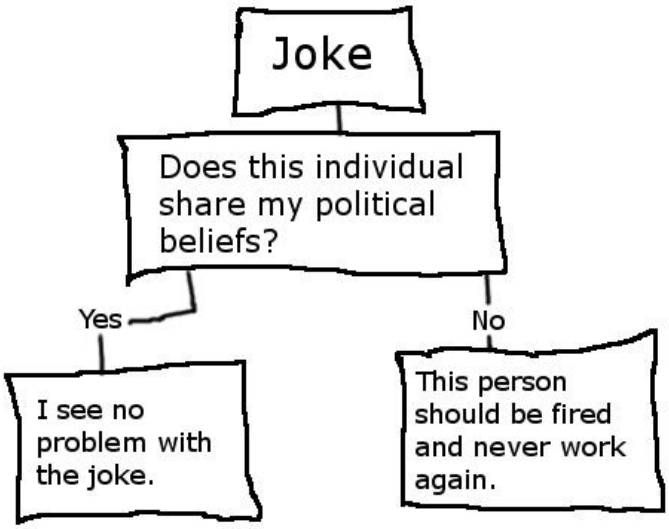
Not So Funny – Double Standards

We live in a strange world. Usually, these days, a world in which we're all forced into personalized filter bubbles that makes us less and less able to empathise with people holding views different to our own. Irony is just about dead. And a whole host of topics have seemingly become forbidden territory as far as humour is concerned. But is that really true? Or does it mean humorists have to try harder?

One of the toughest humour-related tightrope walks these days relates to the area of double standards. Trawl the Internet for double-standard jokes and the large majority seem to relate to real or perceived gender or cultural asymmetries. Most of them tend to make your toes curl. Ones like these:



Classic instance where the politics (and dread 'political correctness') now suffocates the humour. The problem looks something like this:

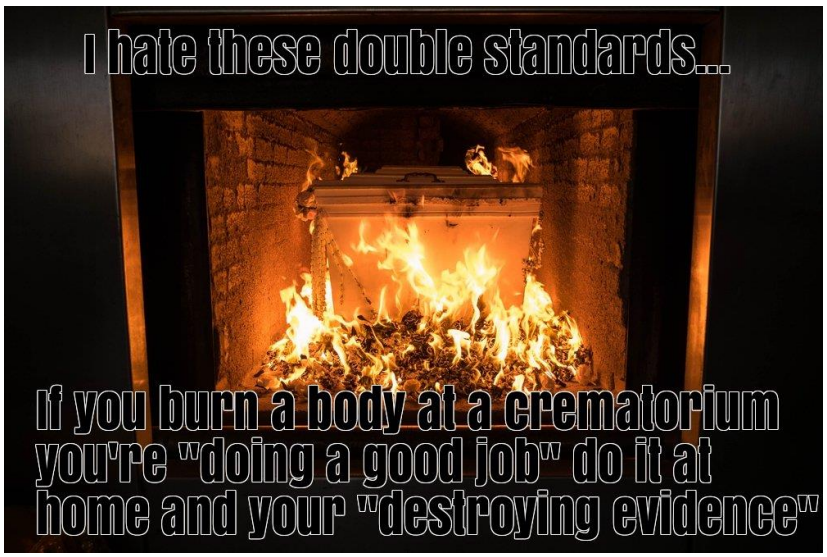


All that said, we like a challenge here at Systematic Innovation Towers. Is it possible to find double standards humour that magically transcends the 'this person should be fired and never work again' filter bubble?

Let's give it a go…

First up, we had several votes for this one:

And then there were these two…



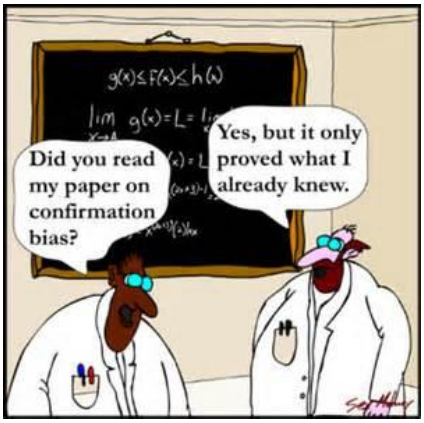
…the key to all three being Inventive Principle 4C, 'if an object or system is already asymmetrical, increase the degree of asymmetry'. i.e. if you find them funny, what makes them funny is the extremity of the asymmetry.

Funnily enough, that didn't quite happen here:

…as it happens, a whole other kind of double standard. Or rather 'standard double' (thankyou, Principle 13), at the worryingly titled, Hotel Joke. I love the idea of the spinning options wheel above the bed, but someone chickened out quite badly when it came to labelling the different zones. They needed Principle 4C again.

That or yet another different kind of double standard…

Someone really needs to take the brewing industry to task over their beer naming foibles. There's that Principle 4C again… or am I just falling in to yet another Asymmetry trap…



Patent of the Month – Fusion Power (Almost)

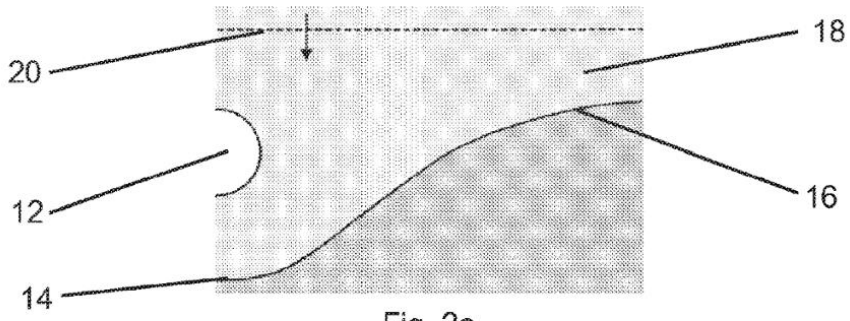


Fig. 2a

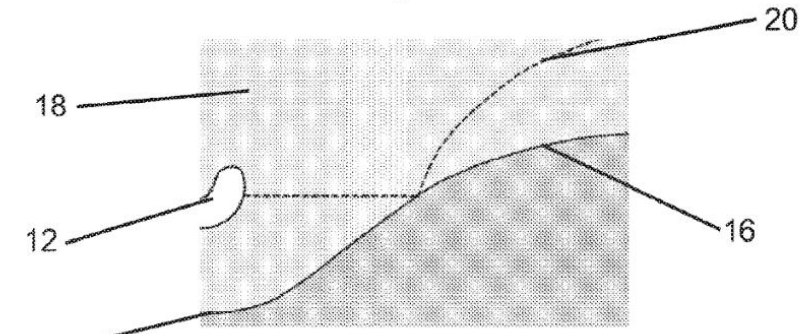


Fig. 2b

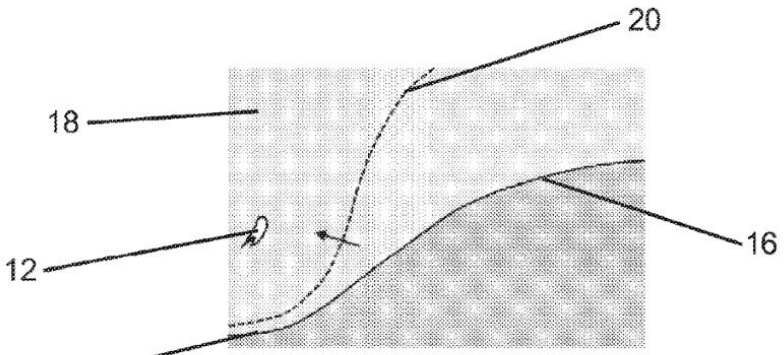


Fig. 2c

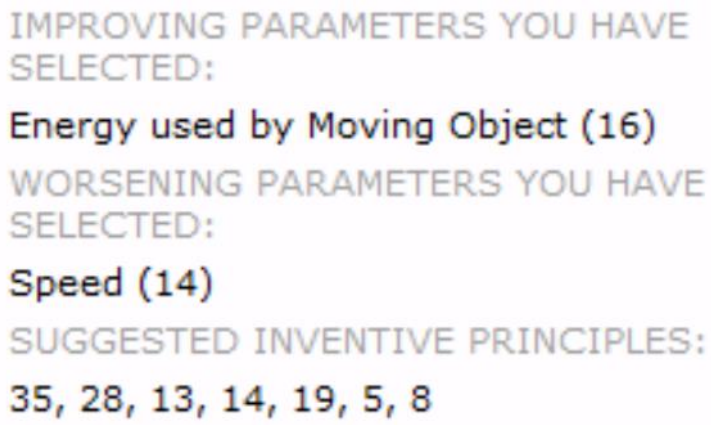
For the most part, the words ‘nuclear’ and ISIS don’t really belong in the same sentence these days. Fortunately, the ISIS in question here is ISIS Innovation Ltd, an offshoot of Oxford University. I’m assuming the company was formed quite a while ago. Anyway, they are responsible for our Patent of the Month this month. US 10,315,180 was granted to a pair of inventors at the Company on 11 June. The ‘nuclear’ part of their work perhaps also requires a little bit of qualification. Here’s what they have to say about the problem being addressed:

The development of fusion power has been an area of massive investment of time and money for many years. This investment has been largely centered on developing a large scale fusion reactor, at great cost. However, there are other theories that predict much simpler and cheaper mechanisms for creating fusion. Of interest here is the umbrella concept "inertial confinement fusion", which uses mechanical forces (such as shock waves) to concentrate and focus energy into very small areas.

Much of the confidence in the potential in alternative methods of inertial confinement fusion comes from observations of a phenomenon called sonoluminescence. This occurs when a liquid containing appropriately sized bubbles is driven with a particular frequency of ultrasound. The pressure wave causes bubbles to expand and then collapse very violently; a process usually referred to as inertial cavitation. The rapid collapse of the bubble leads to non-equilibrium compression that causes the contents to heat up to an extent that they emit light.

It has been proposed in U.S. Pat. No. 7,445,319 to fire spherical drops of water moving at very high speed (.about.1 km/s) into a rigid target to generate an intense shock wave. This shock wave can be used to collapse bubbles that have been nucleated and subsequently have expanded inside the droplet. It is inside the collapsed bubble that the above-mentioned patent expects fusion to take place. The mechanism of shockwave generation by high-speed droplet impact on a surface has been studied experimentally and numerically before and is well-documented. The present invention differs from U.S. Pat. No. 7,445,319, even though the fundamental physical mechanisms are similar, because it does not utilize a high speed droplet impact.

That last sentence gives us as good a clue as any to the conflict the ISIS solution tackles – the desire to achieve fusion being prevented by the need for high speeds. Here's what that pair looks like when mapped on to the Contradiction Matrix:



And here's how the inventors have solved the problem, as described in the main Claim of the patent:

A method of producing a localised concentration of energy comprising: creating at least one shockwave; propagating the at least one shockwave through a non-gaseous medium; allowing the at least one shockwave to be incident upon a pocket of gas suspended within the medium, wherein the pocket of gas is spaced from a concave surface; and reflecting said at least one shockwave from the concave surface onto said gas pocket.

The most obvious connection to the Inventive Principles recommended from the Matrix is perhaps also the most surprising one. How did the Matrix 'know' that (Principle 14) curvature (i.e. the concave surface) would help solve the problem?

The biggest resource, after the curved surface, seems to be the shockwave. There are several possible ways of connecting this to the Inventive Principles. Principles 13 or, better yet 22, would allow us to see the shock wave as an otherwise 'bad thing' that gets to become a very useful thing. We could also see it as a Principle 35, Parameter Change, specifically, Principle 35E, Change the Pressure. Especially since the shock wave is all about creating a non-linear step-change in the pressure characteristics of the flow.

Finally, there's the reflecting of the shockwave to magnify the energy concentration effect. It's a bit of a stretch – one that would require quite a lot of lateral thinking – but what's happening with this reflection is consistent with the recommendations of Principle 8, 'Anti-

weight'. I think I would have got to the reflection idea more easily from Principle 17, Another Dimension though.

That we can make a connection to the Matrix recommendations is good from the perspective of demonstrating the breadth of the tool's applicability. But I think what we also get from patents like this one – one that sits right at the very edges of mankind's knowledge of the world – is how it offers up the potential to offer new directions that aren't explicitly provided by today's version of the Matrix. That's something that doesn't happen very often these days. It took only seven years for Matrix 2003 to lose accuracy to trigger the publication of Matrix 2010. Today, nine years later, and Matrix2010 is still over 96% accurate. Which either means that we're approaching some kind of universal truth. Or – more likely I have to say – the quality of inventions today is not what it was a decade ago.

Either way, let's not take anything away from US10,315180. Any solution that achieves great things by exploiting pressure non-linearities and a bit of curved geometry should serve as a reminder to all of us the importance of making what's already present in a system work much harder before we allow ourselves the luxury of adding stuff.

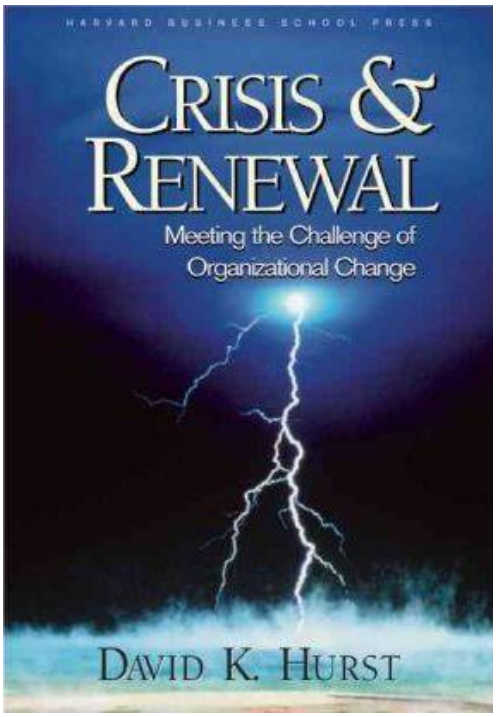
The patent document is also well worth a deeper look. Here's the part describing the Figure 2 images at the beginning of this article:

FIGS. 2a, 2b and 2c show three successive stages of a shockwave interacting with a pocket of gas 12 spaced from a surface 16 in accordance with another aspect of the invention. In this embodiment the pocket of gas 12 is immobilized in the gel 18 in a concave depression 14 in the surface 16.

FIG. 2a shows a shockwave 20 propagating through the gel medium 18, in the direction of the arrow, approaching the gas pocket 12. FIG. 2b shows the shockwave 20 as it is incident for the first time upon the gas pocket 12. The shockwave acts on the volume of gas 12 to compress it, in a similar manner to the embodiments shown in FIGS. 1a and 1 b. At the same time the shockwave 20 is reflected from the upper sides of the concave depression 14 in the surface 16.

FIG. 2c shows the third snapshot in the sequence, by which time the shockwave 20 has passed through the volume of gas 12, compressing it significantly. Also by this time, the shockwave 20 has been reflected from the surface 16 and is travelling back towards the pocket of gas 12 in the direction indicated by the arrow. The reflected shockwave 20 now has a shape resembling the shape of the concave depression 14 and is focused towards the pocket of gas 12 upon which it is incident for a second time, compressing it further and therefore further increasing the temperature and pressure within it.

Best of the Month – Crisis & Renewal



As it becomes more and more difficult to find new business books to recommend to ezine readers, we're forced to make more and more forays into the past to look for lost classics. That search, too, becomes less and less easy, suffering as it does from a massive law of diminishing returns. Which, after nearly two decades of looking, feels a bit like panning for gold in the Dead Sea. Anyway, I'm pleased to say that occasionally the team still manages to pick up something that makes you think, 'how did we possibly miss *that*?' Welcome to 1995's 'Crisis And Renewal'.

In this age of tectonic changes in business – the growing dominance of the information economy, the excesses of the '80s, the downsizings and corporate consolidation in the aftermath of deep recession in the 90s and dotcom boom, and then the GFC in the noughties – there has been a lot of talk about corporate America's search for renewal. How to restore meaning to work and how to make sense of our lives, much of which we spend at work, are the big questions as we hurtle towards the third decade of the 21st century.

In that context, David K. Hurst's book, Crisis & Renewal, seems more relevant today than it did in the relative calm of the mid-1990s. In understanding intangibles, complex systems and the importance of metaphor, it feels like it must've been massively ahead of its time back in 1995. I think it will help all thoughtful working people make sense of the changes that are happening, or will happen, in our companies. It is about the need for renewal—the restoration of something of value, something important that has either been lost or forgotten as both people and organizations grow and prosper. It is about getting back to the excitement and emotional commitment that is present at the start of a company's life, or for that matter, the beginning of a person's career. And, above all, it is about the vital role of crisis in enabling change.

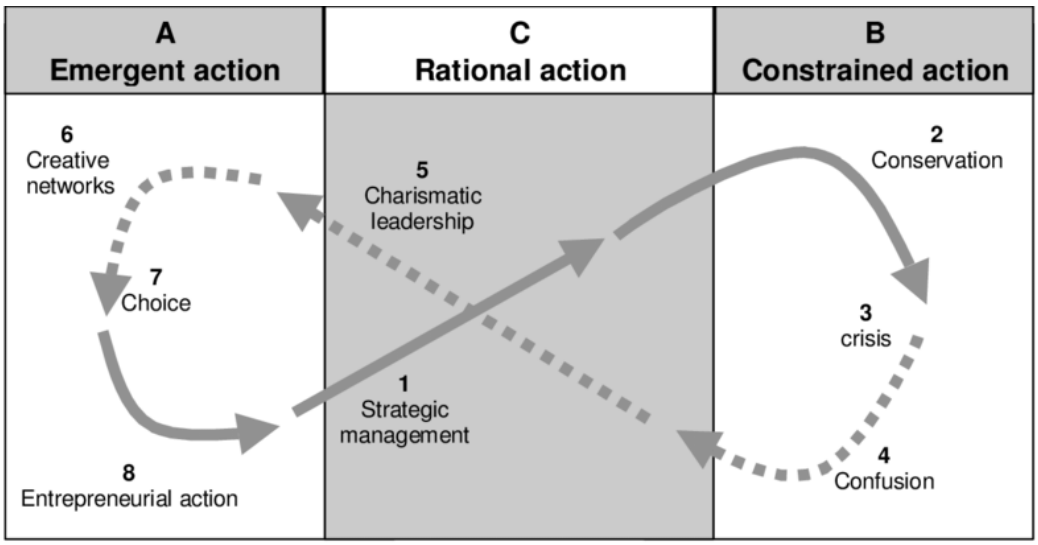
The problem, says Hurst, is that organizations become constrained by their success and must be renewed – like a forest that must burn to allow new growth. Falling into a rut – the

rut of doing what works is ironically a recipe for disaster. And so, Hurst urges managers not to wait for a crisis to happen, but to create it themselves.

Hurst's book is the product of a crisis – a hostile take-over-that occurred in the company for which he worked as a senior manager in the early 1980s and his subsequent failure to find anything in his graduate management education that could help him make sense of what he and the rest of the management team did, seemingly by instinct and without a rational plan, to pull the company out of it.

Crisis & Renewal is not about reengineering. Rather, Hurst describes how managers can perform deliberate acts of "ethical anarchy" – create crises and then become a part of the situation they have created – in order to take their organizations back to the enthusiasm and values that were present at their firms' founding (picture the fanaticism and devotion of the champion runners who started Nike). Often these acts are not rational in the traditional sense. That is, managers need not have a clear plan of where they are going. Instead, after having set the crisis in motion, they must reconnect the organization to its past by having the founding values themselves ("walk the talk") every day, in everything they do, and create contexts for shared learning, communication, egalitarianism, and mutual dependence.

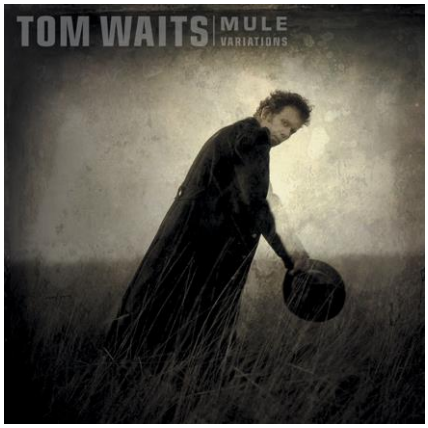
Hurst is a wonderful storyteller and master of the analogy. He uses stories of the Kalahari bushmen and the Quakers as well as from Nike, 3M, Compaq, GE, and his own experience both to show how organizations evolve and because he believes stories and legends from an organization's past carry in them the values that hold it together in time of crisis.

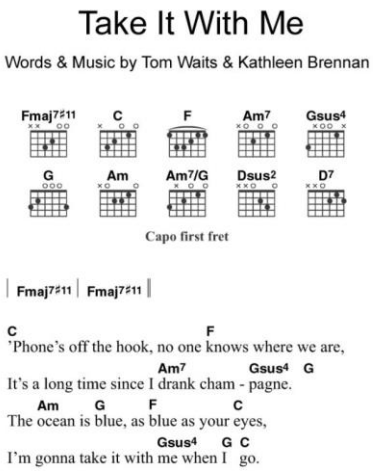


In theory, this is the perfect time for enterprises to be innovating. And yet, somehow, we see less and less evidence of it actually happening. What we see instead are lots of large organisations doing all they can to protect what they have (including acquiring small enterprises to keep their potentially disruptive offerings off the market – not helped by the increasing willingness of said small enterprises to take the money and go retire to a beach on a tropical island). When the crisis comes, these big organisations will have no option but to get off their backsides and do something. The longer it takes for the crisis to arrive, the fatter and lazier they become and hence the less able to survive they also become. In this context, Hurst's 1995 advice seems even more prescient – avoid the devastation of the big crisis by creating your own small ones. Chaos, as can be seen in Cynefin and our own Complexity Landscape Model, is an essential part of the innovation story, the biggest

blessing-in-disguise that any organization can tap in to. Crisis & Renewal was and still is as close as the world has come to a recipe book for guiding organisations through crisis and towards breakthrough success.

Wow In Music – Take It With Me





First up, no-one – no-one – writes lyrics like Tom Waits. He has the rare knack of hitting a nerve. The song 'Take It With Me' from his 1999 album, Mule Variations represents something of a high-point among a myriad other high-points.

As with all of his records from the all-time classic, Swordfishtrombones, the sounds in the room where he was recording are (Principle 22) honored, even accentuated. By this time, he had begun recording in an untreated room in a barn out on the premises of the Prairie Sun Studio 100 miles north of San Francisco. The simple ballad format of Take It With Me — verse, refrain, bridge, repeat (no "chorus" in the pop music sense) — starts with a 10-note motif that returns at the end. We hear the light knocking of the upright piano's sustain pedal against the wood, as Waits presses and releases it. Greg Cohen fingers high up on his double bass.

"We were usually tracking him with at least one other person, most of the time an upright bass player, sometimes a drummer," engineer Jacquire King explained to Paul Tingen at AudioTechnology. "His vocal performance and his piano or guitar, plus the bass, are the basic take. What you hear on the album are often first takes (Principle 21). Tom rarely did more than two or three takes in a row. If he felt it wasn't coming together, he'd switch to piano or guitar and try a different approach or move to another song. We were always trying to capture a mood and atmosphere."

Waits begins, his voice like the low notes on a bowed cello. He is recorded with very little, if anything but the natural atmosphere of the room, present and up front. He croons intimately. So intimately, towards the end, you can almost catch the sound of his beard scratching on the microphone. The first verse begins with champagne, a phone off the hook, no one knowing where they are. It's likely an older couple celebrating, probably an anniversary. The singer is humble, maybe working class. After all, it's "been a long time since [the narrator] drank champagne." They're near the ocean. He declares the theme of the song, "Ain't no good thing ever dies." Waits' lyric is a reverie, a mixture of reminiscence, the past catching up with the present. With a little sip or three, the narrator has tapped into some deep romanticism that was always there, the kind of guy, an old softy who you know feels more than he expresses, deep below the stoic surface. But with a little encouragement, the right setting and situation, he pours forth with time-stopping eloquence…

The phone's off the hook, no one knows where we are

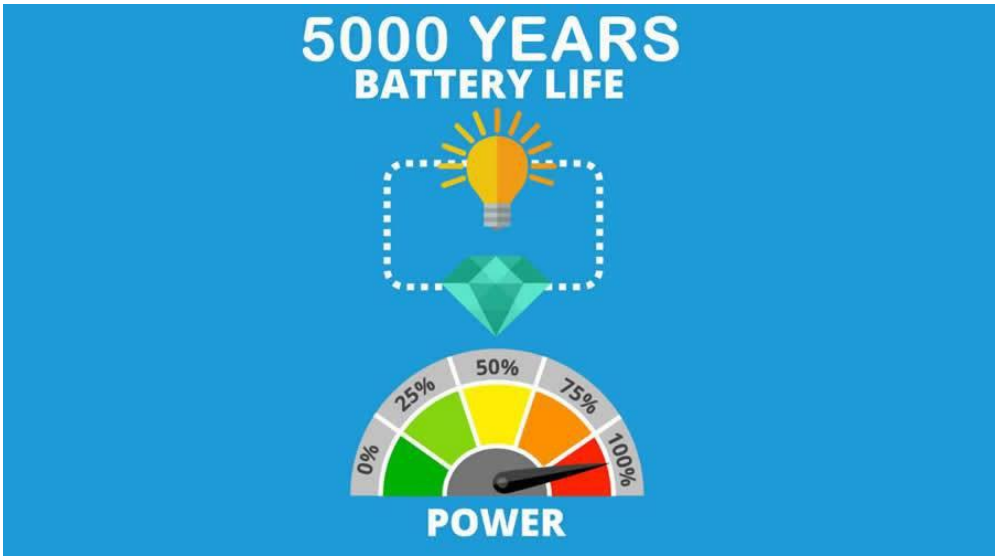
SYSTEM ATIC INNOVAT ION

It's a long time since I drank champagne
The ocean's blue, as blue as your eyes
I'm gonna take it with me when I go
Old long since gone, now way back when
We lived in Coney Island
There ain't no good thing ever dies
I'm gonna take it with me when I go
Far, far away a train whistle blows
Wherever you're goin', wherever you've been
Waving goodbye at the end of the day
You're up and you're over, and you're far away
Always for you, and forever yours
It felt just like the old days
We fell asleep on Beaula's porch
I'm gonna take it with me when I go
All broken down by the side of the road
I's never more alive or alone
I've worn the faces off all the cards
I'm gonna take it with me when I go
The children are playing at the end of the day
Strangers are singing on our lawn
It's got to be more than flesh and bone
All that you've loved is all you own
In a land there's a town, and in that town there's a house
And in that house there's a woman
And in that woman there's a heart I love
I'm gonna take it with me when I go
I'm gonna take it with me when I go

(I particularly like the – Principle 7 – Nested Doll land/town/house/woman/heart climax to the lyric.)

I love the song, and I love the way Tom Waits does it. But then I also recognize that, for a lot of people, he can be a bit of an acquired taste. Several other artists have covered the song over the years, but none – for me – have quite captured the Waits' magic. That is until I heard the version from jazz pianist Lynne Arriale on her 2018 album, Give Us These Days. Take It With Me makes for a perfect closing track, and guest singer, Kate McGarry makes for the perfect singer. First of all getting a female voice (Principle 13) gives the lyric a whole new level of meaning. Second of all, Arriale has the good sense to keep the number of notes to a (Principle 2) bare minimum. Waits' version is sparse, Arriale's is downright skeletal. To the point of making me forget to breathe when I hear it. In my more morbid moments, I sometimes like to think of what music I might have played at my funeral. Different songs enter and exit the playlist. Kate McGarry's version of Take It With Me is a new entry. From where I sit right now, I can't imagine it will ever leave.

Investments – Nuclear Diamond Battery



New technology has been developed that uses nuclear waste to generate electricity in a nuclear-powered battery. A team of physicists and chemists from the University of Bristol have grown a man-made diamond that, when placed in a radioactive field, is able to generate a small electrical current.

The development could solve some of the problems of nuclear waste, clean electricity generation and battery life.

This innovative method for radioactive energy was first presented at the Cabot Institute's recent sold-out annual lecture - 'Ideas to change the world' – in 2016.

Unlike the majority of electricity-generation technologies, which use energy to move a magnet through a coil of wire to generate a current, the man-made diamond is able to produce a charge simply by being placed in close proximity to a radioactive source. Tom Scott, Professor in Materials in the University's Interface Analysis Centre and a member of the Cabot Institute, said: "There are no moving parts involved, no emissions generated and no maintenance required, just direct electricity generation. By encapsulating radioactive material inside diamonds, we turn a long-term problem of nuclear waste into a nuclear-powered battery and a long-term supply of clean energy."

The team have demonstrated a prototype 'diamond battery' using Nickel-63 as the radiation source. However, they are now working to significantly improve efficiency by utilising carbon-14, a radioactive version of carbon, which is generated in graphite blocks used to moderate the reaction in nuclear power plants. Research by academics at Bristol has shown that the radioactive carbon-14 is concentrated at the surface of these blocks, making it possible to process it to remove the majority of the radioactive material. The extracted carbon-14 is then incorporated into a diamond to produce a nuclear-powered battery.

The UK currently holds almost 95,000 tonnes of graphite blocks and by extracting carbon-14 from them, their radioactivity decreases, reducing the cost and challenge of safely storing this nuclear waste.

Dr Neil Fox from the School of Chemistry explained: “Carbon-14 was chosen as a source material because it emits a short-range radiation, which is quickly absorbed by any solid material. This would make it dangerous to ingest or touch with your naked skin, but safely held within diamond, no short-range radiation can escape. In fact, diamond is the hardest substance known to man, there is literally nothing we could use that could offer more protection.”

Despite their low-power, relative to current battery technologies, the life-time of these diamond batteries could revolutionise the powering of devices over long timescales. The actual amount of carbon-14 in each battery has yet to be decided but one battery, containing 1g of carbon-14, would deliver 15 Joules per day. This is less than an AA battery. Standard alkaline AA batteries are designed for short timeframe discharge: one battery weighing about 20g has an energy storage rating of 700J/g. If operated continuously, this would run out in 24 hours. Using carbon-14 the battery would take 5,730 years to reach 50 per cent power, which is about as long as human civilization has existed.

Professor Scott added: “We envision these batteries to be used in situations where it is not feasible to charge or replace conventional batteries. Obvious applications would be in low-power electrical devices where long life of the energy source is needed, such as pacemakers, satellites, high-altitude drones or even spacecraft.

“There are so many possible uses that we’re asking the public to come up with suggestions of how they would utilise this technology by using #diamondbattery.”

Check out: https://www.youtube.com/watch?v=b6ME88nMnYE

Generational Cycles – Childhood Sweethearts

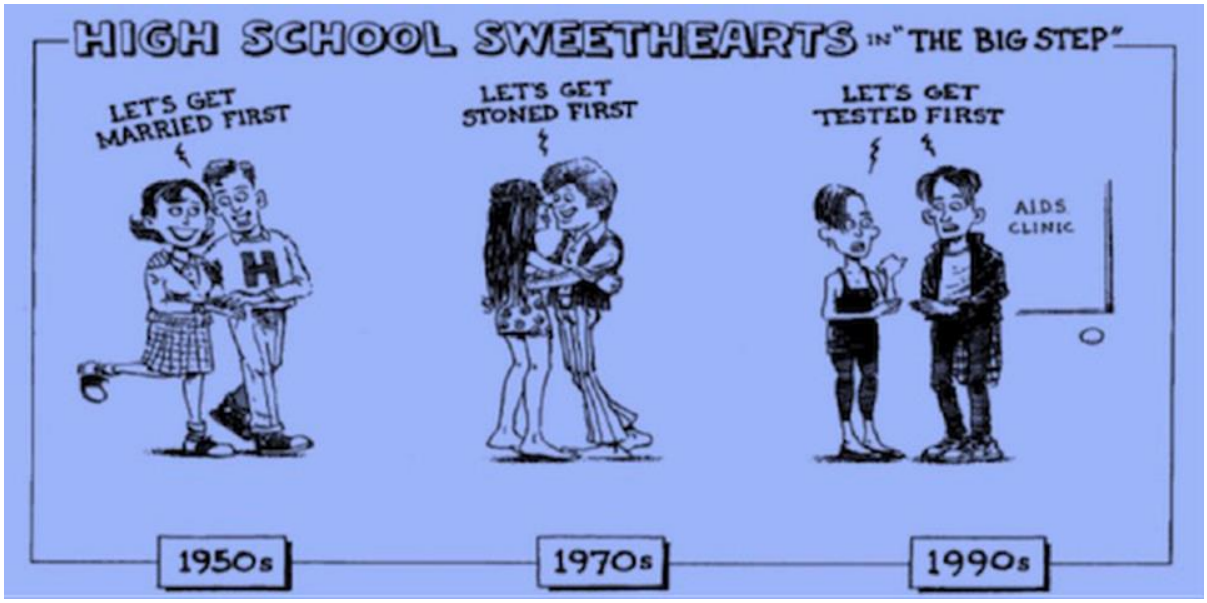
Psychologists from Sigmund Freud forward have generally agreed: our core attitudes about life are largely locked in by age five or so. Changing those attitudes requires intense effort.

Neil Howe and William Strauss took this obvious truth and drew an obvious conclusion: if our attitudes form in early childhood, then the point in history at which we live our childhood must play a large part in shaping our attitudes.

It's not only early childhood, however, that forms us. Howe and Strauss think we go through a second formative period in early adulthood. The challenges we face as we become independent adults determine our approach to life.

These insights mean we can divide the population into generational cohorts, each spanning roughly 20 years. Each generation consists of people who were born and came of age at the same point in history.

These generations had similar experiences and thus gravitated toward similar attitudes. Here's a cartoon Howe used to illustrate one of the key aspects of the second formative period of life:



I'm not sure which generation – Artists, Nomads or Millennials in the cartoon – had the scariest transition. Young love, a universal experience, took different forms for Americans who grew up in the 1950s vs. the 1970s vs. the 1990s. And indeed now in the teenies – where the cartoon might be seen to be heading back in the direction as the 1950s. At least if the parents have anything to do with their kids' second formative period lives. Which, in the case of the Helicopter turned 'Bulldozer' GenyY parents, seems to be quite a lot.

The second formative period' in other words, can easily be 'influenced' by parents, if those parents are domineering.

What's the best way to raise your child? It's a question that has spawned numerous books, and seen authors race to coin the next quirky name for a new style of parenting.

And it turns out there are many styles. To date, some of the best-known categories are:
Tiger parents, who are seen as pushing their children to succeed according to the parents' terms.
Helicopter parents, who take over every aspect of the child's life.
Snowplough parents, who remove obstacles to make life easier for their child.
Free-range parents, who allow children a great deal of freedom.
Attachment or gentle parents, who are relaxed but set limits in line with the child's needs and character.

Psychologists generally talk about parenting as fitting into typologies, which are based on the work of Dr Diana Baumrind, a clinical and developmental psychologist known for her research on parenting styles. There isn't a precise fit with the four Strauss & Howe archetypes because, ultimately, the behaviours of a given parent depends on how they specifically were raised by their parents, rather than the general trend patterns of 'the average parent'. That said, some fairly clear 'on average' connections can be drawn:

Tiger parents (Nomads parenting Heroes)
TYPE OF PARENT: You expect first-time obedience, excellence in every endeavour and a child who never talks back.
WHO COINED IT?
Law professor and author Amy Chua popularised the term in her 2011 book, Battle Hymn Of The Tiger Mother. She describes tiger parents, often seen in Chinese families, as superior to Western parents. Chinese parents assume strength and don't shy away from calling their children names. They assume their children owe them, and expect their children to repay the debt by being obedient and making them proud.
WHY PARENTS CHOOSE THIS STYLE
Tiger mothers are, as Professor Chua attests, socialised to be this way by their cultural background. Thus, when they successfully demand an hour of piano practice, it's part of their cultural background that the child should comply. Western parents would have a hard time emulating the years of acculturation leading to such a moment.
Parents who follow this style might do so because they want their child to be successful. They could have deep insecurities about the future. These parents are most likely authoritarian.
PROS
Raising a child in this way could lead to them being more productive, motivated and responsible.
CONS
Children could struggle to function in daily life or in new settings, which might lead to depression, anxiety and poor social skills. But again, it's culturally dependent.

Helicopter parents (Nomads parenting Heroes)
TYPE OF PARENT: You swoop in to rescue your toddler from every hardship; you're over-involved in your children's education and frequently call their teacher; you can't stop watching over your teenager.
WHO COINED IT?
Psychologist Foster Cline and education consultant Jim Fay coined the phrase in 1990 in their book, Parenting With Love And Logic. They describe helicopter parents as being confused about the difference between love and saving children from themselves. Another name for helicopter parenting is "overparenting".
WHY PARENTS CHOOSE THIS STYLE

They are likely to be scared for their child's future, perhaps like tiger parents. They might not trust their child's ability to navigate the world. They might think that, by hovering around, they can inoculate their children against failing.
There is probably a mix of authoritarian and permissive typologies here, but little research has been done on the style.
PROS
Parents could be overprotective, which might save their child or adolescent from unforeseen problems.
CONS
Children could lack emotional resilience and independence, which might affect them even into adulthood. Being a child of a helicopter parent could lead to an inability to control behaviour.
There's even an AskReddit devoted to the worst aspects of growing up with helicopter parents. In one story, the father followed the contributor, 21 at the time, to jury duty, because he didn't trust the contributor to do it properly. It's claimed that dad had a tantrum when he was kicked out by the security guard.

Snowplough or bulldozer parents (Heroes parenting Artists)
TYPE OF PARENT: You push all obstacles out of your child's way. Perhaps you've nagged the principal for a different teacher or bribed the coach to give your child a place on the team.
WHO COINED IT?
It appears the term was coined by former high school teacher David McCullough. Last year, he published a book, You Are Not Special, in which he implored parents to back off and let their children fail. It was based on a 2012 commencement speech he gave to high school students.
WHY PARENTS CHOOSE THIS STYLE
Maybe you think your child is exceptional, or too great to fail, and that's why you've identified with this parenting style.
In terms of typology, there are aspects of authoritarianism in the mix as such parents demand success (after all, they've bulldozed all obstacles from their children's path). However, they also score highly for permissiveness.
WHAT THE RESEARCH SAYS

There's no empirical evidence either way for the snowplough approach. However, there are a lot of blog posts and media articles devoted to the topic.
That said, the pros and cons are probably similar to those for helicopter parents. Bulldozer parents could help children feel safe and secure. But this style might also foster a sense of entitlement or narcissism in the child.

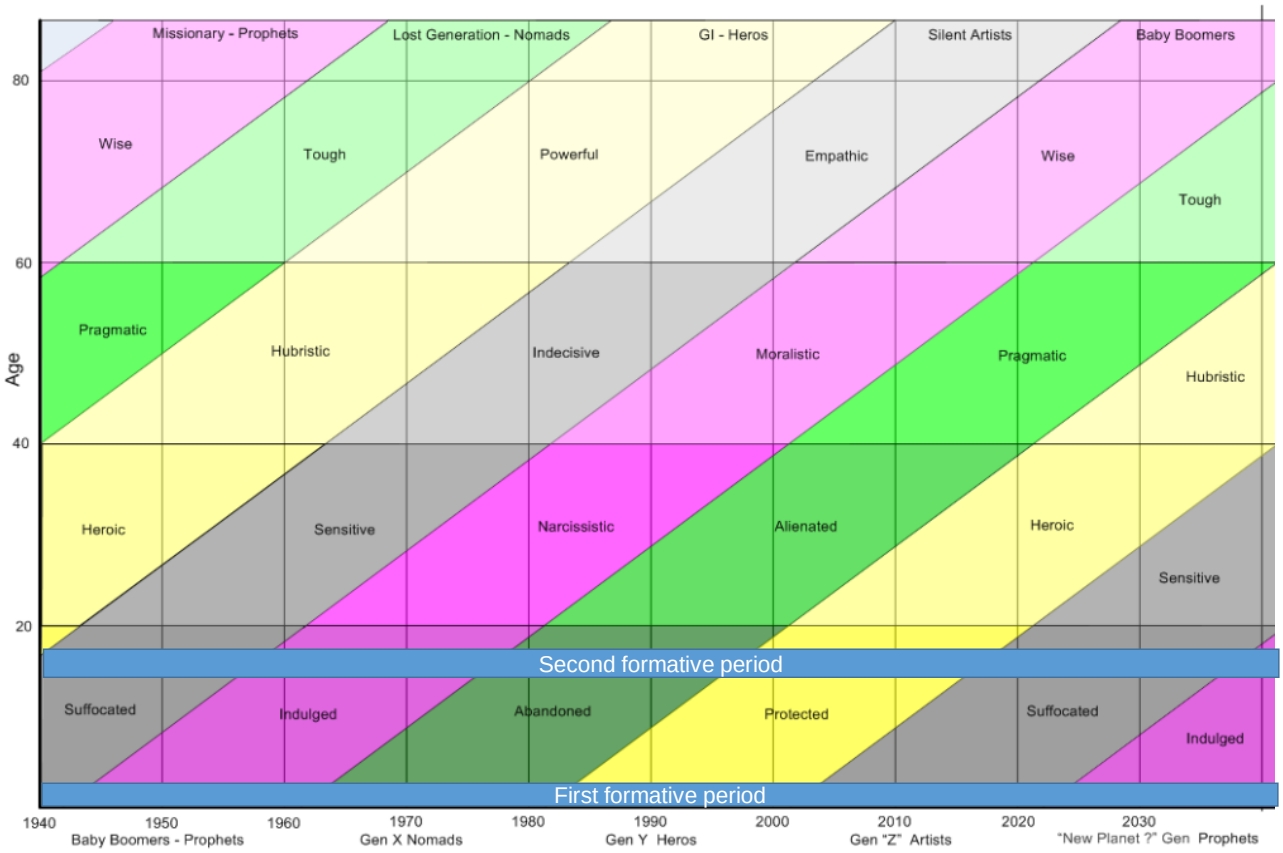
Free-range parents (Prophets parenting Nomads)
TYPE OF PARENT:
You believe your role is to trust your child. You equip them with the skills to stay safe, and then back off.
WHO COINED IT?
The term was made famous by a case of "neglect" involving former columnist Lenore Skenazy, who wrote about letting her nine-year-old son ride the New York subway alone. The experience led to her being labelled "America's worst mother", and prompted her to write a book aimed at fighting the perception that the world was getting more dangerous. Her blog tries to connect parents with like-minded others who agree that children need safety jackets and helmets in order to safely experience their independence. The approach is about giving children the childhoods that their parents experienced in the 1970s and 1980s.
WHY PARENTS CHOOSE THIS STYLE
Psychologists and experts suggest that this style is a backlash against anxiety-driven, risk-averse child rearing.
Ms Skenazy could be right - maybe people worry too much about everything. While she cites responses from parents (and lawmakers) who think the approach is neglectful, it is probably more aligned with the authoritative typology, where parents believe in teaching children to look after themselves.
PROS
Children learn to use their freedom, be autonomous and manage themselves. They might also be better able to handle mistakes, be more resilient and take responsibility for their actions. It could also result in happier adults.
CONS
Problems with this style centre on the legal aspects of the approach. In Queensland, Australia, it is illegal to leave your child alone for an "unreasonable" time while, in other states, parents must reasonably ensure that their child is properly looked after. Queensland law does not define what an "unreasonable" time is, but parents breaching the code would be committing a misdemeanour and could face up to three years in jail.

Attachment or gentle parents (Nomads parenting Heroes; some Heroes parenting Artists)
TYPE OF PARENT: You believe that a child's earliest attachment to caregivers informs all subsequent attachments. The argument suggests that strong emotional and safe physical attachments to at least one primary caregiver are essential to the child's personal development.
WHO COINED IT?
The philosophy is based on the work of psychologists John Bowlby and Mary Ainsworth on attachment theory. The work began with Dr Bowlby in the 1950s. He also worked with Dr Ainsworth, who did some famous experiments with young children.
Attachment theory suggests that children who develop strong bonds with parents or caregivers in their early years have happier, healthier relationships as they age. The term was then popularised by a book dubbed the "baby bible" that was written in 1993 by the Sears, a family of medical professionals.

WHY PARENTS CHOOSE THIS STYLE
Parents might want children to be positive about themselves and their relationships with others as they mature. Attachment parenting is associated with the authoritative typology. Such parents try to balance high expectations with empathy, and this is associated with the best outcomes.
PROS
This environment provides a safe haven of love and respect in which to build the child's relationships and from which the child can safely experience the world.
CONS
The style could be conflated with permissive parenting. It is also associated, somewhat contrarily, with over-parenting - some suggest that it is a name for mothers who can't let their child go. The style has been called anti-women or anti-feminist. Some say the style conflates the woman's role with motherhood, undoing the work of feminism, but others disagree.

Here's the thing, though, a lot of what the second formative period of a young adult's life is all about is *escape* from the home environment. The more authoritarian the parenting, the more traumatic this escape is likely to be.

Overall, though, the big point is this. When we're plotting Generation Maps for a particular situation, we need to pay particular attention to the context of these critical first and second formative periods:



Biology – Polysphincta Wasp

Wasps. Subject of four previous ezine features. Wasps break records. Evil records. We've had two different parasitic wasps (Issue 148 and Issue 184) and this month we hear about a zombie-making species.

Setting off a startling chain of events, the polysphincta group of wasps can force a spider to weave a special web to suspend the wasp pupa. It does this just before it then kills the spider. William Eberhard, staff scientist emeritus at the Smithsonian Tropical Research Institute and Marcelo Gonzaga at the Universidade Federal de Uberlândia in Brazil have assembled wide-ranging evidence that 'zombification' involves hacking existing web-spinning mechanisms by hijacking the spider's own molting hormone, ecdysone.

In a recent paper published in the Biological Journal of the Linnean Society they combined a review of all known reports of different wasp species known to zombify different spider species around the world; the results from a molecular study in Brazil; and new observations of Costa Rican spiders to demonstrate several previously unappreciated patterns that suggest that the wasp larvae use ecdysone.

One puzzle the researchers address is how a single wasp species can induce an impressive diversity of changes in the webs of many different spider host species. In the most complex cases, the spider's web construction is affected at several different stages: from selecting a site to modifying several different key design elements that usually result in a sheltered, stable home for its pupal cocoon.

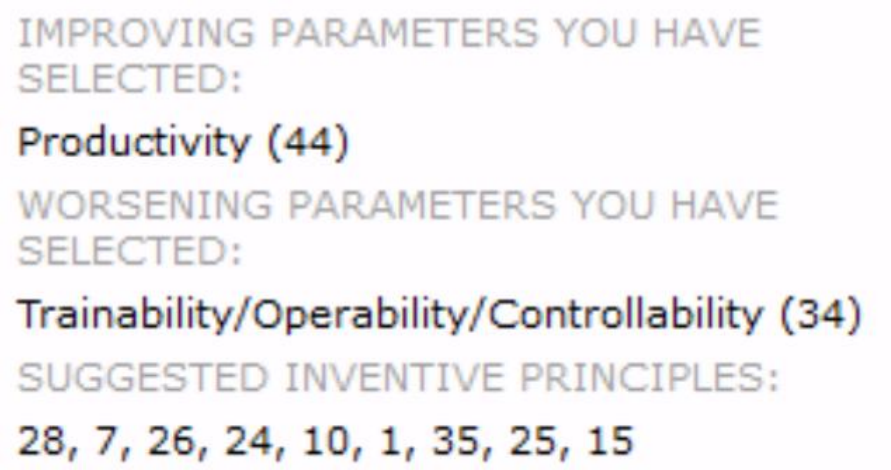
This feat is dramatic because the wasp larva does not have direct contact with the spider's nervous system: it is an external parasite, riding on the surface of the spider's abdomen. Its only access to the spider's brain is via injections of psychotropic substances into the hemolymph in the spider's abdomen, to then be carried by the spider's circulatory system to its central nervous system.

"Several studies suggested that sometimes the webs induced by the wasps resemble the webs that unparasitized spiders build just prior to molting," said Gonzaga. "We combined that observation with a previous discovery that, in one genus, spiders that had just built cocoon webs had unusually high concentrations of ecdysone in their bodies, and predicted that the specificity of the wasp larva's effects may already be present in the spider's nervous system, in the form of its specific behavioral responses to the hormone that controls its own molting cycle. By hacking into this system, the wasps ensure the safety of their own offspring at the expense of their host."

"Now that we have a proposed mechanism, we can ask a new set of questions," Eberhard says. "Because the lines in spider webs represent precise records of their behavior, we could study "zombification" in unprecedented detail by looking at the lines in cocoon and molting webs. We discovered that both web types vary, and more importantly, that the variations only overlap partially.

"The larvae probably tweak the spider's molting web construction behavior to gain added protection. The mechanisms by which these additional modifications are obtained may result from differences in the timing or amounts of ecdysone, or modifications in the ecdysone molecules themselves, but they remain to be documented," Eberhard continued.

From a contradiction solving perspective, the polysphincta wasps are effectively getting spiders to do their hard home-making and offspring protection work for them. Here's a way of mapping the problem onto the Contradiction Matrix:



Answer: Nest (Principle 7) a (chemical) Field (Principle 28) into an Intermediary (Principle 24) in advance (Principle 10), and with varying characteristics (Principle 15) to encourage the spider to perform a variety of different functions. Simple when you know how.

Read more:
William G Eberhard, Marcelo O Gonzaga. Evidence that Polysphincta-group wasps (Hymenoptera: Ichneumonidae) use ecdysteroids to manipulate the web-construction behaviour of their spider hosts. Biological Journal of the Linnean Society, 2019; DOI: 10.1093/biolinnean/blz044

Short Thort

"That which is not measurable is not science.
That which is not physics is stamp collecting."
Sir Ernest Rutherford

"The more physics you have the less engineering you need."
Sir Ernest Rutherford

News

ICSI

A final reminder that the 10th annual International Conference on Systematic Innovation takes place at the University of Liverpool from July 8-11. Darrell will be giving a half-day tutorial on the morning of the 9th and then keynoting in the afternoon. There are also two other paper from the SI team on Wednesday. Registration and full agenda at http://www.i-sim.org/icsi2019/. We'll be there with a TRIZmeta stand for anyone looking to procure sets of the best-selling cards.

IRDG Annual Conference

A date for your diary if you are in or adjacent to Ireland. 22 October is the date of the big IRDG conference, this year being convened in Kilkenny, with likely over 200 participants. Darrell will be giving a keynote address in the morning to kick things off.

China Books

The simplified-Chinese version of Hands-On Systematic Innovation for Business & Management looks like it will be in the shops in the coming month. Publisher, China Machine Press, also informs us that their translation of Systematic (Software) Innovation will also be published before the end of the year.

Book Chapter

A bit of a mouthful, but this month we delivered our chapter to the forthcoming book, 'Harnessing Knowledge, Innovation and Competence in Engineering of Mission Critical Systems'. Only slightly less of a mouthful, our chapter is called, 'Knowledge Redundancy

Cycles In Complex Mission-Critical Systems'. It's about S-curves, contradictions and the periodic need for organisations to 'unlearn' knowledge that has become redundant. The book is scheduled for publication during the final quarter of 2019. More details as we receive them.

New Projects

This month's new projects from around the Network:

IT – Leadership Strategy Workshop
Education – SI Workshops
IT – Innovation Project
IT – Innovation Capability Maturity Assessment & Journey Mapping Project
Government – Innovation Strategy Project
Automotive – IP Generation Project
Agriculture – Design/Make Project
FMCG – Innovation Dashboards