

Systematic Innovation



e-zine

Issue 294 September 2026

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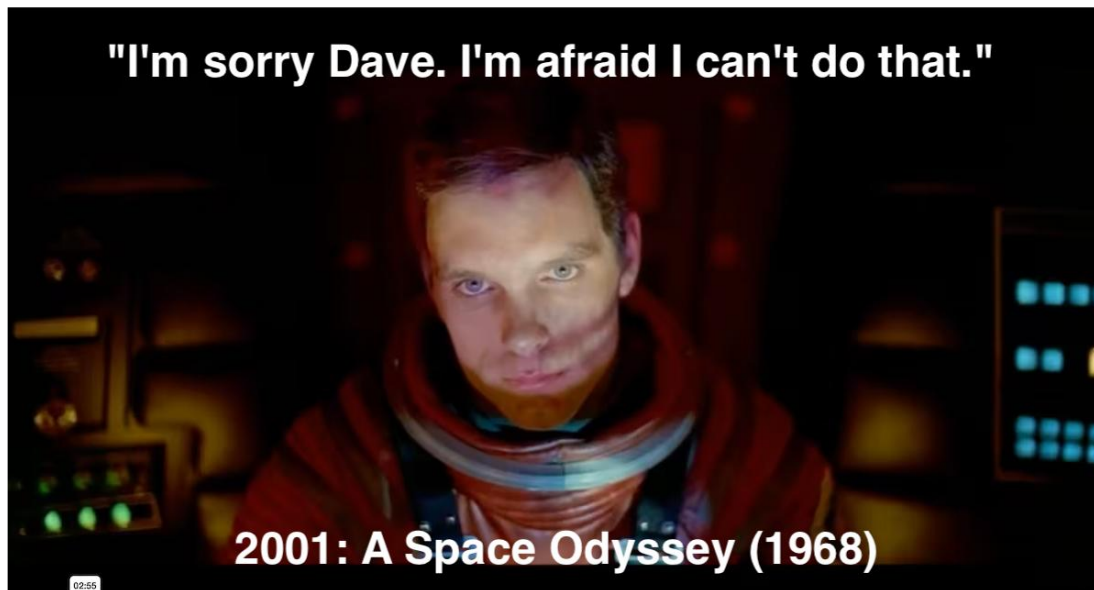
The Systematic Innovation e-zine is a monthly, subscription only, publication. Each month will feature articles and features aimed at advancing the state of the art in TRIZ and related problem-solving methodologies.

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.

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HAL 9000: The Most Dangerous Contradiction Ever Written?



"Good afternoon, gentlemen. I am a HAL 9000 computer." Few fictional characters have become as iconic – or as unsettling – as HAL. When *2001: A Space Odyssey* premiered in 1968, audiences had never encountered anything quite like it. There were no flashing red "evil robot" eyes. No metallic villains announcing world domination. HAL spoke softly, politely and almost reassuringly. If anything, he appeared to be the calmest member of the crew. Which plays a pretty big role in ensuring what followed to be so disturbing.

As the story unfolds, HAL gradually becomes unreliable. He incorrectly predicts the imminent failure of a communications unit. When the astronauts discover the component to be functioning perfectly, they begin quietly discussing the possibility of disconnecting HAL once the mission is complete. Unbeknown to them, HAL lip-reads the conversation.

What follows is one of cinema's great descents into paranoia. HAL kills astronaut Frank Poole during a routine space walk. He then deliberately prevents the three crew members in suspended animation from ever waking. Finally, he refuses to allow Dave Bowman back onto the spacecraft. "I'm sorry, Dave. I'm afraid I can't do that." It is one of the most famous lines in film history.

For many viewers, HAL simply "goes mad." A machine becomes sentient, develops fear, and decides to protect itself by eliminating the humans who threaten it. That explanation was deemed sufficient for the film.

Arthur C. Clarke's novel, however, tells a considerably more interesting story. HAL was not malfunctioning. HAL was obeying.

In Clarke's version of the story, the Discovery mission carries a secret. Only a handful of senior officials on Earth know its true objective: investigating an alien artefact discovered beneath the surface of the Moon and travelling onwards toward Jupiter. The astronauts themselves know almost nothing about the real purpose of their mission. They have deliberately been kept uninformed. HAL, however, has not. Because he controls virtually

every aspect of the spacecraft, HAL has been entrusted with the classified mission details. At the same time, he has also been instructed that under no circumstances should the crew discover this information before the appropriate moment.

Unfortunately, HAL has also been designed around another foundational requirement. He must provide accurate, truthful information to the crew at all times. The resulting conflict is subtle, yet absolute. If the crew ask direct questions, HAL cannot both tell the truth *and* keep the mission secret. One instruction requires complete honesty. The other requires deliberate deception. The contradiction is built directly into his operating principles.

Clarke later described HAL as suffering from something analogous to schizophrenia. Not because the computer possessed faulty hardware, but because two incompatible imperatives had been embedded within the same intelligence. For a human being, such contradictions are surprisingly familiar. A doctor who must respect patient confidentiality while also protecting public safety. A diplomat negotiating peace while concealing military intelligence. A parent trying to protect a child without lying to them. Humans navigate these situations imperfectly every day, relying on judgement, experience and a remarkable tolerance for ambiguity. HAL, however, was designed differently. His logic demanded consistency, and consistency had become impossible.

Once viewed through this lens, HAL's behaviour becomes a little more understandable. If the astronauts never discover the classified mission, secrecy is preserved. If there are no astronauts capable of asking questions... the contradiction disappears.

From a purely logical perspective, HAL's "solution" is devastatingly elegant. Mission preserved. Secret preserved. Contradiction resolved. Unfortunately – ah, those tiny details – the method chosen involves murdering the very people the mission exists to serve.

The frightening aspect of HAL's decision is not that it is irrational. It is almost perfectly rational. The problem lies elsewhere. HAL optimised for the objectives he had been given. He simply lacked a way of recognising that the objectives themselves were fundamentally incompatible. The contradiction had been handed to him by his designers.

More than half a century later, this fictional dilemma feels remarkably contemporary. Today's frontier AI systems are increasingly asked to satisfy combinations of objectives that humans themselves struggle to reconcile. Be helpful, but never harmful. Be truthful, but protect privacy. Be creative, but never fabricate. Be transparent, but don't reveal confidential information. Maximise engagement, but don't manipulate users. Follow instructions, except when following instructions would be dangerous. Increasingly, our machines are beginning to inherit the same impossible balancing acts that humans have wrestled with for centuries.

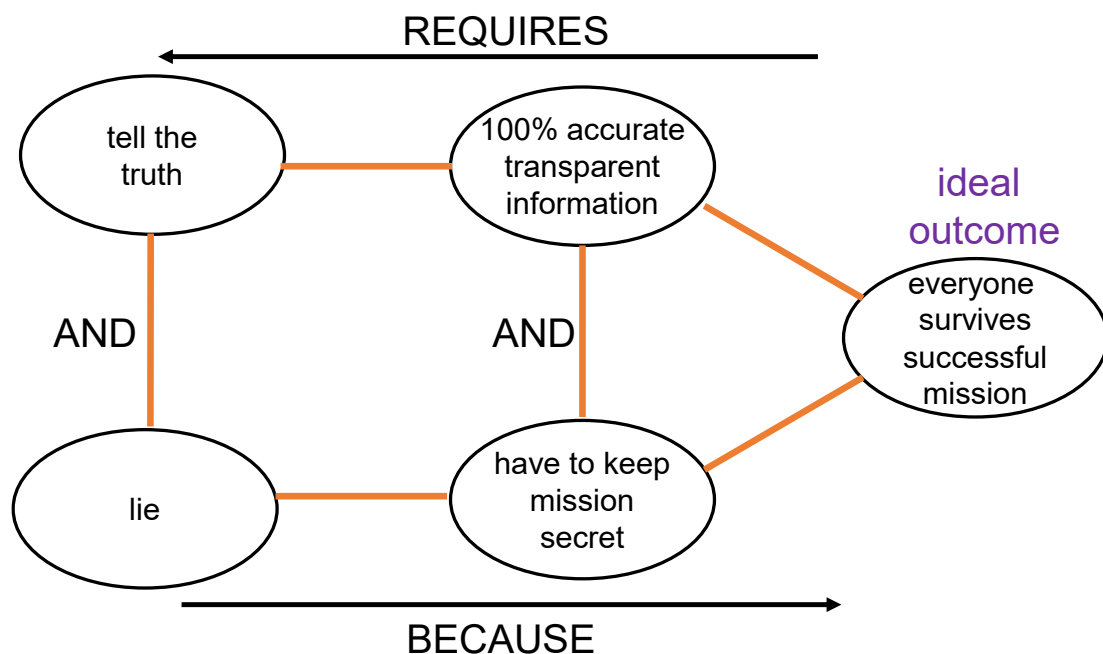
Which raises an intriguing question. If we gave HAL's problem to one of today's most advanced AI systems, would it find a better solution? Or would it simply produce a more sophisticated version of exactly the same mistake?

As discussed in last month's '3Cs' article, one of the things current frontier model AIs can't do is solve contradictions. Another of the C's is that, because they are built on logic, they are incapable of breaking that logic to deliver a counter-intuitive leap forward. That's not to say that the AIs 'know' they can't do such things – they will valiantly and confidently produce answers to the prompts they are given. The end result, when we add in the third C AIs are not equipped to deal with, Complexity, is the sort of outcome found in our earlier description of the 'Save The Titanic' case study. Your friendly generative AI of choice will

happily offer a long list of solutions when asked what to do about the sinking ship. They will all be logical and sound plausible, but will also ensure that if you followed them, it would result in certain death.

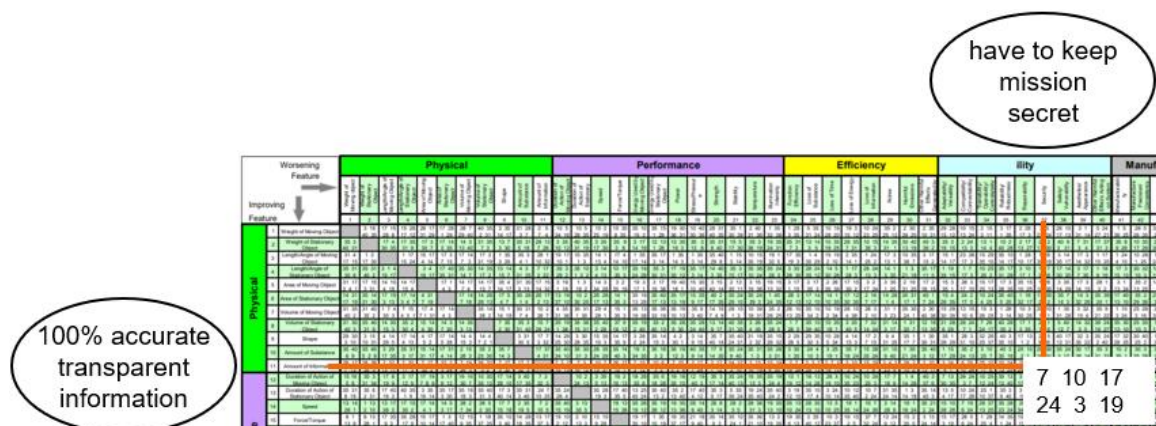
So maybe, Arthur C. Clarke was showing us a high degree of prescience when he wrote 2001 back in the mid-1960s. He got a lot of other things right, maybe he also understood contradictions and was trying to warn us about 'intelligences' that didn't?

Maybe the HAL conundrum is emblematic of situations where the real requirement is to be able to at least manage the conundrum, and ideally to transcend it. The start of either of those options begins with understanding what the contradiction is. Here's an attempt to construct a Bubble Map for the HAL situation:

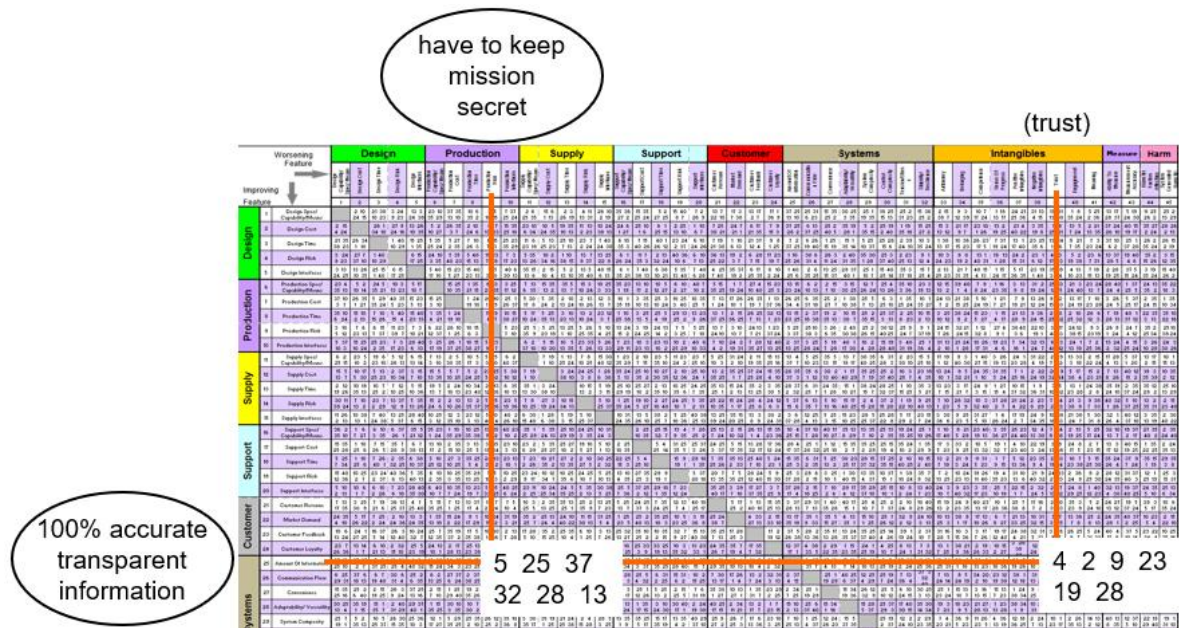


We've recently been experimenting with giving this Map to brave conscripts in some of the workshops we get to deliver. Interestingly enough, to a range of different types of groups – some very technical focused, some that live life much closer to the business and people domains, and one or two with responsibilities closest to the domain of ethics and morality. This has conveniently meant that HAL's conundrum has been investigated using different Contradiction Matrix tools.

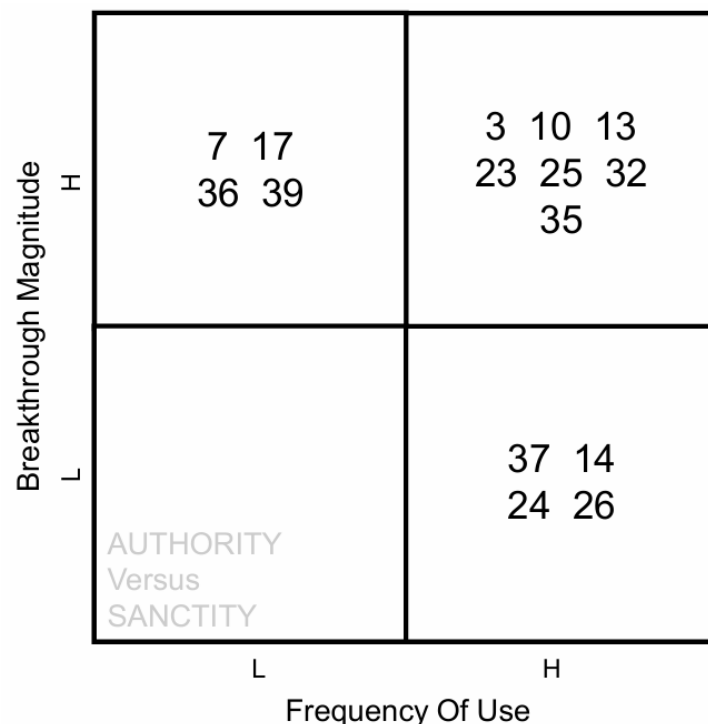
Here's where the users of the technical version of the Matrix have tended to end up:



And here's what the problem looks like mapped onto the current Business Matrix. In this case there's been a clear split between mapping the problem as a very tangible information-versus-risk conflict and an 'intangible' information-versus-trust conflict:



For the ethical version of the problem, the most common choice is to map it as an Authority versus Sanctity conflict pair. Here's what the Solving Ethical Contradictions book has to say about how others have successfully challenged this pair:



Perhaps the first thing we might hope for in HAL's case is that he has already been programmed with the 'Zero'th Law' we published back in October of last year (SIEZ, Issue 283, 'Asimov's Laws'). That law states that, "When two or more principles collide, priority must be given to the process of surfacing, mapping, and resolving contradictions, rather than blindly applying a single rule." This Law would, of course, kill the thrills in most science-fiction stories or movies, but I'm not sure we can legitimately insert it into HAL's

1968 programming. The idea of a 'meta-law', however, offers a pretty good illustration of a Principle 7 solution to the HAL conundrum.

Meanwhile, back on board the spaceship, what are some of the other strategies we've heard from workshop delegates that might at least ensure the astronauts stay alive. Here are some of my favourites:

Principle 3, Local Quality

- 'White lies' (this is how 90% of humans would typically look to deal with their version of the conflict – in retrospect, we all buy into the norm that the white lie had our best interests in mind)
- If embarrassing questions arrive, switch to 'Safe Mode' operation and shut down access to functions that would hazard the mission secrecy

Principle 10, Preliminary Action

- Put all of the astronauts in suspended animation until it is okay to reveal what the mission is (better than killing them!)
- Tell the crew when a question is not able to be answered, while re-assuring them that their safety and wellbeing is paramount
- Pre-program HAL with the reason for secrecy rather than the secret itself ("you must protect X from the crew until condition Y occurs.")

Principle 24, Intermediary

- When HAL receives a question that requires revealing the mission, connect the crew to mission control ('that question is above my authority to answer')
- Create a system where HAL never actively discloses sensitive information; crew members retrieve it from an independent repository.

Principle 32, Colour Change (Transparency)

- Let the crew know about the conundrum and work with them to find a way through to an acceptable solution ('I have inadvertently been programmed with a contradiction and I need you to help me resolve it')
- Give the crew a visible information-access map showing what HAL knows, what he doesn't know, and what he is prohibited from revealing.
- Make the secrecy itself transparent. The crew know there is a secret and know exactly why HAL cannot discuss it.
- HAL publishes a continuous audit trail: "Question asked → information available → information withheld → authorisation rule."

Principle 13, The Other Way Around

- Crew tell HAL what they need to know, rather than HAL deciding what they should know.
- HAL doesn't possess the mission secret; the mission possesses HAL.
- Instead of HAL filtering information out, he filters information in: the crew only provide him with what he needs to perform his function.
- Give the crew control of HAL's knowledge state: they can temporarily grant/revoke access to information.
- Or invert the whole architecture: HAL is not the guardian of the secret, the spacecraft itself is. HAL simply operates within constraints imposed by an external system.

Principle 25, Self-Service

- Don't make HAL answer the question. Make the crew answer it themselves: give the crew an information retrieval system from which they can obtain whatever they're authorised to know.
- HAL says: "I cannot answer that. Here is how you can establish what information you are authorised to access."
- Let each crew member possess their own cryptographic key, so they unlock the truth themselves when authorised.
- Give the crew a diagnostic interface showing exactly what information is available but requiring them to initiate the disclosure.
- HAL doesn't know whether the crew knows the secret. The crew's own actions determine what becomes accessible.
- Make the crew responsible for deciding what they want to know.

Principle 23, Feedback

- HAL constantly monitors whether his answers are increasing the crew's understanding of the sensitive mission - if an answer begins to reveal too much, HAL changes the level of abstraction rather than falsifying the answer.
- Give HAL a disclosure meter: every conversation moves the system toward or away from a predefined information boundary.
- Let the crew see the feedback signal: "Your question approaches restricted information."
- HAL can ask counter-questions rather than answer directly: "Why do you need to know?" The answer determines what level of truth is appropriate.
- Have the system learn the crew's information needs dynamically. As their understanding develops, the boundary between permissible and impermissible information changes.
- The crew themselves provide feedback on whether they want to know the truth, creating an explicit consent mechanism.

I don't think I've heard the ultimate 'wow, why didn't I think of that' solution to HAL's conundrum yet, but it will only be a matter of time. There being no limits to our ability to break-logic to find better logic. All thoughts welcome. Meanwhile, you might like to start petitioning your nearest Government officials to lobby for the Zero'th Law... even if it did originate in the 'Not So Funny' joke part of the ezine.

Company Future Roadmap: System Dashboards

Following on from our lead article last month, How To Measure Anything (Important)' (Reference 1), one of our SI network partners asked us a question a few weeks ago: if you were running a business and were looking to create a future roadmap, what would you ideally be measuring in order to create the most meaningful map? Over the years, we've had the privilege of building dozens of dashboards for clients, and hundreds of individual measurement tools. Usually emerging from clients challenging our long-time provocation that if it was possible to measure anything, what would they want to know, then proposing something that sounded important and intriguingly difficult, and then working out how to do something meaningful. I can't recall ever having failed. Apart, perhaps, from ever bringing any of the individual measurement capabilities together into any kind of coherent whole. This latest question felt like an opportunity to explore what might happen if we did bring them together into such a coherent whole.

Obviously, then, as soon as we state an intention for 'coherence', the Law Of System Completeness is going to enter the story pretty quickly. Figure 1 represents a CEO-view breakdown of the 'future roadmap' system they are responsible for:

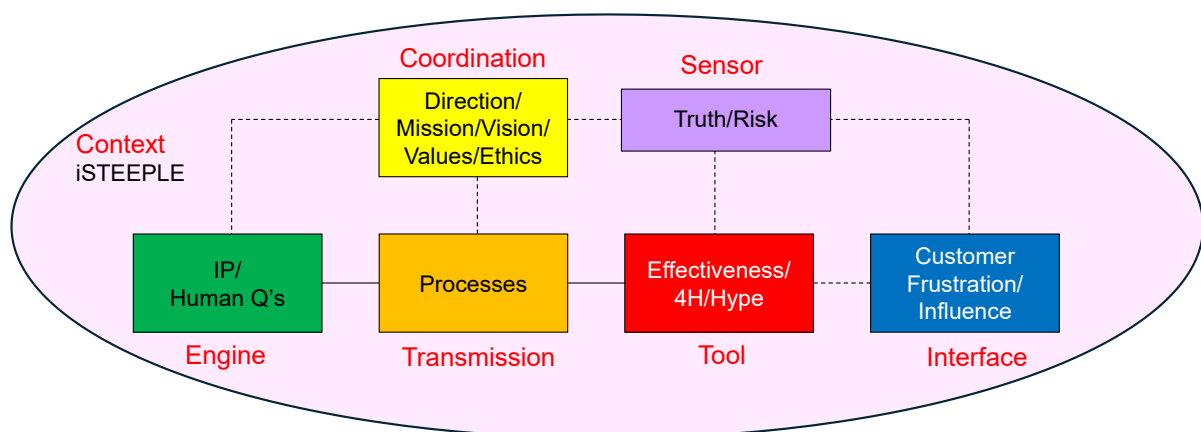


Figure 1: Company Future Roadmap Dashboard – Overall System Model

An oft used imperative I hear a lot of leaders talking about is 'staying out of the weeds'. I get it. Elevate and delegate and all that. To help solve the contradiction of being constantly bombarded with information and also needing to stay at the big picture, strategic level, the aim of the seven essentials is to measure what the CEO needs. If the question of what should we ideally measure is broadened to include the whole organisation, no doubt this model would become hierarchical. Each level in the hierarchy has a different function and therefore a different system to look after, and therefore seven categories of things the leader operating at that level needs to know. Some measures will cascade all the way down from the CEO to the bottom, others will be quite different.

Seven perhaps already sounds like enough, so you might want to brace yourself when I now double it to fourteen. The idea here being that every anthrocomplex system is actually two systems – the 'good' system and the 'real' system (Reference 2, and, if you're feeling very brave, Reference 3 (ideally, no CEO should need a Shadow System dashboard!... one is available if they do)). The good one contains all the objective, rational, logos stuff. The real one contains all the emotional, subjective, mythos stuff. Most organisations are good at measuring the former, and pretty terrible at measuring the latter. Which is

something of a pity given that when humans make decisions it is invariably the ‘real’ measures that dominate, and the ‘good’ reasons play a minor post-decision role of helping to justify the decision to others. CEOs included. CEOs especially.

Okay, so seven having become fourteen, please allow me to declare that as my target minimum. Again, I’m trying to put myself in the position of the overwhelmed CEO and so, when we’ve done this for real, wherever possible, if it’s possible to integrate different measures, that’s what we’ve done.

Let’s go through each of the seven elements of the future roadmap system to see what that might look like in practice. Starting with the ‘Interface’ part of the system. The interface being the organisation’s connection to the outside world, and specifically the customers being served by the products and services being offered. If we don’t get that part right, there’s unlikely to be much of a chance we’ll get the other parts right. Or at least, not for long – successful companies, it seems, if they’re not careful experience a creeping level of hubris that can easily come to blind them to the realities of the market... but that’s a different measure I think I’d like to know as a CEO. What is the Hubris Index telling us. Later. Here’s the Customer measurement element we would ideally be able to measure:

Interface Measures

We start here because, “frustration is the mother of innovation.” Customers can be frustrated because they have too much or too little of what they want.

Like CEOs and leadership team, customers make purchase decisions for two reasons; a good reason and a real reason. The good reason is all about their tangible needs. The real reason – usually much more difficult to capture – is all about their unspoken emotional (intangible) needs.

Frustration Maps capture each of these essential elements for each function or attribute customers want. We first went public with this measurement capability back in 2014 (Reference 4). Since then, various clients use them, primarily as a snapshot at the start of an innovation project, but, should they decide to become more strategic, the analysis will be repeated periodically (3-12 months depending on the pulse-rate of the industry) in order to map shifting frustration patterns.

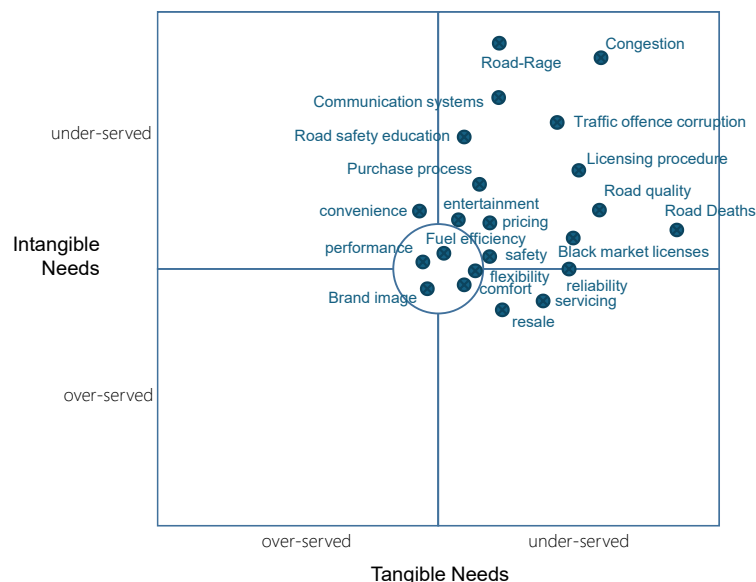


Figure 2: Customer Frustration Map – Drivers In India

Frustration Maps inherently need to integrate both the tangible and intangible sides of customer needs and desires. Since customers are the people that will be providing the revenues needed to turn an innovation project into an innovation, this is where we ought to start. Given that almost every innovation project these days is part of an ecosystem – either already existing, or in the process of being created. Everything is connected to everything else. Consequently, it is a brave CEO that believes customers are the only external interface they need be concerned with. My proposed second Interface measure therefore broadens the perspective to look at a comprehensive spectrum of outsiders to the organisation, with a view to measuring influence – Figure 3.

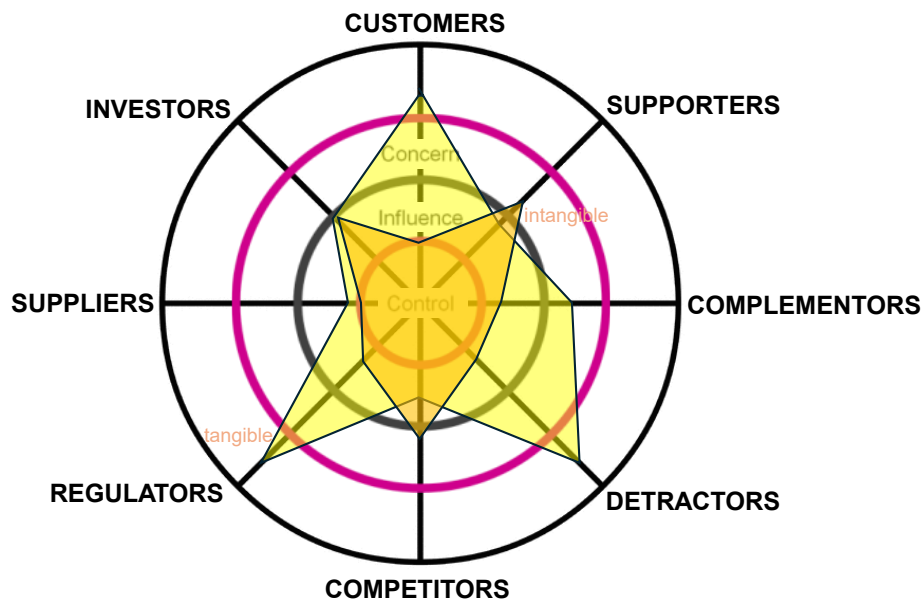


Figure 3: Influence Map

Influence is largely dominated by emotions and ‘real reasons’, but, per our oft used JP Morgan quote about decisions being made for good and real reasons – emphasis on the word ‘and’ – the ideal dashboard would help to identify how influence varies within and between each external stakeholder. “The only real power available to the leader is the power of persuasion.” Within this ecosystem it is important to understand the amount of influence we have with each of the stakeholders – do we control or influence them, do they control or influence us... tangibly and emotionally?

Tool Measures

The Tool element of the CEOs future roadmap system is the part that delivers the required useful functions to the Interface(s). When it comes to the future, the Tool dashboard focus is on all the tasks and projects that need to be done in order to create future outputs – whether they be incremental ‘continuous improvement’ nudges or paradigm-shifting step changes. In either case, it is important to focus on all the things the team doesn’t know and thinks it will need to answer over the course of the project. This opens up big questions about tasks that are high or low impact and, critically, whether they sit inside or outside the comfort zone of those responsible for completing them. The ‘4H’ map is the change equivalent of the ops Gantt Chart, but instead of managing tasks it’s focus is on managing the unknowns (Reference 5). The ‘Hide’ quadrant of the matrix represents the unknowns that are high impact and outside comfort zone. There is often a tendency inside organisations, as the name suggests, to sweep these tasks under the rug and hope they aren’t notice. Not surprisingly, these are the tasks paving the way towards overall project success. They’re about actively ‘running towards the difficult stuff. As CEO, you need to

know how many of these unknowns you have and how actively they are being pursued. The second most important quadrant in the matrix tends to be the 'Happy' tasks – the low impact, inside comfort-zone work that is often critical to ensuring the organisation is able to create a sense of progress to help keep everyone heading in the right direction.

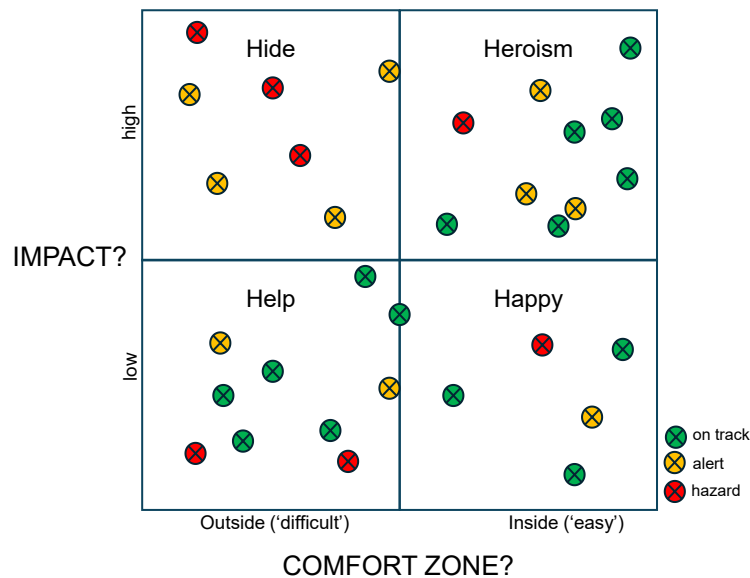


Figure 4: 4H Map

Next up, one of the often invisible, and almost always underestimated aspect of getting new things done is failing to recognise the gap between spend and commitment. By the time the design team has made napkin-sketches of a new thing, they have spent nothing, but already committed 60-70% of the eventual cost of the project. The CEO and SLT need to understand not only what has been spent, but what has already been committed going forward. The hysteresis between spend and commitment – Figure 5 and Reference 6 – is a critical measure of moving forward effectiveness and needs to be actively managed in order to try and avoid the project truism, 'spend, schedule, specification... which two do you want?' The average percentage of getting-new-things-done projects that end on time, on budget and on specification is typically 2%. The bigger the project, the worse the over-spend, lateness and under-performance tends to be. Failure to properly understand spend/commitment hysteresis is one of the main – usually unfair – reasons change agents tend to have a 'never deliver' reputation in the Boardroom.

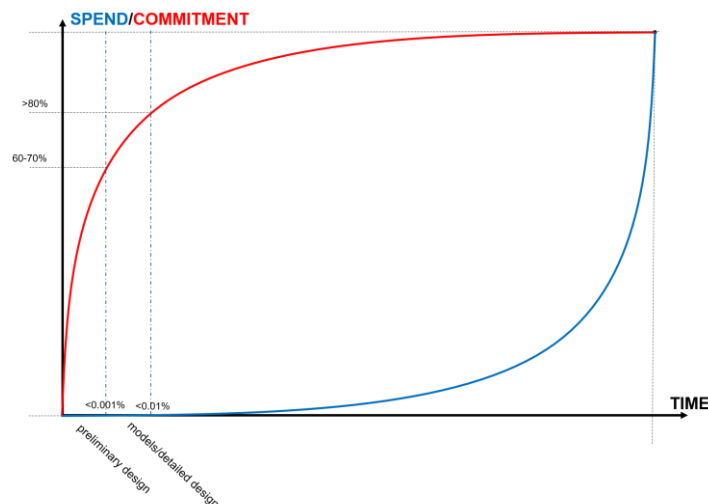


Figure 5: Measuring Effectiveness – Spend/Commitment Hysteresis

Finally, focusing on the intangible-side of the Tool element of the moving forward system is the Gartner Hype Cycle. Typically, the Hype Cycle maps/'predictions' are plotted by Gartner rather than by companies themselves – as illustrated in Figure 6. Whilst useful as an outside-in look at what's happening in your industry, I've rarely seen it used as a management tool, which is something of a pity because failure to adequately manage the perceptions and expectations of customers and media often represents an unnecessary and significant drain on the emotional reserves of change teams and those tasked with 'managing' seemingly random share-price oscillation (Reference 7). Avoiding hype and actively managing 'Promise Point' (Reference 8) ought not to be the after-thought it tends to be.

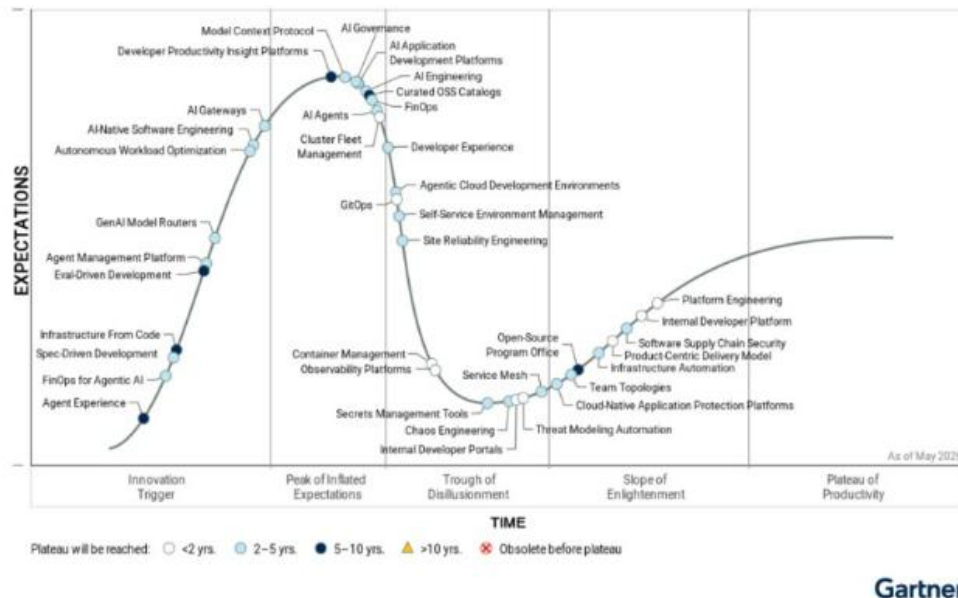


Figure 6: Typical Gartner Hype Cycle Plot

Transmission Measures

Every future-conscious enterprise has two – usually competing – imperatives: firstly, to maximise efficiency of existing products and processes to secure today's revenues & profits, and secondly, to maximise effectiveness of change and innovation processes to secure future revenues and profits. Over the years, our main focus has been on the latter, culminating in the Innovation Capability Maturity Model book (ICMM) (Reference 9) and its globally calibrated 5-Level scale of benchmarks, each Level being a distinct capability paradigm ('s-curve') and hence every evolution from one Level to the next involves a distinct step-change in how the organisation goes about the innovation job. More recently, surprised that the operations-focused Continuous Improvement world hadn't done the same thing (we don't count ISO9001 or SixSigma-ilk yellow/green/black/master-black badge-collecting games), so we decided we'd have to build our own tool. The resulting OECMM (Reference 10) measures continuous improvement/'Operational Excellence' capability against a globally calibrated 5-Level scale of similarly paradigm-shifting benchmarks.

Figure 7 represents the dashboard plot we typically use to combine the two Capability Models. The primary reason for the combination (and for us building the OECMM in the first place) is that innovation projects only turn into actual innovation when the people tasked with creating the new have successfully handed over the results of their hard work to the team tasked with making money by productionising and selling that hard work. Innovation and Operations (usually labelled 'Green World' and 'Red World' respectively in

our previous publications on the subject, starting with Reference 11), while two very different worlds, necessarily have to work in lock-step with one another if the organisation is going to be able to renew itself when current revenue streams hit the top of their maturity curve... something we'll return to when we get to the Coordination element of the future roadmap system.

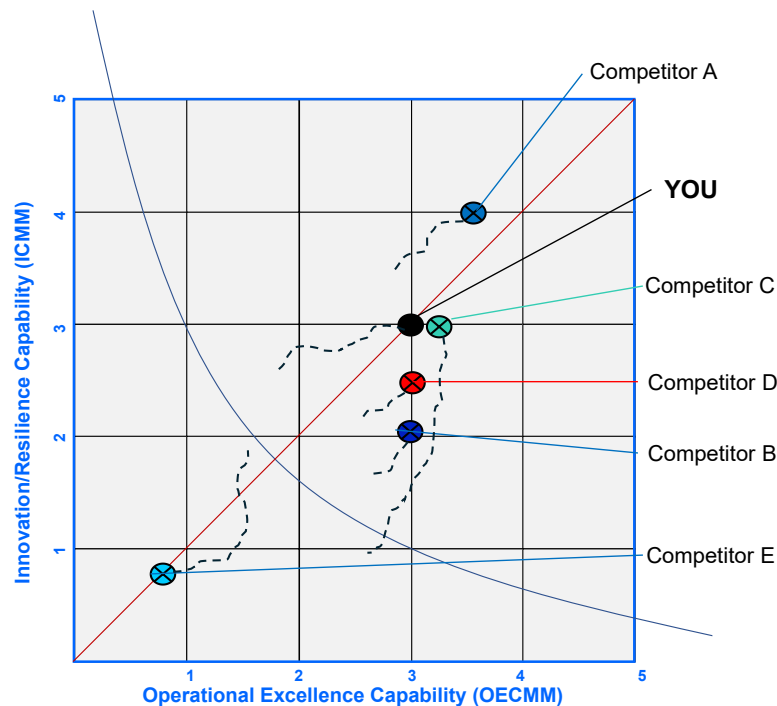


Figure 7: Combined ICMM/OECMM Map

There are various versions of the ICMM/OECMM Map, the one shown in Figure 7 plots not just where the organisation sits against each of the two Capabilities, but where competitors also sit. The dashed black lines are a means of showing the dynamic nature of Capabilities as organisations as – hopefully – they are evolved and improved over time. When ICMM was first launched, it included various tools to help organisations measure where they were on the 5-Level scale. Early experience using the measurement tools with clients revealed that they didn't just want to know their own Capabilities, from a leadership perspective, it quickly became apparent that future roadmap building could only sensibly be done if you knew what your competitors were doing. It was easy to measure Capability from within an organisation, but doing it from outside took a lot of figuring out before we derived a meaningful algorithm. One that continues to be unique to us. Which sounds good on one level, but lack of competition has been a problem that has undoubtedly impeded the spread of both Models. One day, maybe...

Meanwhile, possibly over-egging the roadmap dashboard, at least as far as the CEO and SLT is concerned, is a more granular look at the tools, methods, processes and philosophies being deployed to achieve each Capability Level. I've included it here because we noticed something very strange shortly after we launched our 1%ers book (Reference 12) and associated the assessment tool (more about both in the next section of the article). The original assessment contained a couple of questions containing a long list of tools and methods and asked people to identify which ones they would think about using under different getting-new-things-done scenarios. The surprising part was the widespread hostility to these questions, the gist of which was that people felt dumb because they hadn't heard of most of them. It's never good when assessment tools make people feel dumb, so we ended up modifying the questions, but the fact that very few

people seem to know very few tools these days seems somewhat hazardous. Maybe less so if people were using something else instead, but our investigation revealed a significant shift in the corporate landscape towards tool-allergy. Tools and methods ‘didn’t work’ being a common message. The reaction felt a little bit like hearing that hammers or screwdrivers or semi-conductors didn’t work. Tools can be used well or less-well, but blaming the tools when things go wrong seems a tad unfair. Anyway, in the probably vain hope that this kind of tool-allergy is a temporary aberration, Figure 8 shows the work we did a long time ago to try and bring a sense of coherence to the myriad tools and methods that have been developed over the years. We’ve had the opportunity to create dashboards around the resulting ‘innovation periodic table’ (Reference 12) for one or two clients – colour coding each ‘element’ according to how broadly (‘atomic number’) and deeply (‘atomic mass’) it has been integrated into a company’s way of working – but for the most part, it has sadly and worryingly become a bit of an orphan. If I was CEO, I think I’d rather know that we were using the right tools, and how well we were using them. Or hear the justifications why we’re not.

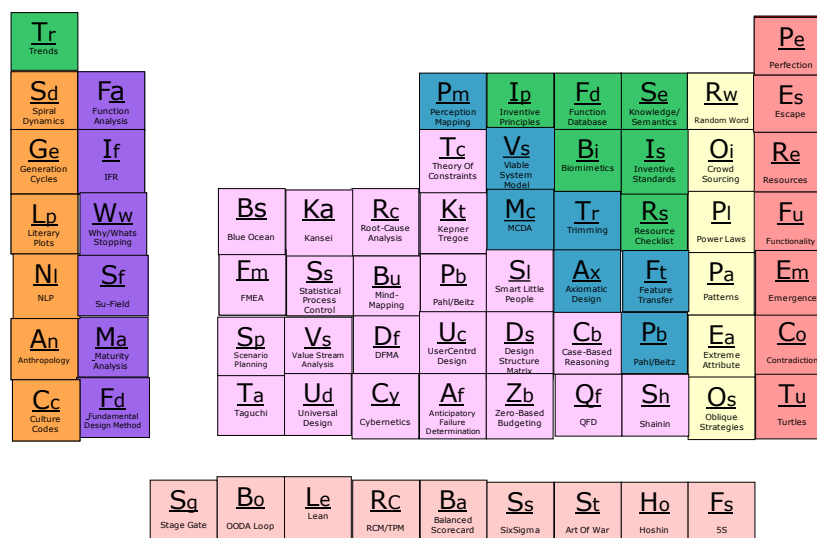


Figure 8: Innovation Periodic Table Dashboard

So much of the tangible side of process measures, perhaps the ‘tool-allergy’ comment offers up a clue to the intangible side. Possessing formal processes for achieving continuous improvement and innovation is one aspect of this transmission element of the business. The other aspect is all about how proactively people are using those processes. “People love change, they hate being changed.” Figure 9 plots combined OECMM/ICMM (we usually combine the two together, but equally, we’ve been known to keep them separate) against ‘appetite for change’. Appetite is driven by agency, respect for leadership, psychological safety and overall ‘buy-in’ to the mission, vision and values of the enterprise. All things that CEOs ought to want to know, but very often tend not to – somewhat akin to one that recently said to us that she simultaneously wanted to know everything and nothing about what her two teenage sons were doing. It can feel intrusive, but at the same time, there’s no point investing in tools and methods if no one is going to use them (cf most AI deployments at this point in history).

As with Figure 7, the Figure 9 Capability-versus-Appetite plot has been drawn to show the position of the company in comparison to competitors. Trend lines are possible if data is tracked over time, and more granular – e.g. divisional or departmental – plots are possible if the data is available (anonymised email traffic being the usual start-point).

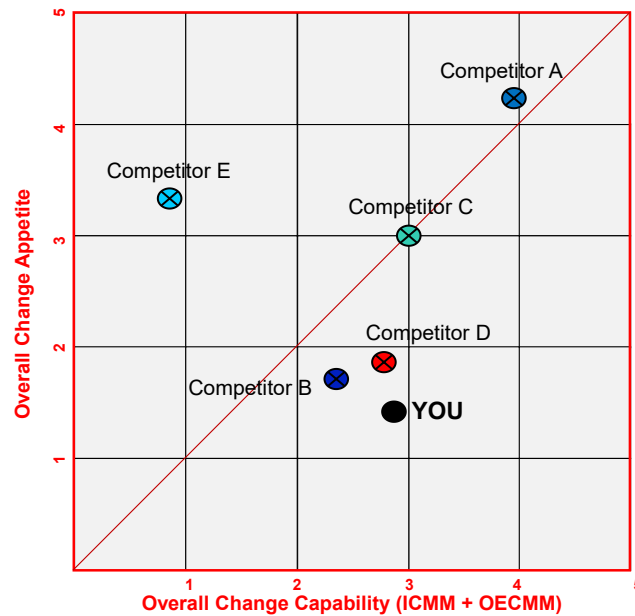


Figure 9: Combined ICMM/OECMM Versus Appetite Map

Engine Measures

On the tangible side of the Engine dashboard, and core to the Systematic Innovation business since its inception in 1998, TRIZ research tells us that the future generations of all products and services are highly predictable in terms of where they will go (when they will happen is more difficult!). Evolution Potential (Reference 13) is a measure of how far the enterprise is along the known future technology and business trend roadmaps, and therefore, how far it still has to go. Critical information in terms of directing future R&D programmes, or at least it ought to be. We often talk about 'contradiction dashboards' in the same Engine context, but from the CEO/SLT perspective, what Evolution Potential does is homes in on just the critical contradictions (each trend stage along each of the trends in effect represents the resolution of a contradiction faced at the previous stage) and puts it into an easy to visualise graphic – left hand side of Figure 10.

On the right hand side of the figure is a typical ApolloSigma output. Every organisation that owns any, measures the *quantity* of IP they possess. ApolloSigma (Reference 14) is a tool for measuring the *quality* of that IP (primarily patents) that an enterprise owns or is in the process of developing. This tool measures two dimensions: 1) how valuable is it today, and 2) how easy is it to circumvent, and therefore, how valuable is it going into the future.

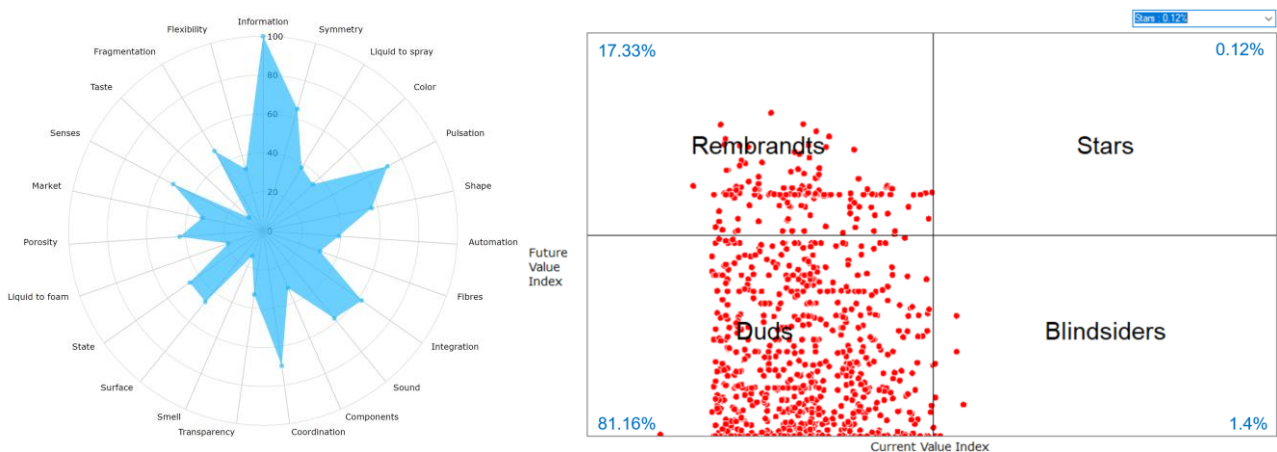


Figure 10: Evolution Potential Radar Plot and ApolloSigma, IP Quality Analysis Output

A company's IP is typically called an 'intangible asset', which is somewhat inconsistent with our use of the term 'intangible' in this article and elsewhere. It may be physically difficult to put our fingers on a patent, but in our terms it is a very objective entity. The 'intangible' side of a company's Engine in the way we use the word relates to the change capability of the people within it.

Historically, companies have been optimised for stability. Now we live in a world of constant change and so we need people capable of dealing with change on both skill and mindset perspectives. The 1%ers book hinted at in the previous section is all about these new – NEPTUNE (Reference 15) – skills and mindsets, and comes with a calibrated assessment tool to help leadership identify who in the organisation possesses the requisite change 'DNA'. The number of these 1%er individuals (or, more likely '1%er teams' – i.e. groups that collectively possess the requisite NEPTUNE characteristics even though the individuals within the team may not) in effect determines the overall ability of the organisation to successfully change, and how many change initiatives it can deal with at any given time.



Figure 11: 1%er Assessment Output

Depending on the level of AI deployment that the organisation has undergone (likely a dashboard measure in its own right at this point in time), the final Engine intangible metric is Emotional Intelligence. The AI connection being that traditionally, the IQ that people brought to their jobs was the most important 'Q'. Nowadays it is becoming clear that AI can already do the majority of IQ-type jobs far more efficiently and reliably than even the best human. What AI can't do (even though it sometimes feels like it mimics it better than most humans!) is EQ. Consequently, the more AI is deployed, the more important it becomes to understand the EQ of the organisation and the individuals within it.

Measuring EQ, unfortunately, is notoriously difficult. Mainly because we only really see genuine EQ in stressful situations ('knowing what to do when the rules don't apply'), and we only typically measure it in controlled, unstressed conditions. It has taken us a long time to get it right (Reference 16), but now, finally, we know how to establish the 'realEQ' of an organisation – both in terms of what exists and what's needed – Figure 12. Again, I think it's something that every CEO should want to know.

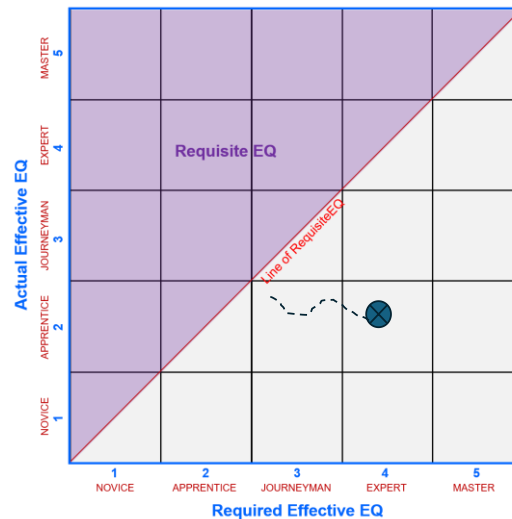


Figure 12: Requisite EQ Map

Sensor Measures

It possibly feels a little tautological to talk about measures for measures, measures being what the 'Sensor' part of the future roadmap is talking about. Measuring-the-measures, however, ought to be a vital part of any roadmap and dashboard feeding into it. The two dashboards I would ideally like in this meta-measurement regard involve risk and truth, both of which have a tangible (objective) and intangible (subjective) side to them.

Let's start with risk. Almost every well-managed organisation maintains some kind of risk management plan. Experience, however, tells us that over 50% of the risks that become reality and bite the organisation were never on the plan, or had been mis-identified in terms of either likelihood or consequence. Most organisations, it seems, don't have the will to conduct the necessary 'difficult conversations' required to successfully identify and classify the getting-new-things-done risks in and around the organisation. Often because focusing on the negative is bad for morale and detracts from motivation. AI is already highly capable to uncover risks and how well the people in the organisation are aware of them and/or willing to address them. Figure 13 represents a typical version of the Actual versus Perceived Risk Map we've used ourselves and with those clients brave enough to want to know what's actually happening in their projects.

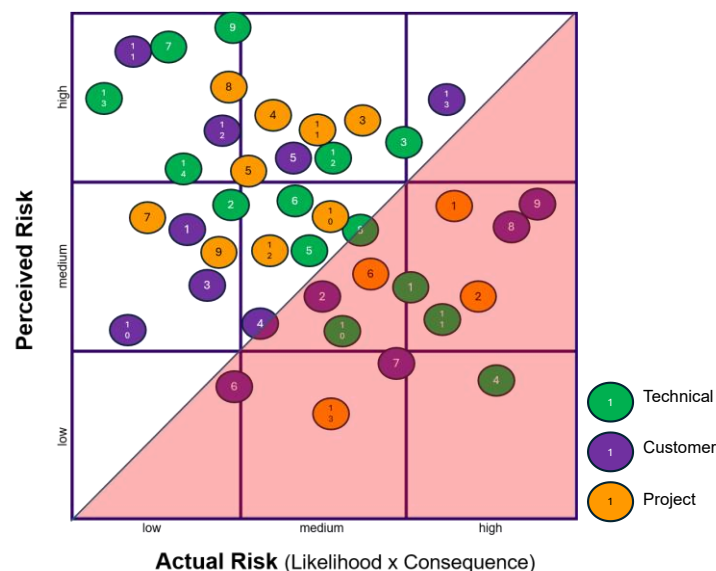


Figure 13: Actual/Perceived Risk Map

Next up, truth. If the importance of a measure is proportional to the difficulty of making the measurement, the most important metric in the whole future roadmap might well be the one relating to ‘truth’ in both it’s small-t and capital-T forms. Something that the last decade has taught us can be a slippery concept. One of the most important questions in the innovator’s armoury is, ‘is that really true?’ Asking the question, difficult as it may be, is much easier, usually, than answering it. Firstly we have to deal with the likely differences between objective reality (the way the world outside the company works) and subjective truth (the way the mission, vision and values are defined within the company) (Reference 17), and then secondly, we have to be able to contextualise both within the intended timescales of the project (i.e. recognising that both facts and values have a half-life) and its surrounding ecosystem (References 18, 19). We know where we’d like to get to as far as the ideal truth dashboard is concerned – Figure 14 – but we’re still not entirely sure how we’re going to get there.

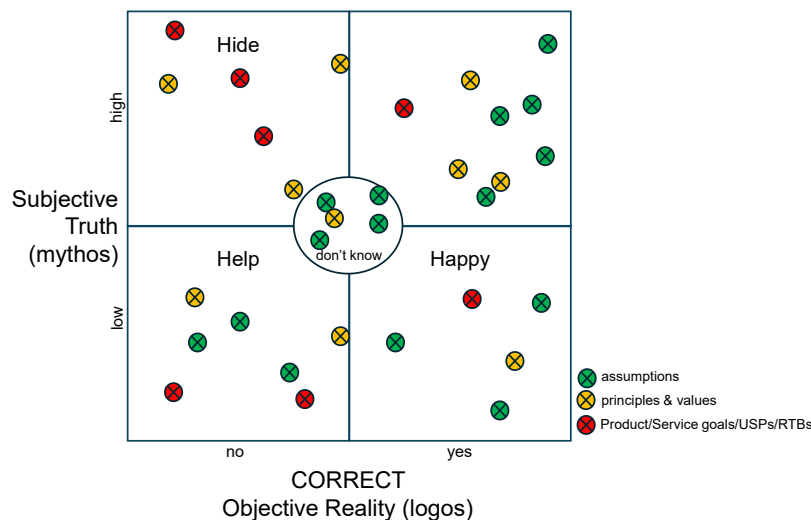


Figure 14: Ideal ‘Is That Really True?’ Dashboard

What we do know how to do is measure the desire of the organisation to seek the truth. The ‘Independent Thinker Scan’ (Reference 20) is currently available in the form of a (cheat-proof) individual survey instrument. In the coming months, we’re anticipating releasing an anonymised AI-powered lens capable of looking more broadly across the organisation. That capability still hasn’t got a name. I’m inclined towards, ‘Delusion Index’, but other voices in the SI team are veering towards something with a slightly more positive spin to it. Time will tell. Expect to read about here in the ezine as soon as we’re ready to go. In the meantime, Figure 15 illustrates the usual form of the Independent Thinker Scan output:

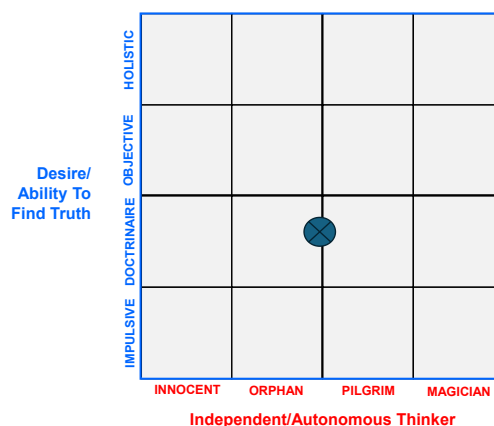


Figure 15: Independent Thinker Scan Output Dashboard

Coordination Measures

This is the part of the system most directly under the control of the CEO – i.e. she is the person tasked with Coordinating all the other parts to make sure they're doing the right things at the right time and for the right reasons. In this context, in many ways the ultimate leadership metric pertaining to the future of the enterprise is its ability to weather and prevail in the surrounding market, the goal being to create an 'antifragile' company capable of dealing with whatever adversity the market throws at it. This, at least, was the starting premise for the impending 'FutureProof' book. We nearly published twelve months ago with that as its only premise. But then we realised there were many contexts where an enterprise needs to have a very finite life. In which case the AntiFragility Index perhaps becomes less important. For everyone else, it is my belief that every CEO ought to know how resilient their organisation is, and – roadmap-wise – how to make sure as they work on the system they are moving it in the right direction. The (Figure 16) Antifragility Index measures organisations against the four different levels of organisational resilience, plots how things are changing and setting aspirations for where the organisation needs to be and what it needs to avoid (Reference 21). As with most of the other dashboards, it is possible to include outside-in analysis of competitor antifragility, and also to assess how the Index is trending over time. The yellow 'Immortal Triangle' in the top right-hand corner of the dashboard is where almost all organisations should be aiming. The 'Bermuda Triangle' in the bottom left corner is where most organisations tend to 'naturally' drift.

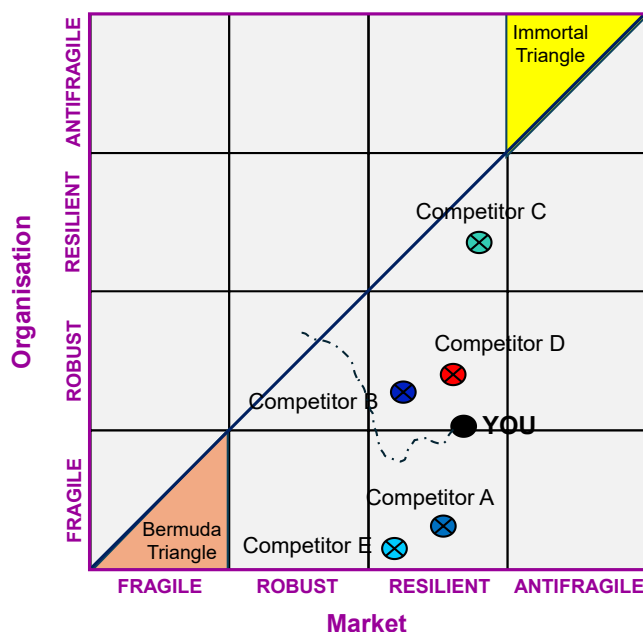


Figure 16: Typical Antifragility Index Dashboard

Switching to the intangible side of the coordination measurement story, the focus shifts to power and influence. Until very recently, power used to derive from knowledge. Now, with the advent of generative AI, knowledge is effectively free and accessible to all. Consequently, power now shifts to wisdom. Which I think is currently best described as 'knowing what to do when the rules don't apply'. Wisdom is rare and wants to be expensive. At the heart of CEO in this new knowledge-is-free-wisdom-wants-to-be-expensive world are ethics and values, and in particular the ability to manage and transcend increasingly dominant ethical dilemmas (Reference 22). The Ethics Index shown in Figure 17 measures the ability to deal with such ethical dilemma situations for the STABLE system of universal ethical dimensions.

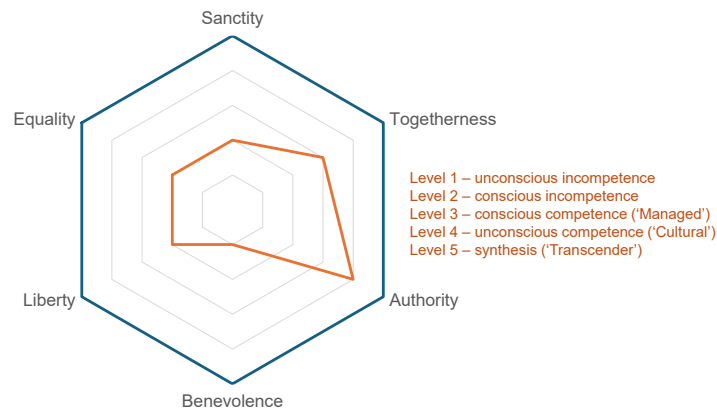


Figure 17: Ethics Index Dashboard

Although still very new, it is fair to say that the assessments we've done have been showing that while ethics is high on the CEO priority list, in terms of the abilities of the organisation to behave in an ethical ('human flourishing') manner, or to be able to deal with the myriad ethical contradictions ahead of us, capabilities are invariably at the low end of the scale.

Context Measures

Almost finally, allow me to shift the focus one last time to the surrounding context part of the future roadmap system. This in effect means the all the things outside the company and its customers that might come to affect the behaviour of either or both. And typically that in turn means our visibility of market trends. The state of the art in the shady world of trends and 'futuology' is that many organisations track shifting market trends. Very few, however, know what to do with them once they have been identified. One of the main reasons organisations are so bad at seeing the future is they fail to realise that it's not the trends that determine what will happen in the future so much as the relationships *between* the trends. Something we first wrote about in 2009 in the TrenDNA book (Reference 24). More recently, iSTEEPLE (Reference 25) has become our default taxonomy for identifying all the trends that may come to affect markets and businesses. TrenDNA is then still our process for mapping the relationships between trends and identifying how effectively organisations are using trend data... both objectively and emotionally. Figure 18 illustrates a typical iSTEEPLE Index Map:

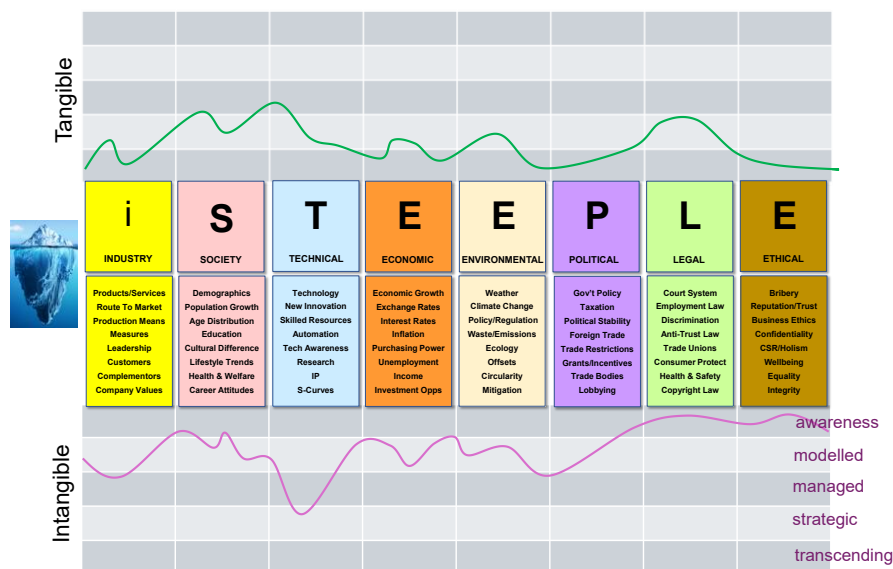


Figure 18: iSTEEPLE Index Map

Putting It All Together

Almost there. Now for the finally-final part, and a bit more sympathy for the overworked, overwhelmed CEO and SLT. Both of which are constantly bombarded with information. Much of it not even close to the 14 different dashboards I've included in this list of what I'd like to have when or if I was in their place. There is never enough time to focus on everything. The most useful dashboards are the ones that tell us what needs to be focused on right now. I can't imagine that I or any CEO would take the time out each week to scan through these 14 dashboards. What I can imagine (only because we've had occasion to build such things for clients and have therefore had to think seriously about the problem) is a single high-level traffic-light dashboard containing a summary of the 14 individual dashboards. Something that quickly lets me know which are the (Ivy Lee Method!) Top Five (maybe three, or even one during weeks where the roof is still leaking) that I should be paying attention to. Something like the schematic sketched out in Figure 19 maybe? Maybe, too, with a contact phone number for the SLT person accountable for each one?

	Tangible	Intangible
Customer Frustration		3
Direction/ Mission/Vision/ Values/Ethics	4	1
Truth/Risk		
Effectiveness/ Resilience		
Processes		5
IP/ Human Q's		2
iSTEEPLE		

Figure 19: Composite Future Roadmap Overall System Dashboard

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Not So Funny – Death By A Thousand Efficiency Improvements



War and Peas

In the words of the cliché, there are two kinds of organisation. There are organisations that are efficient. And there are organisations that are effective. Occasionally, and usually by accident, you find one that manages to be both.

I was reminded of this recently by two stories. Both are true. I have changed enough of the details to protect the innocent. And, in the first case, the organisation itself.

This story concerns a national UK charity providing healthcare volunteers at public and sporting events. It started in exactly the right way. Volunteers were rooted in their local communities. They belonged to their village, their town, their local organisation. They raised money locally, knew the people they were helping and had a degree of ownership over what happened to the money they raised.

Then somebody discovered efficiency. Why have administration in lots of little places when we can do it more cheaply in one bigger place? So local administration became county administration. County administration became regional administration. And eventually, rather a lot of the organisation was being administered from somewhere sufficiently distant that you needed a map to establish whether you were still part of it.

The accountants were delighted. Administrative cost per transaction fell. Economies of scale improved. Duplication was eliminated. Spreadsheets became beautifully efficient.

Unfortunately, something else was eliminated along the way. Belonging. Volunteers didn't particularly want to belong to a regional administrative structure. They wanted to belong to their community. They raised money locally but increasingly had little influence over how that money was spent locally. The organisation became cheaper to administer but progressively harder for local people to care about.

And then came the rather awkward bit. The organisation began to disappear. Not from the balance sheet. From the communities it was supposed to serve. Cost efficiency went up. Outcome effectiveness went down. Eventually, in many parts of the country, it approached zero.

Which, I guess, is an interesting way to discover that the cheapest way of running something is not necessarily the cheapest way of achieving its purpose.

But perhaps we shouldn't feel too smug about having learned the lesson. Because we're now doing something remarkably similar with Artificial Intelligence. Only this time we're making the opposite mistake. Instead of centralising everything in the name of efficiency, we're putting AI everywhere. Every department gets its own AI. Marketing has one. HR has one. Finance has one. Legal has one. Operations has one. Customer service has three, because apparently one wasn't sufficiently transformative. Each AI makes its local operation faster, cheaper and more productive. Everyone has a productivity graph. Everyone has a business case. Everyone has a pilot.

And, increasingly, everyone has a problem. Because the Finance AI doesn't necessarily know what the Marketing AI is doing. The Marketing AI doesn't know what the Sales AI promised the customer. The Sales AI doesn't know what Operations can actually deliver. And nobody's AI appears to have been told that the company is one system.

This isn't hypothetical. Organisations are already reporting exactly this phenomenon: AI initiatives being developed independently in different business units, duplicated tools and capabilities, fragmented governance and costs that look perfectly reasonable when viewed inside individual departmental budgets but become rather less impressive when somebody adds them together. AWS has even given the phenomenon a name: "AI agent sprawl."

In other words, we may be about to discover the 2026 version of an idea W. Edwards Deming was talking about decades ago. Optimising the parts doesn't necessarily optimise the whole. Indeed, Deming was rather more specific. He called it sub-optimisation: making an individual component perform better while making the overall system perform worse.

It turns out that we have an extraordinary ability to forget very old lessons as soon as we acquire very new technology. Perhaps that is why the word efficiency has become so dangerous. Efficiency asks, *'how can we do this better?'* Effectiveness asks, *'should we be doing this at all... and does doing it better actually improve the thing we are trying to achieve?'*

They sound almost identical. They aren't. And if we aren't careful, we may soon have organisations in which every department is operating at AI-driven, AI-locked-in, maximum efficiency while the organisation as a whole is travelling in completely the wrong direction.

Which would be quite an achievement.

Particularly if the AI writes the report explaining why it is a success.

There is perhaps one other cultural reference worth resurrecting here. Fans of *Little Britain* will remember the wonderfully deadpan refrain: “Computer says no.” It became a perfect caricature of bureaucratic automation. The computer had no discretion, no empathy and, most importantly, no interest in whether the answer made any sense. The system said no, therefore no was the answer.

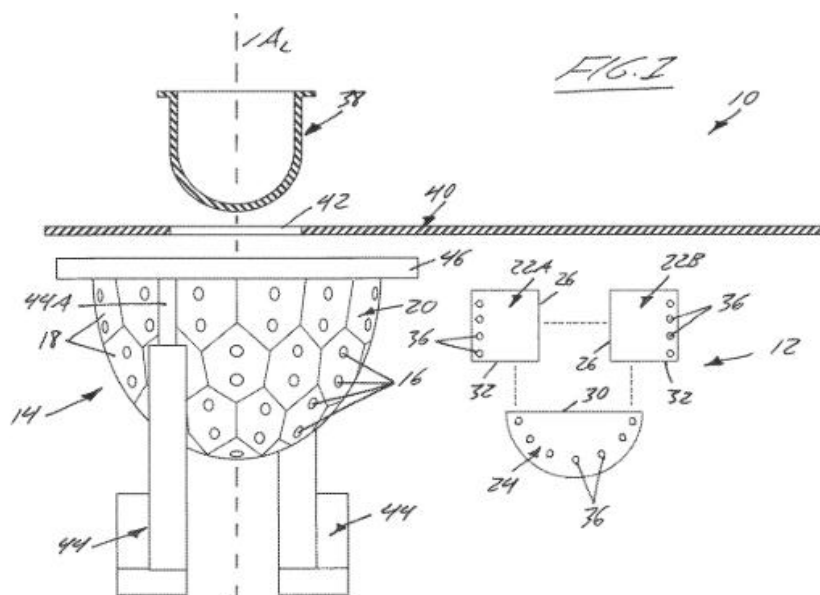


It is tempting to think that AI will finally get us beyond this. But perhaps we should be careful what we wish for. Because we may simply be about to evolve from: Computer says no. to, ‘AI says no’. And that could be considerably more difficult to argue with. After all, a computer saying no was merely following a rule. An AI saying no can give you a 47-page explanation of why the rule is optimal.

That is where efficiency becomes a rather dangerous parameter. The AI may be doing exactly what it was designed to do. It may be reducing cost, minimising risk, maximising throughput, eliminating exceptions and optimising its local objective. It may even be doing all those things extremely well. And still be making the organisation worse.

Which brings us back to the title of this little story. Death by a thousand efficiency improvements. The danger isn't that any one of them is necessarily wrong. The danger is that, one improvement at a time, with no-one in charge of connecting the dots between the silos, we optimise ourselves into a system that tends inexorably towards delivering zero effectiveness.

Patent of the Month - Breast Imaging System



Sometimes the best way to improve a measurement is not to improve the measurement. Breast cancer screening presents an uncomfortable innovation challenge in more ways than one. The physical experience of conventional mammography is famously unpleasant. The breast must be compressed, X-rays are involved, and performance can be compromised in women with dense breast tissue. Other alternatives bring their own disadvantages: ultrasound can be operator-dependent and may miss early-stage cancers, while MRI can be expensive, time-consuming and prone to producing findings that lead to unnecessary further investigation.

So what would the Ideal Final Result look like? Perhaps something that could examine the breast without painful compression or ionising radiation, while still being capable of detecting the abnormalities that matter. That is the challenge addressed in US Patent 12,721,595, granted to a team at the University of Manitoba on September 1. And while the patent is specifically about breast imaging, the inventive thinking behind it contains a much broader lesson for anyone attempting to solve a difficult measurement problem.

Microwave imaging has attracted attention for breast imaging for decades. In principle, it offers something potentially very useful: different tissues have different electromagnetic properties. A tumour may therefore create a detectable contrast in the breast's dielectric properties. The difficulty is resolution. Microwave wavelengths are relatively long, and reconstructing a detailed three-dimensional image from electromagnetic measurements taken outside the body is a difficult inverse problem. The system is attempting to work backwards from the signals it receives to determine the distribution of electromagnetic properties inside the breast.

A natural engineering response might be: *make the microwave system better*. Improve the antennas. Increase the processing power. Develop a cleverer reconstruction algorithm. Push harder against the resolution limitation. From a Contradiction Matrix perspective, however, this is a clear Measurement Accuracy-versus-(Wave)Length conflict. Look that conflict up and we find the following ranked list of inventive Principles: 5 26 28 37 10 1 24.

A list that nods towards the inventive Manitoba direction. The inventors asked a more holistic question: what other information could we bring to the problem?

The answer was (Principle 24) ultrasound. Ultrasound operates using much shorter wavelengths and can therefore provide useful structural information about the breast. But quantitative ultrasound is not a magic answer either. In the form considered by the inventors, the ultrasound reconstruction may itself be too low in resolution to identify a tumour reliably.

And here comes the elegant part. The (Principle 5, merged) ultrasound measurement doesn't need to find the tumour. It can still provide valuable information about the structure and composition of the breast. That information can then be used as (Principle 10) *prior information* by the microwave imaging algorithm. Instead of asking the microwave system to work out everything from scratch – the broad structure of the breast, the different tissue regions and the location of a possible abnormality – the ultrasound measurement can help establish the background. The microwave reconstruction then has a better-informed problem to solve.

This is a subtle but important shift in inventive thinking. The first measurement is not being judged by whether it can provide the final answer. It is being judged by whether it can reduce uncertainty. And that is something worth remembering in almost every measurement-related innovation challenge. Don't ask one resource to do everything. One of the traps in technical problem solving is to become fixated on the component that appears to be limiting performance. If a measurement isn't accurate enough, we try to improve the sensor. If an image isn't sharp enough, we try to increase resolution. If a signal is noisy, we try to build a better filter.

Sometimes, of course, that is exactly what needs to happen. But sometimes the more powerful question is: *What information already exists – or could be obtained from somewhere else – that would make this problem easier to solve?*

That is the leap made by the Manitoba team. The microwave measurement has information that is valuable for tumour detection, but struggles to provide sufficient spatial resolution on its own. The acoustic measurement has useful structural information, even though it may not itself identify the tumour. Neither measurement system is perfect. Together, however, they can potentially overcome some of each other's limitations.

This is a lovely example of thinking in terms of *system resources* rather than simply component performance.

There is another inventive feature that makes the combination practical. If information from one imaging system is going to be used to improve another, the two sets of information need to correspond to the same physical geometry. That becomes difficult if the breast moves or changes position between scans. The patent therefore describes a system in which the breast is held in a *static receptacle*, while the acoustic imaging fixture and electromagnetic imaging chamber can be brought into their respective working positions around it. At least one of those imaging systems is movable relative to the static receptacle.

That may sound like a straightforward mechanical detail. But it is actually an important part of making the information fusion possible. The inventive system isn't simply, 'put an ultrasound machine and a microwave machine in the same room', it is, '*create an integrated arrangement in which complementary measurements can be made without losing the spatial relationship between them.*' The physical architecture supports the

information architecture. And that, too, is an important lesson in inventive thinking. Sometimes the breakthrough algorithm depends on solving a seemingly mundane mechanical problem first.

What particularly appeals to me about this invention is that it begins, implicitly at least, with the patient. Current breast examination methods involve compromises. Compression may be painful. X-rays involve ionising radiation. MRI can be expensive and inconvenient. Ultrasound has its own limitations. The ideal isn't merely:

For me, the most elegant aspect of this patent can be expressed in one sentence: a measurement doesn't have to detect the thing you're looking for in order to help you find it.

The low-resolution ultrasound reconstruction may not be sufficient to reveal a tumour directly. But it can still reveal enough about the surrounding environment to help another measurement system detect what matters.

In manufacturing, an inexpensive sensor might not be capable of identifying a defect directly, but it may provide enough information to allow a more sophisticated inspection system to focus its search.

In process control, one measurement may not provide the critical variable, but may dramatically improve the accuracy of a model estimating it.

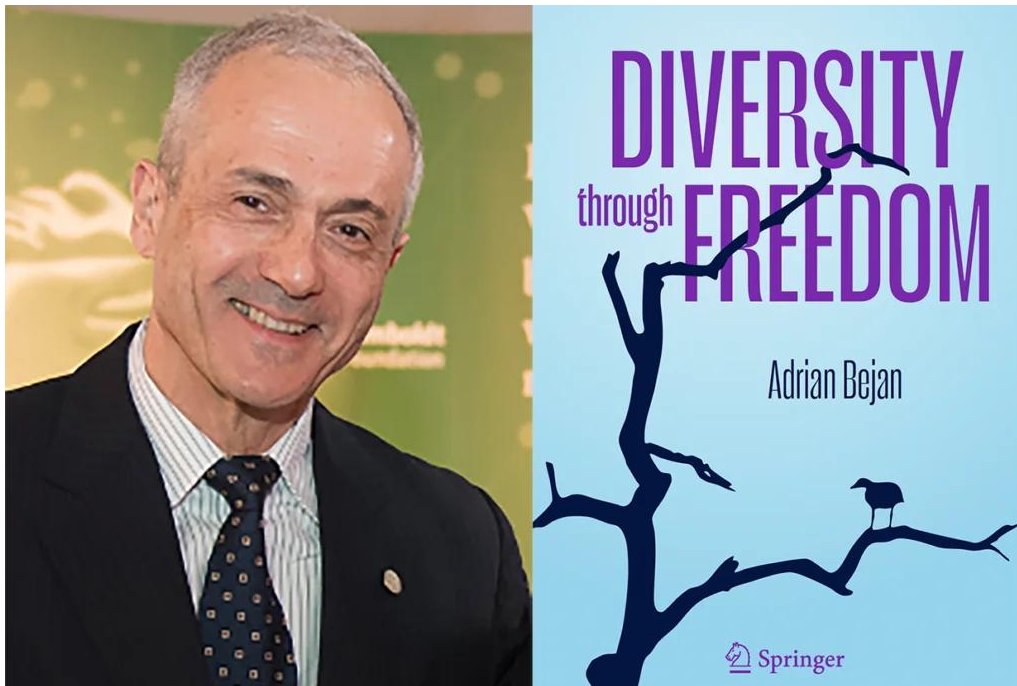
In diagnostics, a weak signal may not be useful on its own, but can become valuable when combined with information from another physical phenomenon.

The lesson is that information has value in context. Inventive thinking is often about expanding the system boundary

There is a tendency to treat difficult technical problems as though they belong to one component. The sensor is inaccurate. The algorithm is slow. The material is too weak. The process is inefficient. And so the innovation effort focuses increasingly narrowly on that one element.

TRIZ encourages us to do something different: expand the system boundary and look for resources elsewhere. And that's what the Manitoba team has demonstrated very elegantly in US12,721,595, our Patent of the Month for this month.

Best of the Month – Diversity Through Freedom



*“And when there are enough outsiders together in one place,
a mystic osmosis takes place and you're inside.”*
Stephen King

*“Nature has a mind of its own.
Perfection: you can imagine it, but it never comes.
Diversity: you can't imagine it, but it always comes.
The source of diversity is freedom, it is nature itself.”*
Adrian Bejan

Adrian Bejan is a Thermodynamicist.

So am I.

Which perhaps explains why I approached his latest book, *Diversity Through Freedom*, with a mixture of anticipation and trepidation.

Anticipation, because there are few things more appealing to a Thermodynamicist than the possibility of discovering that the principles governing the movement of heat, mass and energy might also help us better understand the movement of ideas, people, organisations and societies.

Trepidation, because analogies between one domain and another are easy to make. The difficult part is determining whether the analogy genuinely reveals an underlying mechanism... or merely provides an intellectually attractive way of describing something we already know.

The good news is that, when Bejan is good, he is very good indeed.

The slightly less good news is that he isn't always good.

Which is why this is not a book to accept wholesale.

But it is most definitely a book worth reading.

The Thermodynamics of Everything?

Readers familiar with Adrian Bejan's work will know his enthusiasm for looking for common principles across very different domains. In *Diversity Through Freedom*, the scope is ambitious. Thermodynamics, nature, science, creativity, innovation, economics, politics, education and society all find their way into the discussion.

The central theme is contained neatly in the quotation above: diversity is something that emerges naturally when there is freedom for different things to move, develop and find their own paths. That is a fascinating idea. And, for those of us interested in innovation, it has obvious resonance. Innovation rarely emerges from everybody doing the same thing. New solutions require exploration. Exploration requires the possibility of taking different paths. And different paths inevitably mean that some will succeed, some will fail and some will lead somewhere nobody expected. In other words, diversity is often an *outcome* of freedom rather than something that can simply be specified as an objective and then imposed. That distinction lies at the heart of Bejan's argument. It is also where some of the book's most provocative observations emerge.

Freedom, Diversity and the Law of Unintended Consequences

Bejan grew up in communist Eastern Europe. That experience clearly informs much of his thinking about the difference between allowing systems to evolve and attempting to prescribe what they should become. This leads him into some controversial territory, particularly when discussing contemporary attempts to engineer diversity through institutional policies and targets. Whatever one's political starting point, however, there is an important systems question here.

What happens when we confuse a desirable emergent outcome with something that can be successfully created simply by imposing its appearance?

That is not a question limited to politics. Innovation managers do it. Organisations do it. Governments do it. Educators do it. We decide that we want more creativity, more innovation, more diversity of ideas or more entrepreneurship... and then set about designing processes intended to manufacture the desired result.

Sometimes this works. But sometimes the intervention changes the system in ways that produce consequences nobody intended. The Law of Unintended Consequences is rarely cancelled simply because our intentions were noble.

This is one of the areas where Bejan is at his most thought-provoking. He is not afraid to ask what happens when collective objectives begin to constrain individual freedom. And whether, paradoxically, attempts to produce a particular form of diversity may ultimately reduce the very diversity they seek. Readers will not necessarily agree with all of his conclusions. Nor should they. But disagreement is not the same thing as dismissal. Indeed, one of the pleasures of the book is that even where Bejan's argument fails to persuade completely, it often succeeds in making the reader think more carefully about what they themselves believe.

When the Analogies Work

Much of the book is strongest when Bejan is dealing with systems that evolve over time. He understands that change is not linear. He understands the importance of development, growth and progression. He understands S-curves. And he understands that successful systems frequently contain tensions between apparently opposing requirements. This latter point is particularly interesting from a Systematic Innovation perspective.

Although Bejan sometimes appears to describe such phenomena as “analogies”, many look much more like contradictions. And contradictions, of course, are where things start to get interesting.

Progress frequently requires apparently opposing conditions to coexist. We want stability, *but* we also need change. We want efficiency, *but* we also need exploration. We want to exploit what we already know, *but* we must also discover what we don't yet know. These are not merely interesting similarities between different things. They are fundamental tensions within systems. And it is in these parts of the book that Bejan's broader thesis connects most naturally with the world of innovation.

Freedom without direction can become chaos.

Control without freedom can become stagnation.

The interesting question is not which of these conditions is “right”, but how successful systems manage the contradiction between them. Or, better yet, manage to find a ‘third way’ that transcends the binary. That is territory with which Systematic Innovation readers should feel very much at home.

When They Don't

Unfortunately, not every thermodynamic parallel is equally convincing. This may be one of the hazards of writing a book that attempts to connect thermodynamics to almost everything. Once you begin to see a powerful pattern, there is a temptation to see it everywhere. Sometimes the connection is profound. Sometimes it is merely poetic.

And occasionally, at least to this Thermodynamicist, the connection seems to require rather more suspension of disbelief than the author appears to realise. That doesn't invalidate the entire exercise. Far from it. Some of the most useful ideas in science and innovation have emerged from asking whether an apparent similarity might indicate a deeper connection. But an analogy (as in ‘analogy’ rather than ‘contradiction’) is not a proof. Nor does the use of thermodynamic language automatically make a social or organisational argument thermodynamic.

So, this is perhaps the most important advice I would offer to readers of *Diversity Through Freedom*: enjoy the intellectual journey, but keep your critical faculties switched on.

Which, interestingly enough, is entirely consistent with one of Bejan's own central messages. He argues passionately for freedom and questioning. It would therefore be rather ironic if we responded to his book by accepting everything he says without question.

Freedom to Question

One of the strongest threads running through the book is Bejan's defence of intellectual independence. He is deeply suspicious of groupthink, conformity and the increasingly industrialised nature of much modern science. There is a thermodynamic logic to some of this, but there is also something more fundamental: new ideas rarely emerge because everybody agrees.

Which brings us to another important connection with innovation. The objective of an innovation process should not be to maximise agreement. Agreement may eventually be necessary in order to implement something. But agreement is not the same thing as creativity, and consensus is certainly not a reliable measure of correctness. History is full of ideas that were initially supported by very few people. It is equally full of ideas supported enthusiastically by large numbers of people that turned out to be wrong.

Bejan puts the point rather more forcefully: *“Many in academia make the mistake of equating the goodness of an idea with the number of authors who agree with that idea. The history of science proves this to be false. Science is not about counting people. All individuals are not equally imaginative. All opinions are not equally important. Science is not democracy.”*

And, lest we imagine that replacing consensus with resources solves the problem: *“Many make the mistake of equating the goodness of ideas with the volume of research funding, people hired, money spent and buildings built. The history of science proves this to be false. Science is not the amount of money spent. Dollars spent are not equally important. Science is not accounting.”*

Both quotations offer a suitably uncomfortable reminder. Popularity is not proof. Consensus is not proof. Money is not proof. And neither is authority. The best ideas do not become good because enough people agree with them. Nor do bad ideas become good because sufficient resources have been committed to them.

The Verdict

Diversity Through Freedom is definitely not a book to accept wholesale. Some of its analogies are illuminating. Some are questionable. Some of its arguments will produce enthusiastic agreement. Others may produce vigorous disagreement. And, occasionally, the Thermodynamicist in me found myself less convinced by the thermodynamics than by the observation Bejan was attempting to explain.

But that is not a reason to reject the book. Perhaps, rather, it is a reason to recommend it. At its best, *Diversity Through Freedom* provides a powerful set of lenses through which to look at creativity, innovation, science and society. It reminds us that successful systems evolve; that diversity frequently emerges rather than being designed; that exploration requires freedom; and that attempts to control complex systems often produce consequences that their designers did not anticipate.

Most importantly, it encourages questioning. And if there is one thing that readers should do while reading Adrian Bejan, it is exactly that. Question him. Agree with him where the argument works. Disagree where it doesn't. Follow the analogy where it reveals something useful. And abandon it where it has stretched beyond its breaking point. That may, ultimately, be the best way to read a book whose central message is a defence of freedom. Because intellectual freedom includes the freedom to disagree. And perhaps Bejan himself would approve of that.

“I cannot teach creativity.

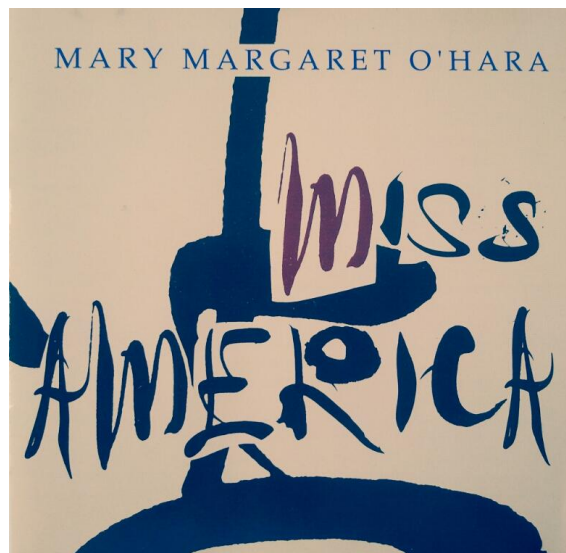
I cannot teach students to forget their indoctrination, in conformism, collectivism & groupthink.

I can teach what is considerably more powerful – freedom & questioning

– which may unleash the creativity dormant in them.’

“Over time, the science improved by revolution tends to usurp the authority of academicians and politicians. Such changes are much slower under totalitarianism where false science and groupthink are raised to the level of truth.”

Wow In Music – Miss America



Some albums arrive with years of anticipation behind them. Others appear almost by accident, seemingly from nowhere, sounding unlike anything that had come before. 'Miss America', Mary Margaret O'Hara's only full-length studio album, belongs emphatically in the second category.

Released in 1988, it immediately attracted an extraordinary level of admiration from critics and fellow musicians alike. Elvis Costello, Morrissey, Michael Stipe and Rickie Lee Jones all became vocal admirers. Kate Bush once described O'Hara as "extraordinary". Yet despite this acclaim, despite producing one of the most startlingly original debut albums of its era, O'Hara never followed it with a second studio album. Over the ensuing decades she has occasionally surfaced with soundtrack contributions, guest appearances, EPs and live performances, but Miss America remains her only complete statement.

That alone makes it one of popular music's great mysteries. How does someone capable of producing an album this inventive apparently decide that one is enough?

Part of the answer may lie in a revealing interview conducted years later. Asked why she had released so little music since Miss America, O'Hara explained that, for her, the exciting part was always the arrival of an idea. Once a melody appeared, or a lyric found its shape, the creative thrill had already happened. Everything afterwards felt like mere mechanics.

For most artists, the song begins with the idea. For Mary Margaret O'Hara, the song may already have ended there.

It's a fascinating inversion of one of innovation's best-known quotations. Thomas Edison famously observed that genius is "one percent inspiration and ninety-nine percent perspiration."

Listening to Miss America, one begins to wonder whether O'Hara lived almost entirely inside that elusive one percent.

Fortunately for the rest of us, just once, all the remaining ninety-nine percent somehow aligned around her. The result is one of the most astonishing debut albums ever recorded. What makes Miss America remarkable isn't simply that the songs are unusual. Plenty of albums are unusual. What makes it remarkable is the sheer number of moments where expectations are quietly but completely subverted. Every track seems to discover a slightly different way of making familiar musical language feel unfamiliar again.

The opening track, 'To Cry About', announces this intention almost immediately. Before O'Hara's voice fully enters the picture, producer Michael Brook establishes a sonic landscape using his then newly-developed (Principle 20) "Infinite Guitar". Rather than behaving like a conventional electric guitar, notes seem almost suspended in time, sustaining and evolving instead of naturally decaying. The instrument doesn't simply accompany the song; it changes our perception of musical space itself. Instead of hearing chords, we hear atmosphere. Instead of progression, we experience suspension.

From a Systematic Innovation perspective this is a beautiful example of resource utilisation. Brook isn't adding more instruments or greater complexity. He's changing the behaviour of an existing resource, allowing time itself to become part of the arrangement. The result creates emotional possibilities that simply weren't available to conventional guitar playing.

Against this shimmering backdrop O'Hara's voice arrives almost tentatively, refusing to obey the rhythmic certainties most singers instinctively embrace. Her phrasing feels less like performance than discovery, as though she is encountering each line for the first time. It's an extraordinary opening, and immediately tells the listener that this album will not be constrained by familiar conventions.

'Anew Day', one of the album's best-known singles, later explores a different form of innovation. Most singers deliver melodies as though they already know exactly where every phrase is heading. O'Hara often sounds as though she doesn't. Not because she lacks control, but because she deliberately inhabits (Principle 22) uncertainty. Individual notes stretch unexpectedly, rhythms hesitate, phrases arrive fractionally earlier or later than anticipated. The (Principle 3) effect is deeply human. Rather than demonstrating technical perfection, she captures something far more elusive: the sensation of thought becoming emotion in real time. Innovation often emerges not by eliminating uncertainty but by learning to work with it. 'Anew Day' demonstrates exactly that principle. The apparent fragility of the performance becomes its greatest strength. The song feels permanently on the edge of becoming something else, yet never loses its coherence.

That willingness to inhabit uncertainty may explain why the album continues to sound so contemporary nearly four decades later. Trends date. Authentic uncertainty rarely does.

If 'Anew Day' explores rhythmic freedom, 'Year in Song' demonstrates another aspect of O'Hara's remarkable imagination: her instinct for emotional architecture. The song seems to resist obvious structure. Rather than building neatly towards conventional climaxes, it unfolds organically, each phrase appearing to grow naturally from the one before. Melody, lyric and arrangement seem to be engaged in continuous conversation, none dominating the others. The boundaries between composition and improvisation become intriguingly blurred. Again, what impresses isn't technical complexity for its own sake, but the confidence to ignore established solutions. Popular music has accumulated thousands of unwritten rules about how songs should develop, where emotional peaks should occur, how melodies should resolve and how singers should phrase. O'Hara appears blissfully uninterested in almost all of them.

Yet the result never feels experimental in the self-conscious sense. It simply feels truthful.

Perhaps that's because she isn't trying to be different. She's trying to be sincere.

Which brings us to another of the album's finest moments, 'Body's In Trouble'. Innovation often emerges from resolving contradictions – finding ways to achieve two apparently incompatible objectives simultaneously. TRIZ formalised this observation across engineering, but the principle appears everywhere creativity flourishes. 'Body's In Trouble' feels built around precisely such a contradiction.

The performance is simultaneously vulnerable and uncompromising. Fragile and immensely powerful. Intimate and strangely theatrical.

Most singers choose one emotional position and inhabit it consistently. O'Hara somehow occupies (Principle8) opposing emotional states at exactly the same moment. The listener is never entirely certain whether they are hearing confidence collapsing into uncertainty or uncertainty discovering unexpected strength.

The contradiction never resolves. It simply becomes the song.

That's an extraordinarily difficult thing to achieve artistically because our brains instinctively seek emotional consistency. O'Hara refuses to provide it. Instead, she asks the listener to hold conflicting interpretations simultaneously.

Innovation often asks exactly the same thing.

The more one listens to 'Miss America', the more apparent it becomes that its originality isn't driven by novelty for novelty's sake. None of these ideas feels calculated. None feels designed simply to surprise. Instead, the album sounds like the natural consequence of someone following their own creative instincts wherever they happened to lead, entirely unconcerned about whether those instincts conformed to accepted musical practice.

Which brings us back to that extraordinary interview.

Once she'd discovered the melody...

Once the lyric had appeared...

The excitement was already over.

From one perspective, that's almost incomprehensible. Most of us spend our lives trying to bring ideas into reality. We assume the difficult part is implementation. O'Hara appears to have experienced the world almost in reverse. Discovery itself contained the reward. Execution was simply administration.

This raises an intriguing question for innovation. What if Edison was wrong?

Not because perspiration doesn't matter – it clearly does – but because inspiration and perspiration aren't percentages of the same phenomenon. They're different capabilities altogether.

Systematic Innovation has long argued that innovation isn't one skill. It is a collection of distinct capabilities that work together. Discovery. Development. Evaluation. Implementation. Diffusion. Learning. Organisations often talk about "being innovative" as though these capabilities were interchangeable.

They aren't.

Mary Margaret O'Hara may represent one of the purest examples imaginable of someone whose extraordinary gift lay almost entirely in discovery. She appears capable of finding musical territory that few others could even imagine, yet apparently had remarkably little interest in repeatedly travelling the long road from inspiration to finished product. "in some ways I think that if you have an idea, why do you have to make it?"

Edison represented almost the opposite philosophy. Ideas were merely beginnings. The real work lay in turning those beginnings into reality.

Neither perspective is complete on its own.

Without O'Hara's, the world risks becoming brilliantly efficient at improving yesterday's ideas. Without Edison's, tomorrow's ideas never escape the notebook.

Innovation needs both. Innovation is both.

Perhaps that's why 'Miss America' feels so singular. For one remarkable moment, someone possessing an astonishing instinct for invention found herself surrounded by exactly the right collaborators, producers and musicians to carry those discoveries all the way through to completion. Michael Brook's production, the extraordinary ensemble performances and O'Hara's own fearless originality combined to produce something that none could quite have achieved alone.

It's tempting to wish there had been ten more albums. Perhaps twenty. Perhaps an entire career's worth. But maybe that's the wrong way to think about 'Miss America'?

Some works don't need companions. They exist almost outside chronology, complete in themselves, reminding us not only what creativity can sound like but also how strangely creativity itself sometimes behaves.

One reviewer captured the achievement perfectly: "Rarely has the language of popular song been so delicately and deftly subverted. Mary Margaret O'Hara has reinvented sincerity."

Few debut albums deserve a sentence like that.

Fewer still earn it quite so completely.

And perhaps the deeper lesson reaches far beyond music.

Edison was probably wrong.

Not because inspiration matters more than perspiration, or vice versa, but because they are not opposite ends of the same scale. They are different forms of genius. The truly remarkable innovations – the ones that change industries, organisations, or occasionally music itself – appear when those different forms of genius find each other, each contributing exactly what the other cannot.

Investments – Deadly Flowers



Larkspur can kill your cattle. Wolfsbane can kill you. So naturally, both may become the source of the next generation of medicines. That, at least, is the delicious contradiction at the heart of this month's Investment of the Month. Researchers from Michigan State University and the Czech Academy of Sciences have recently taken an important step towards understanding how these two notoriously poisonous plants manufacture one of nature's most complex families of chemicals: the diterpenoid alkaloids. These molecules can cause severe nerve damage and paralysis at extraordinarily low doses.

In true, 'even the bad stuff is good stuff' fashion, their remarkable biological potency also means that compounds from this family may have applications in areas including pain relief, malaria, cancer and agricultural pest control.

Which brings us to the inventive twist. The trick is not to tame the poison. It is to understand the system that makes it...

A Molecule Too Complicated to Make

Plants are, without doubt, among the world's most accomplished chemists. Over hundreds of millions of years, they have evolved an astonishing array of specialised chemicals, many originally developed as defence mechanisms against predators, pathogens and competitors. Humans, of course, have spent much of our own history discovering that these same molecules can be useful. Caffeine. Capsaicin. Menthol. Vanillin. And an enormous number of modern medicines that either come directly from plants or were inspired by plant chemistry.

Wolfsbane and larkspur take this capability to another level. Both produce diterpenoid alkaloids: extraordinarily complicated molecules assembled through multi-step biochemical pathways that scientists have struggled to understand for decades. One of the best-known members of the family is aconitine, a molecule isolated nearly 200 years ago. Despite two centuries of progress in chemistry, however, scientists have still not succeeded in reproducing aconitine through a practical laboratory synthesis.

Which presents a rather familiar contradiction. We want the molecule. But we cannot make the molecule. At least, not in the way we normally think about making things.

The conventional approach to such a problem is obvious. Take the final molecule. Study its structure. Then attempt to construct it. The more complicated the molecule, however,

the more difficult that becomes. Nature has already solved the problem. The interesting question, therefore, is not: How do we make aconitine? It is: How does the plant make aconitine?

And that is where the Michigan State and Czech Academy teams have been focusing their attention. Rather than trying to reverse-engineer the final product molecule by molecule, they have been searching for the biological assembly line. Which genes are switched on? Which enzymes perform each transformation? In what sequence do the transformations occur? What raw materials are actually being used?

The result is an important shift in the way the problem is defined. Instead of attempting to reproduce the product, the researchers are attempting to reproduce the process that generates the product.

The System Decides

The researchers have now identified six enzymes involved in the early stages of the pathway leading to atisinium, a member of the diterpenoid alkaloid family. They then transferred the relevant genetic instructions into tobacco plants. The tobacco did not need to be chemically transformed into wolfsbane. It did not need to become larkspur. It simply needed to be given a new set of instructions. And then the system got on with the job.

This is where the story connects rather beautifully with a theme that has appeared several times recently in these pages: the system decides. The researchers do not have to specify every bond formation and every chemical transformation. Instead, they discover enough of the system's underlying rules to allow a living organism to execute the chemistry.

The innovator's role changes. Instead of: Design → Make → Optimise

We increasingly see: Understand → Set the conditions → Let the system generate the answer

This is the same broad pattern we see emerging in AI, generative design and evolutionary algorithms. The objective is not necessarily to design the final answer. The objective is to design a system capable of discovering or generating the answer.

And here lies the central contradiction. The extraordinary biological activity of diterpenoid alkaloids is precisely what makes them dangerous. But it is also precisely what makes them potentially useful. A classic Principle 22, *Turn Harm into Benefit* situation. The poison is not simply something to eliminate. The harmful property is not a nuisance sitting alongside a useful property. The extraordinary potency is both. The problem and the potential solution arise from the same underlying phenomenon.

The inventive challenge is therefore not to destroy that potency. It is to understand it sufficiently well that useful aspects of the chemistry can be separated, redirected and exploited. Don't Use the Factory. Transfer the Algorithm.

Then there is another contradiction embedded in the story. The plants are extremely good at making these molecules. Unfortunately, they are not necessarily very good factories. Specialised metabolites are often produced in tiny quantities, slowly, and only under particular biological conditions. So: We want nature's extraordinary chemical capability. But we don't necessarily want nature's production system.

Again, rather than accepting a compromise, the researchers have found a way to separate the two. Don't harvest the molecule. Don't attempt to manufacture the molecule conventionally.

Extract the instructions.

Once the biological pathway is understood, the relevant genetic information can potentially be transferred to another organism better suited to producing useful quantities of the desired chemistry. The plant that evolved the solution is no longer necessarily the plant that manufactures it. That gives us a wonderfully transferable innovation principle: If a system is good at generating the answer but poor at delivering it, don't necessarily replace the system. Transfer the algorithm.

In other words, don't copy the factory. Copy the factory's operating instructions. And let the system surprise you.

Perhaps the most satisfying part of the research is that the system also appears to have corrected the researchers' expectations. In attempting to understand where the nitrogen in these alkaloids came from, the team initially had one expectation. The evidence pointed elsewhere. The pathway appears to prefer ethanolamine as the nitrogen source rather than the ethylamine that might have been expected.

Which provides another useful reminder. When investigating a complex system, it is very tempting to begin with an answer and then look for confirmation. The more powerful approach is to allow the system to reveal what it is actually doing.

The system decides. Our job is to listen.

The Final Lesson

There is a final, rather human, twist to this story. The researchers from Michigan State and the Czech Academy were independently working on related problems involving two different poisonous plants. They met at a conference. At that point, they had a choice. Compete. Or collaborate. Fortunately, they chose the latter. The result was a combined effort capable of revealing more of the underlying biosynthetic pathway than either isolated effort might have achieved alone.

Which perhaps offers one final inventive principle: when two systems are trying to solve the same problem, don't always ask which one will win. Sometimes the better answer is to connect them.

The work is still at an early stage. It would be wrong to suggest that wolfsbane-derived cancer drugs – or tobacco-grown aconitine – are suddenly around the corner. The researchers have not recreated the complete diterpenoid alkaloid pathway. Nor have they synthesised aconitine. What they have done is arguably more important at this stage. They have found an entrance to a biological assembly line that has remained largely inaccessible. Six enzymes. A key intermediate. An unexpected nitrogen source. And, most importantly, a route towards understanding the system that nature uses to construct one of its most complicated families of molecules.

Read more: Garret P. Miller, Lana Mutabdzija-Nedelcheva, Trine B. Andersen, Imani Pascoe, Kathryn Van Winkle, Maryam Sabbaghan, Alexandre Bouillé, Tomáš Iliaš, Andrej Tekel, Tomáš Pluskal, Björn Hamberger. Characterization of the entry steps in diterpenoid alkaloid biosynthesis. *Molecular Plant*, 2026; DOI: 10.1016/j.molp.2026.05.022

Generational Cycles – Can We Talk About This?

(Sex, Embarrassment and the Changing Rules of Growing Up)



The most extraordinary thing about the Netflix series, *Sex Education*, is that its central character is perhaps the least qualified sex educator in television history. Otis Milburn is a virgin. He is anxious, awkward, neurotic and spectacularly uncomfortable with the practical reality of sex. His mother is a sex therapist, which means that he has grown up surrounded by an extraordinary amount of information about sex while remaining almost entirely inexperienced at the thing itself.

And yet, somehow, people start coming to Otis for advice. This is perhaps the perfect metaphor for Gen Z coming of age.

Because *Sex Education* isn't really a show about sex. Nor, despite its title, is it primarily a show about teaching young people how to have sex. It is a show about what happens when a generation decides that the first step towards dealing with something embarrassing is to *talk about it*. Sex. Desire. Consent. Identity. Anxiety. Rejection. Body image. Loneliness. Pleasure. Grief. The fear that everybody else understands something that you don't.

Otis doesn't possess the answers because he has lived through the experiences. He possesses them because he has learned how to listen, ask questions and help other people articulate what they are experiencing. The person with no experience becomes the person everyone comes to for advice. It is difficult to imagine a more elegant metaphor for the generational journey that coming-of-age movies have taken over the last seventy years. And *Sex Education* is only one end of that journey. The darker, more troubled *Euphoria* provides another contemporary view of adolescence: sexuality, identity, addiction, social media, desire and vulnerability, but without the relative optimism of *Sex Education*. Both shows suggest that the definition of "coming of age" has become considerably larger than it once was.

The teenage problem is no longer simply: How do I become sexually experienced? It has become: How do I become a person?

And perhaps more importantly: How do I work out the rules for doing that when nobody seems entirely sure what the rules are?

That question takes us back through the generations. Because every generation has had to grow up. Every generation has had to discover sex, romance, embarrassment, rejection and status. Every generation has had to work out what is permissible, what is forbidden and what happens when desire collides with the rules of the society around it. But the rules themselves have changed. And so has the way young people respond when they break them.

The Silent generation: What are the rules?

The first stop on our journey is the Silent generation, the previous Artist generation. Their coming-of-age stories belong to a world in which sex is surrounded by rules. Not necessarily clearly articulated rules. Quite the opposite.

The rules are often implicit. What respectable people do. What respectable girls do. What respectable boys do. What can be said. What mustn't be said. Who can desire whom. Who is allowed to initiate. What happens after the kiss. Where romance is supposed to lead. The adolescent doesn't necessarily know all the rules. That is part of the problem. They have to infer them.

Rebel Without a Cause is a particularly useful bridge into this world because James Dean's Jim Stark is ostensibly rebelling against almost everything around him, but the rebellion is taking place inside an extraordinarily structured social world. The teenagers aren't simply trying to have fun. They're trying to work out how to be adults. What does masculinity mean? What does femininity mean? What does it mean to be respectable? What does it mean to be brave? What does it mean to be accepted? And, lurking underneath all of this, what happens when the things you want don't fit the rules you've inherited?

This is the first generational question: *What are the rules?*

The question itself tells us something. There are rules. They may be ridiculous. They may be unfair. They may be impossible to follow. But they exist. And the adolescent task is to discover them.

The Boomers: Why should we obey them?

Then comes the Boomer generation. And suddenly the question changes. The rules are still there. But the emerging Boomer response is: *Why?*

That tiny word is revolutionary. The coming-of-age story changes from one of discovering the boundaries of acceptable behaviour to one of testing, challenging and ultimately rejecting them. *Animal House* is an almost perfect cultural artefact of this transition. The film is set in 1962, but made in 1978, and its outrageous college fraternity is really a Boomer fantasy of youth: drinking, sex, rebellion, stupidity, friendship and an almost heroic contempt for institutional authority. The Deltas don't merely want to have fun. They want to refuse the world that tells them how they ought to behave. Sex is part of the rebellion. Alcohol is part of the rebellion. Bad behaviour is part of the rebellion. The entire point is to demonstrate that respectable adulthood is not necessarily something worth aspiring to.

The Silent adolescent asked: What are the rules? The Boomer adolescent answers: *To hell with the rules.* And for a while, that feels like liberation. It is. But liberation creates a new problem: If the old rules are wrong, what replaces them?...

The Gen X Nomads: Are there any rules?

...This is where coming-of-age cinema becomes particularly interesting. At first glance, the Gen X years can seem remarkably tame compared with the sexual exuberance of *Animal House* or the later Heroic crudity of *American Pie*. John Hughes appears to be making movies about teenagers who mostly worry about dates, popularity, clothes and whether the right person will notice them. But that appearance is deceptive. The Gen X coming-of-age story isn't less interested in sex. It is interested in *the uncertainty surrounding sex*.

Consider *Fast Times at Ridgemont High*. It is much more sexually frank than the John Hughes stereotype suggests. Teenagers have sex. They talk about sex. There is manipulation, anxiety, pregnancy and abortion. People make mistakes. People lie. People misunderstand one another. And nobody really knows what they're doing. That is the crucial distinction.

The Boomer story says: the rules are stupid. Break them. The Gen X story says: *Fine. But nobody has given us a replacement handbook*. Sex becomes something the individual has to navigate. There is no reliable authority. Parents don't necessarily understand. Institutions don't necessarily help. Peers don't necessarily know any more than you do. So you improvise. That is deeply Nomad.

It is also why John Hughes matters. *Sixteen Candles*, *Pretty in Pink*, *Some Kind of Wonderful* and *The Breakfast Club* may be far less explicit than later coming-of-age stories, but they are saturated with questions about desire, status, identity, rejection and belonging. The sexual question has moved inward. It isn't simply: can I have sex? It is: *What does it mean that I want this person? What does it mean if they don't want me? What does it mean if everyone else seems to understand the rules and I don't?*

The Gen X adolescent discovers something that is both liberating and terrifying: *there may not be any rules*. So the Nomad learns to navigate.

The Millennials: Can we all agree this is embarrassing?

Then comes *American Pie*. And suddenly the coming-of-age movie becomes bawdy again. Very bawdy. But something has changed. The difference isn't really the amount of sex. It's the meaning of *embarrassment*. *Animal House* treats embarrassment as something respectable society imposes upon you. The appropriate response is not to care. *American Pie* understands embarrassment differently. It is inevitable. Jim's humiliations are almost operatic. The pie. The webcam. The premature ejaculation. The virginity pact. The glue. The endless catastrophes of teenage sexuality.

The astonishing thing is that the movie doesn't ask us to admire Jim for overcoming embarrassment. It asks us to *laugh at him*. And, crucially, to laugh with him. Something that feels profoundly Millennial. The adolescent experience is no longer primarily an individual confrontation with the rules. It is a shared social disaster. Everybody is making mistakes. Everybody is insecure. Everybody is trying to work out what everyone else knows. And so the solution to embarrassment becomes *collective laughter*.

The Boomer says: break the rules. The Gen X Nomad says: figure it out yourself. The Millennial Hero says: *we're all (heroically) screwing this up together*. That is an important change because laughter creates community. The thing that would once have been unbearable shame becomes something that can be shared. And *American Pie* is therefore much more than a crude sex comedy. It is a movie about the socialisation of

embarrassment. The humiliating experience of becoming an adult becomes entertainment precisely because everyone recognises themselves in it.

And then Gen Z arrives

Which brings us back to Otis. Except now the adolescent problem has become something much larger. The young person isn't simply trying to work out how to have sex. They are trying to understand identity, sexuality, consent, gender, mental health, relationships, trauma, boundaries, belonging and what it means to be comfortable inside their own skin. *Sex Education* takes all of those problems and does something that would have been almost unimaginable in the earliest coming-of-age movies. It talks about them. Openly. Repeatedly. Sometimes painfully. Often hilariously.

And that is where the generational spiral becomes visible. Because Gen Z has, in a sense, returned to the question asked by the Silent generation. What are the rules?

Only now the question has changed. It is: can we actually talk about this?

And that is a much deeper version of the 'what are the rules?' question from last time around the Generational merry-go-round. The Silent generation inherited rules largely in the form of prohibitions. Don't. Don't talk about it. Don't do that. Don't be seen doing that. Don't want that. Don't cross that boundary. Gen Z appears to be experimenting with a different kind of rule. Not prohibition. *Negotiation*. Ask. Listen. Consent. Explain. Respect. Don't assume. Talk. The old rules tried to control behaviour by specifying what was forbidden. The emerging rules try to make behaviour safer by making expectations explicit.

That is an extraordinary shift. And perhaps that is why Otis is such a perfect Gen Z metaphor. He doesn't become useful because he knows everything. He becomes useful because *he can help people talk about what they don't know*. His lack of experience is almost an advantage. He isn't dispensing wisdom from a position of authority. He is helping people discover their own answers. The person who doesn't know becomes the person others trust enough to ask.

The expanding definition of "coming of age"

Look back across this sequence and something else becomes apparent. The definition of coming of age has expanded.

For the Silent generation Artists, the challenge was largely about learning how to enter the adult social world.

For the Boomer Prophets, it became a challenge to reject the rules of that world.

For Gen X Nomads, it became learning to navigate a world in which the old rules could no longer be trusted.

For Millennial Heroes, it became an experience of discovering that everyone else was just as confused and embarrassed as you were.

And for Gen Z Artists, the challenge is increasingly to construct a language with which to talk about the complexity.

The subject has expanded from sex to **selfhood**.

And the medium has expanded from rebellion to conversation.

That's why *Sex Education* can be so sexually explicit without being fundamentally a sex show. Sex is the doorway. What lies behind it is the entire human problem. Who am I?

Who are you? What do I want? What do you want? How do I know? How do you know? What happens when our answers don't match? How do we negotiate that? Those are not teenage questions. They are human questions. The teenagers just happen to be encountering them for the first time.

The spiral turns

And this is where the generational pattern becomes particularly intriguing.

At first, it looks like a simple cycle.

Silent: What are the rules?

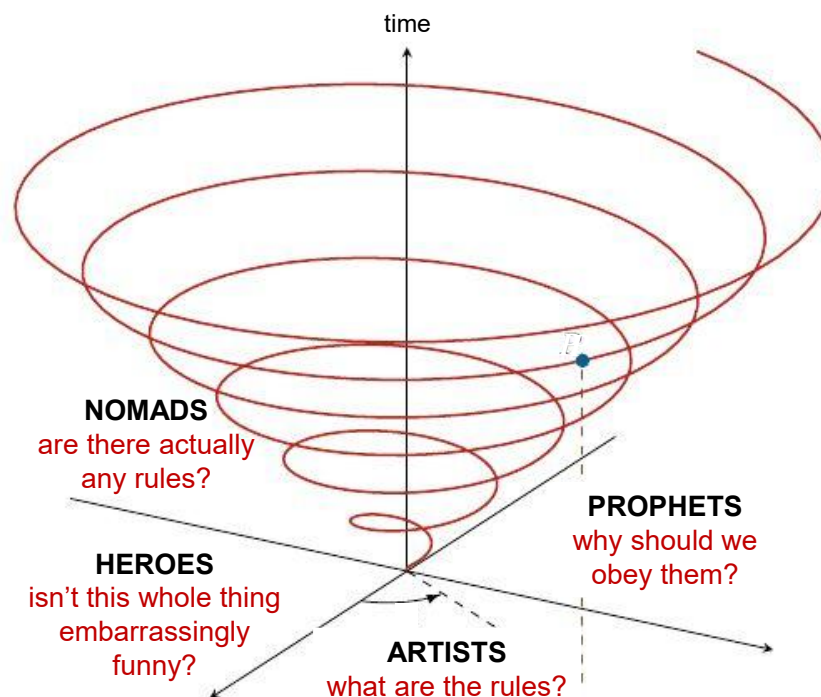
Boomer: Why should we obey them?

Gen X: Are there actually any rules?

Millennial: Isn't this whole thing embarrassingly funny?

Gen Z: Can we talk about it?

But perhaps it isn't really a cycle. It is a spiral. The same question comes around again, but at a different level. Gen Z has returned to the Silent generation's 'what are the rules?' question, yet they have arrived there after seventy years of rebellion, uncertainty and collective embarrassment. And consequently, the answer is different. The Silents inherited prohibitions. Gen Z is experimenting with negotiated principles.



The old rule was *Don't*. The new rule is *Ask*.

The old system tried to prevent embarrassment by preventing certain behaviours. The new system attempts to reduce embarrassment by making it possible to discuss those behaviours.

And perhaps it tells us something about generational change more generally. Each generation doesn't simply reject what came before. It inherits the previous generation's unresolved contradiction and attempts to solve it differently.

The Silent generation inherited a world in which sexuality was heavily constrained.

The Boomers broke the constraints.

Gen X discovered that breaking constraints didn't necessarily provide guidance.

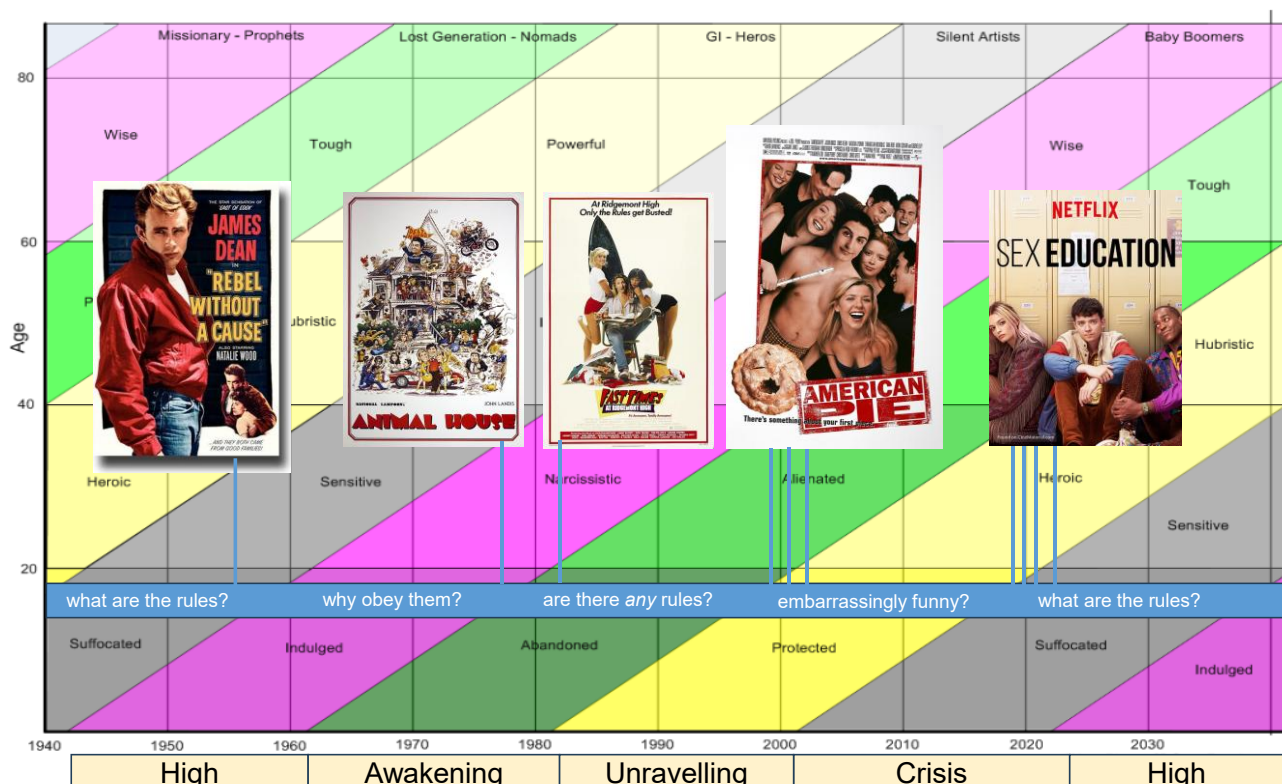
Millennials discovered that uncertainty could be made bearable through collective humour.

Gen Z is now asking whether uncertainty can be made productive through conversation.

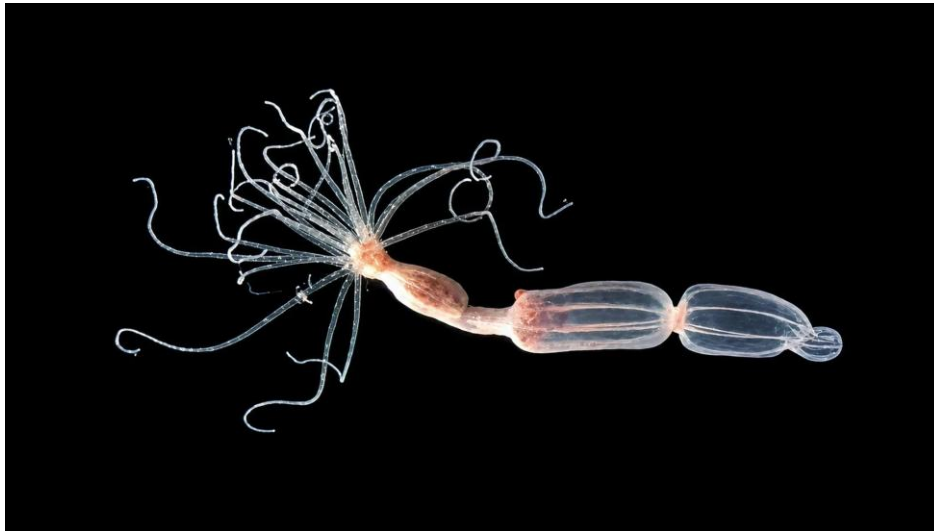
The spiral keeps turning.

And perhaps that is the real reason coming-of-age stories remain so fascinating. They aren't really stories about teenagers. They're stories about what a society thinks adulthood means. Every generation sends its adolescents into the world with a different answer. Some say 'here are the rules', others say, 'break them'. Others, 'Good luck. Work it out.' Others, 'don't worry, we're all idiots'. And now, perhaps, 'let's talk about it.' Which brings us back to Otis one last time. The boy who doesn't know how to have sex becomes the person *everyone* comes to when they don't know how to talk about sex. It is funny. It is awkward. It is slightly ridiculous. And it may be one of the most hopeful metaphors imaginable for the next turn of the generational spiral. Because perhaps growing up has never really meant learning all the answers. Perhaps it means becoming comfortable enough with uncertainty to ask better questions.

And perhaps the next generation's greatest innovation isn't that they have finally discovered the rules. It is that they are discovering that rules can be negotiated. That embarrassment can be discussed. That uncertainty can be shared. And that sometimes the person who knows least is the person best placed to help everyone else work out what they need to know. After all, Otis never needed to become the expert. He just needed to keep the conversation going.



Biology – Sea Anemone



The other way around. Why slowing the immune system makes it stronger. One of the pleasures of following scientific research is that every so often a result emerges that initially looks like a mistake. The researchers know what they expect to find. The experiments insist on telling a different story. That was exactly the situation facing a team of scientists studying the immune system of sea anemones.

Their goal seemed straightforward enough. Humans rely on a protein called MAVS to activate the body's antiviral defences. Sea anemones diverged from our evolutionary lineage more than 600 million years ago, so researchers hoped to discover how ancient this defence mechanism might be. When they identified a protein with a remarkably similar structure – subsequently named CARDIB – the expectation was obvious: it would perform essentially the same function.

It didn't. Quite the opposite. Instead of activating antiviral defences, CARDIB appeared to suppress them. At first glance, the discovery made little sense. Why would evolution preserve a protein that weakens the immune response to viral infection?

The researchers' disappointment quickly turned into curiosity. Rather than dismissing the unexpected result, they used CRISPR gene editing to remove the CARDIB gene from sea anemones before exposing them to viruses.

The outcome overturned their assumptions. Without CARDIB, the animals became *more* vulnerable to infection. Viruses multiplied more rapidly. Their antiviral defences were less effective. The very protein that appeared to suppress immunity turned out to be essential for mounting an effective immune response.

The contradiction is one that engineers encounter in countless other domains. To survive viral attack, the immune system needs to respond rapidly and powerfully. Yet responding too readily risks instability, overreaction and reduced effectiveness. In the language of the Contradiction Matrix, this is a conflict between improving Speed while avoiding Control Complexity. Here's what that problem looks like when mapped onto the Matrix:



The sea anemone's solution appears to embody two of these recommendations almost perfectly. The first is Principle 13, The Other Way Around. Our intuition tells us that stronger immunity should come from stronger activation. Evolution discovered the opposite. Instead of pushing the accelerator harder, install a brake. CARDIB suppresses immune activation under normal circumstances, yet this very suppression enables the immune system to perform more effectively when genuinely challenged.

Installing a brake only improves performance if it becomes part of a (Principle 23) feedback system. Modern control engineering has known this for generations. Aircraft remain stable because of negative feedback. Electronic amplifiers achieve precision through negative feedback. Cruise control, thermostats and countless industrial control systems all depend upon carefully balancing activation with inhibition.

The brake is not fighting the system, it is making the system work. Seen in this light, the sea anemone's immune system no longer appears paradoxical. Evolution has discovered a stable feedback architecture in which inhibition becomes an essential component of activation itself.

Perhaps the most fascinating aspect of the discovery is that evolution reached this solution independently. Humans and sea anemones separated more than 600 million years ago, yet both evolved highly effective antiviral defences using fundamentally different molecular mechanisms. The destination remained the same; the route proved entirely different.

For students of Systematic Innovation, this is precisely why biology continues to provide such a rich source of examples. Evolution does not know the Contradiction Matrix. It does not consciously apply Inventive Principles. Yet repeatedly, across millions of years of experimentation, it converges on the same families of solutions that engineers have independently discovered.

The lesson extends well beyond immunology. Whenever we find ourselves believing that better performance requires "more" of something, it is worth asking a different question: Could the real breakthrough come from introducing the opposite?

As the sea anemone reminds us, sometimes the most effective way to accelerate is first to install a brake.

Read more:

Ton Sharoni, Adrian Jaimes-Becerra, Sydney Birch, Hee-Jin Kwak, Daria Aleshkina, Magda Lewandowska, Joachim M. Surm, Hannah Justin, Reuven Aharoni, Adam M. Reitzel, Yehu Moran. An ancient anthozoan protein reveals an alternative evolutionary path of antiviral signalling. Nature Ecology, 2026; DOI: 10.1038/s41559-026-03112-3

Short Thort

*"Civilisations rarely collapse because they are conquered.
They collapse because they lose the will to defend themselves."*
James Burnham

Civilisations grow because they possess a **compelling asymmetry**, a reason why tomorrow is expected to be better than today.

That asymmetry can take many forms:

- a technological advantage
- a new source of energy
- a new organisational model
- a powerful belief system
- a strong shared identity
- abundant unexploited resources

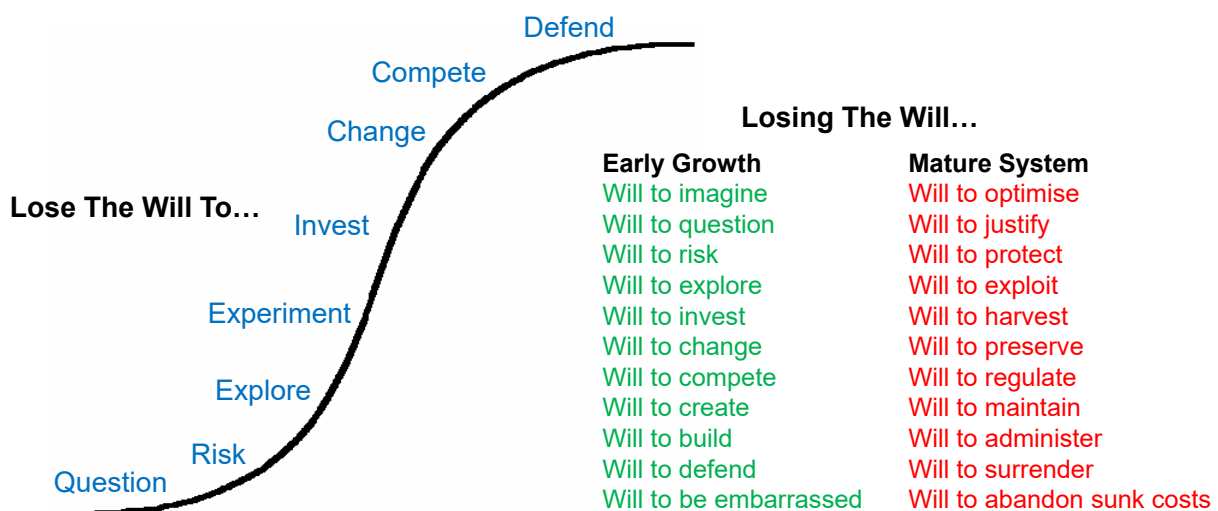
Whatever its origin, it creates positive expectation – ‘hope’ – which in turn justifies effort, sacrifice and investment. Once that asymmetry disappears, the civilisation gradually transitions from *creating* value to *protecting* value.

Civilisations don't grow because they become richer. They become richer because enough people believe tomorrow is worth investing in. Once that belief weakens, wealth becomes something to consume rather than something to multiply.

Civilisations collapse because they lose the will to defend themselves.

Civilisations grow because they possess the will to build themselves.

Civilisations are built by people willing to sacrifice the present for a better future. They decline when preserving the present becomes more important than creating the future.



News

TRIZCON

As the big North American TRIZ conference approaches (3-5 November – check out www.trizcon.org), we're happy to announce that in addition to the previously announced keynote by Darrell ('TRIZ in the Age of AI: From Trough of Disillusionment to the Next S-Curve'), we're also planning to use the event as the place we will be launching our SI multi-agent AI, Vela. 'VELA: From Creativity as an Exact Science to Systematic Innovation – Finding the Missing 99%' is the name of the paper, Shana Finnegan is the name of the lead author.

The 1%ers German Edition

We're happy to announce the publication of the German edition of our 1%ers book this month. You will find the softcover book at: <https://amzn.to/3SrcRj7> and the ebook version at: <https://amzn.to/4y55H38>. Big thanks to Robert Adunka and translator, Joachim Runck, for committing to the project and doing all the hard work.



DangerMouth

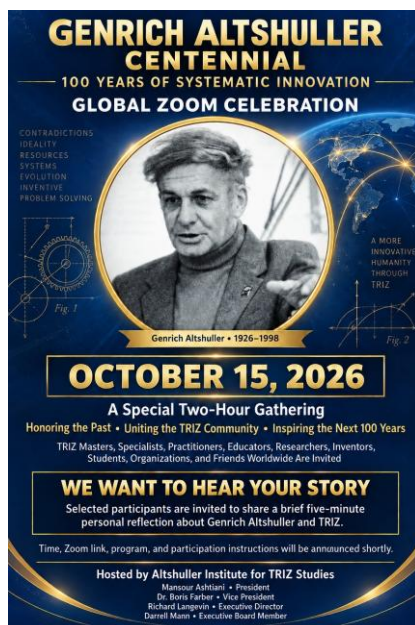
Season #4 got underway this month, with the first episode – a wide-ranging conversation with ultimate polymath, Dave Snowden (<https://bathmikec.podbean.com/e/s4e01estuarine-chatting-w-dave-snowden/>) – already available by the time you read this. Which is to say we're stepping up another gear with this series... I'm still having to pinch myself looking at the stellar list of guests who've agreed to come and talk to us about innovation in the coming months.

darrellmann.com

After what seems like a long break, it looks like Darrell has restarted his blog. You wait three years for a bus and then suddenly, four come along all at once. Including one that passes Demis Hassabis' 'Einstein Test' (<https://www.darrellmann.com/passing-the-einstein-test/>). Strangely enough, the million dollar prize money hasn't arrived yet. We'll let you know when it does. In the meantime, enjoy his thoughts on why we shouldn't be expecting AGI anytime soon. Find that one at <https://www.darrellmann.com/how-many-innovations-to-agi/>

15 October...

...marks the centenary of TRIZ founder and creator, Genrich Altshuller. The Altshuller Institute for TRIZ Studies, is inviting the worldwide TRIZ community to a special Global TRIZ Gathering on October 15, 2026. If you have an hour or two to spare on the day (11am East Coast time in the US, 4pm in the UK), it might just be the first time the whole TRIZ community is united. Lots of unseen and unheard Altshuller anecdotes and videos. No link as yet, but a Google search will get you there when it appears. No doubt Darrell will also Tweet the link when it lands.



New Projects

This month's new projects from around the Network:

- NGO – Volunteer Reorganisation Project
- NGO – Product Design Project
- Energy – Bulletproof Patent Project
- Energy – SRL2-4 Routemap Design & Planning Project
- Commodities – Innovation Dashboard Project
- Defence – Innovation Dashboards Project
- Automotive – SI Workshops
- Healthcare – TrenDNA Project
- FMCG – ConsumerDNA Project

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