

Systematic Innovation



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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.

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

Lies, Damn Lies And System Boundaries Redux: Why Every System Gives The Answer It Was Designed To Find

An intriguing coincidence last month. During public 1%er Workshops I've been running an exercise to get participants thinking about systems. Because everyone arrives with different interests, it's always a challenge to find a focus that will engage everyone in a breakout room team. My admittedly weak attempt to resolve that contradiction has usually been to offer several alternatives. Stephen Covey's Seven Habits Of Highly Effective People has always been one of them. Mainly because it contains the magic number 'seven' and the exercise uses the seven-element version of the TRIZ Law of System Completeness. That's not to say that I've ever actually done the exercise myself, or that there has been any presumption on my part that the Seven Habits were ever intended to form a system. Normally, none of the groups pick the Covey option. This week, two groups picked it. And, somewhat scarily, both ended up with quite different answers. Both of which, when the groups explained their rationale, seemed entirely plausible. That's part one of the coincidence. Part two is that, outside the workshop context, we've been having lots of discussions about system boundaries in recent weeks (check out the last two 1%er podcasts), and as a result of them, I've been thinking I need to update a blog post on the subject I wrote a few years ago, 'Lies, Damn Lies And System Boundaries' (<https://www.darrellmann.com/lies-damned-lies-system-boundaries/>). The Seven Habits exercise seemed like it offered a focus for the update. So, here we go.

Starting with the clearest facts in the story. *The 7 Habits of Highly Effective People* was published in 1989, and has sold somewhere between 25 and 40 million copies worldwide depending on source and date of measurement. That's already a pretty broad range of uncertainty. One that I think is interesting because it highlights an important systems issue. Namely that sales are easy to measure; effectiveness is not. In other words, how many of the 25 to 40 million people that bought the book become any more effective as a result of reading it?

This is where we hit a first system boundary question. Suppose we define:

Level 1 Success - Bought the book.

Level 2 Success - Read the book.

Level 3 Success - Understood the book.

Level 4 Success - Applied the habits.

Level 5 Success - Sustained application.

Level 6 Success - Became more effective.

Level 7 Success - Created positive effects for others.

The further down the levels we go, the less easy it is to measure, but also – naturally – the more important the question becomes. As best I can tell, no-one has made any attempt to meaningfully measure anything below the second level. But let's not let that prevent us from making a 'Systems Engineer's Guess', something informed by more generic research on learning outcomes. Let's start with 30 million copies sold as a round number. Then make conservative assumptions:

Stage	Percentage
Bought	100%
Read most of it	50%
Understood key ideas	30%
Tried Applying habits	20%
Sustained habits > 1 year	5%
Became measurably more effective	2%
Created positive spillover effects	1%

That would imply:

- 30 million sold
- perhaps 600,000 people genuinely became more effective
- perhaps 300,000 generated meaningful downstream societal benefits

Those numbers are entirely speculative, but they are not obviously unreasonable.

The First Boundary Problem

Here's a sequence of different boundaries we might draw around the book:

Publisher Boundary - the system ends when the book is sold. Success: 30 million copies.

Covey Boundary - the system ends when habits are adopted. Success: behaviour change.

Reader Boundary - the system ends when life improves. Success: effectiveness.

Society Boundary - the system ends when collective outcomes improve. Success: flourishing.

Note how the answer changes dramatically depending on where the boundary is drawn. The question is not: "Did readers become more effective?" The question is: "Compared with what?" Suppose someone reads *7 Habits*. Five years later they get promoted, improve relationships, and become healthier. Were those outcomes attributable to the book? Age and maturity? Career experience? Marriage? Luck? Selection bias?

This is the classic attribution problem.

A bit like pulling at a loose thread and unravelling the whole sweater, what makes *7 Habits* such an intriguing case study is that it exposes a widespread error in how success is measured. Most systems measure outputs. Few measure outcomes. Almost none measure impacts. And virtually nobody measures second-order consequences. Which means that from a systems perspective:

We can estimate the number of books sold with reasonable confidence.

We can only weakly estimate the number of people whose behaviour changed.

We can barely estimate the number who became more effective.

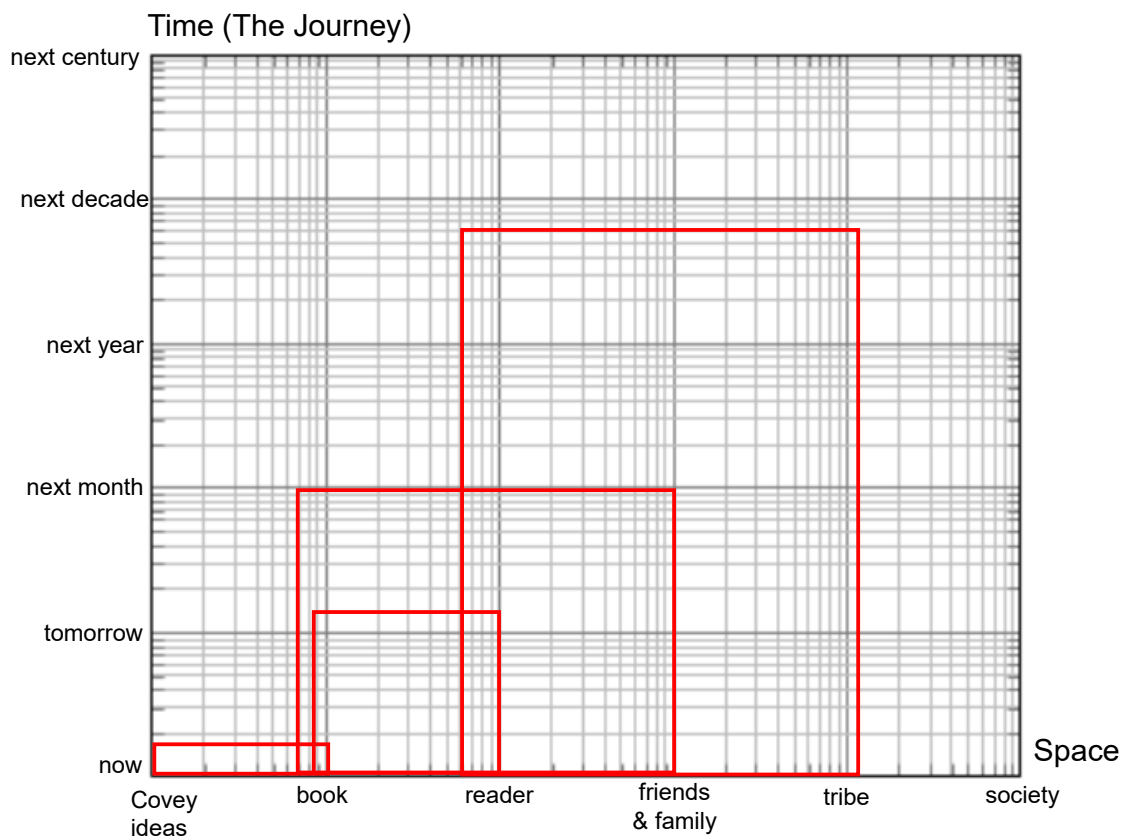
And we have almost no reliable way of measuring whether society became better as a consequence.

Modern civilisation has become extraordinarily good at measuring outputs and increasingly poor at measuring flourishing. We know clicks, views, sales, downloads,

engagement. But the further we move toward questions of effectiveness, resilience, identity formation, antifragility, flourishing, the weaker our sensors become.

Which is precisely why system boundaries matter so much. The moment we move the boundary from "book sold" to "human flourishing," we discover that the thing everyone assumes is being measured is often not being measured at all.

As we first tried to demonstrate in the Hands-On Systematic Innovation book, system boundaries have a space and a time dimension. And depending on where and when we draw those boundaries, the component parts of 'the system' can take on quite different forms, and, perhaps even more worryingly, purposes and outcomes. That was the primary thrust of the 'Lies, Damn Lies...' article: are electric vehicles better for the environment? Answer: it completely depends on where we draw the system boundaries.



My naively designed workshop exercise didn't make it clear what system boundaries might be relevant to the Seven Habits question. If the boundary is drawn around the book today, it has one purpose, if I draw the boundary around a person reading the book this week, it takes on a different purpose, and if I draw the boundary around the people that have to work with the person that read the book two years after they read it, it takes on a whole other purpose.

Here's what those differences look like in more detail:

Level 1: The Book as a System

The narrowest interpretation is that the purpose of the book is to communicate Covey's ideas. Not make people effective, transform organisations, or improve society. Simply to transfer knowledge from Covey to the reader. In this case the system breakdown looks something like this:

Element	Candidate
Coordination	Covey's philosophy
Tool	The book
Engine	Covey's experience and insights
Transmission	Language, stories, exercises
Interface	Reader
Sensor	Reader reflection/comprehension
Context	Reader's life circumstances

This is a complete system. But it is not the system most readers think they are buying.

Level 2: The Personal Transformation System

Here the book becomes merely one component in a system with the purpose of creating a highly effective person. Now:

Element	Candidate
Coordination	Personal mission/principles
Tool	Reader behaviour
Engine	Habits, motivation, character
Transmission	Practice routines and habit formation
Interface	Reader/self
Sensor	Self-awareness & feedback
Context	Life circumstances

And the interesting consequence is that the book is no longer the Tool, but rather has become the Engine input, or Transmission support. This feels much closer to Covey's intention.

Level 3: The Social Effectiveness System

Broadening the system boundary to include people beyond the reader requires us to recognise that effectiveness is not self-defined. It emerges through interaction. As such, the purpose of the system at this level is to generate beneficial outcomes in relationships and society. Now the system looks like this:

Element	Candidate
Coordination	Principles and values
Tool	Reader behaviour
Engine	Character and capability
Transmission	Habits and interaction processes
Interface	Other people

Sensor	Responses from others
Context	Family, workplace, society

This again feels very compatible with Covey. Especially Habits 4-6: Think Win-Win, Seek First to Understand, Synergise. Each of which is impossible to evaluate in isolation. Their success is judged externally. So, in many ways this may be the strongest interpretation.

Level 4: The Seven Habits Themselves as a System

My psychological inertia inducing motivation for including the Seven Habits as an option in the workshop exercise (seven habits = seven system elements) draws an even tighter system boundary, one that essentially forms around the ideas contained within the book. In my defence, I think it (accidentally) ends up being the most interesting one. Because the question becomes, Do the seven habits themselves constitute a complete system?

Here's what I think:

Habit 1: Be Proactive

Feels like: **Engine** – the source of agency. The energy source. The capability to act rather than react.

Habit 2: Begin with the End in Mind

Feels like: **Coordination** – defines purpose and direction. Provides navigation.

Habit 3: Put First Things First

Feels like: **Transmission** – translates purpose into action. Converts intention into operational priorities. The habit describes a process.

Habit 4: Think Win-Win

Feels like: **Interface** – defines how the system relates to others, and the outcomes that will help us to appear 'effective' in the eyes of others.

Habit 5: Seek First to Understand

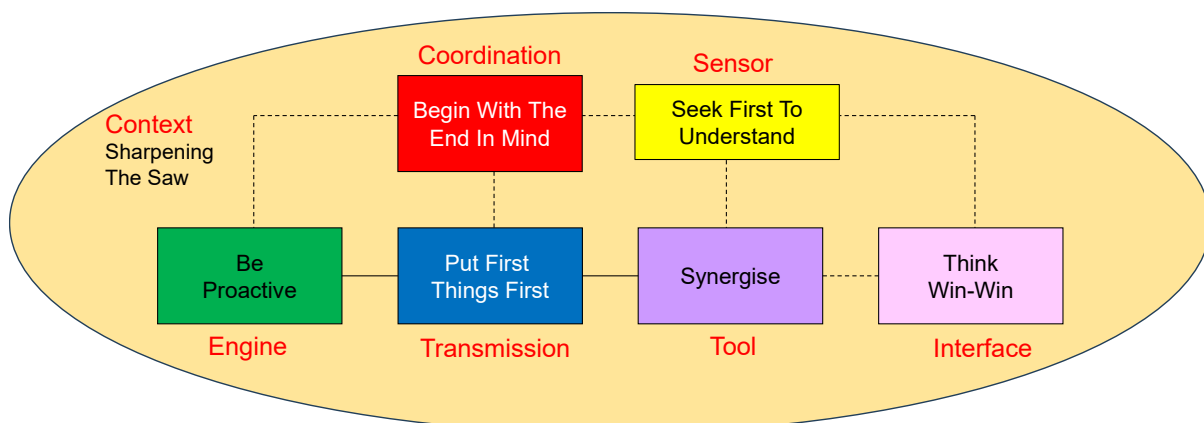
Feels like: **Sensor** – the observation mechanism. Collect information before acting.

Habit 6: Synergise

Feels like: **Tool** – the productive mechanism. The place where useful outcomes are generated.

Habit 7: Sharpen the Saw

Feels like: **Context** – we operate in a world of 'use it or lose it'. In a complex world, being effective requires a continuous learning journey.



I've used the term 'feels like' here because Covey wasn't designing against the Law of System Completeness. He was designing around a developmental sequence. In that sense the habits are more like self-governance, self-management, relationship management and renewal.

In other words the seven habits are a *journey*.

Not necessarily a system architecture.

This distinction is important. A roadmap describes how to move from one state to another. A system architecture describes what must exist at any given moment for the journey to succeed. The two are related, but they are not the same thing.

In this context, I perceive the seven habits are actually closer to a system development roadmap rather than the system itself. This would explain a lot.

The progression looks like:

Habit	Developmental Function
1	Create agency
2	Create direction
3	Create discipline
4	Create mutuality
5	Create understanding
6	Create collective effectiveness
7	Sustain capability

That sequence is coherent. But a journey is not the same thing as a system. Each stage of a journey, of course, requires the existence of a complete system in order to successfully complete it, but each different stage (i.e. where we draw the time dimension of the system boundary) may require very different system elements.

The Hidden System Covey Assumes?

I suspect Covey implicitly assumes the complete system already exists.

His habits focus almost entirely on:

- improving Coordination,
- improving Sensor quality,
- improving Transmission quality,
- improving Engine quality.

He pays much less attention to:

- Interface definition,
- Tool design,
- Context design.

Why? Because he assumes the reader already inhabits those. The reader already has a job, has relationships, exists in a society, and has opportunities to act. Covey is trying to improve the human operating system. Not redesign the surrounding system.

The TRIZ Critique of Covey

A paradoxical critique emerges: the 7 Habits book does not describe a complete system. Rather, it is a methodology for improving the human component inside an existing system.

That explains why it works.

And also why it sometimes doesn't.

Because many failures of effectiveness arise not from poor habits, but from broken Context, broken Interfaces, broken Tools, and dysfunctional Coordination structures. Problems Covey largely leaves untouched.

The Seven Habits, meanwhile, can be interpreted as at least four different systems depending on where we place the system boundary. The resulting variation is not evidence that one interpretation is correct and the others are wrong. Rather, it reveals one of the most important truths in systems thinking: before identifying system elements, analysts must first agree on what the system actually is and what purpose it is required to serve.

Something many people miss: **The boundary is part of the model.**

And once the boundary changes, every element inside the Law of System Completeness may change with it.

System boundaries are not a technical detail. They are a design choice that determines what questions can be asked, what answers can be found, and what success ultimately means.

The Winners Take All Problem

NATIONAL BEST SELLER

WINNERS TAKE ALL

The **ELITE CHARADE** of
CHANGING the **WORLD**



ANAND GIRIDHARADAS

I have to admit, when our choice for last December's Best of the Month was published in 2019, I had previously made the mistake of grouping it with the swathe of other books (Winner Takes All, The Winner-Take-All Society, The Power Law, How To Win In A Winner Take All World, etc) on the subject of the inevitable (?) migration of rewards in a Capitalist society to a diminishingly small cluster of winners. Turns out I should've homed in on the sub-title, 'The Elite Charade Changing The World'. For various (client project related) reasons, I ended up reading the book just in time for the December 2025 review.

To say the least, it was one of the most depressing reads I've ever experienced. Which, I guess, shouldn't have made it a great candidate for any kind of 'Best Of' award. In an ideal world, I would've (should've?) declared that the problem the book highlights was nothing to do with me and could only be solved by someone with a deal more status and, more importantly, anti-Elite resources. Critical Mass at the Critical Point and all that. That would've been the smart move. On the other hand, anyone that knows me knows that one of my regular pieces of advice to others involves 'running towards the difficult stuff'. After all, if I have any desire (I do!) to stop living 'under the radar' and start 'making a difference', whether I like it or not, I'm almost inevitably likely to encounter the Elite Charade problem. i.e. it is precisely the sort of thing I have to run towards.

Here's the problem in a paragraph: modern elites engage in an "elite charade" in which they champion social initiatives framed as "win-win" solutions – projects that promise to do good while also advancing their business interests – but in practice avoid any changes that would threaten their own power or wealth. By favouring market-friendly, non-disruptive interventions, these elites shape the agenda of social change so that it aligns with their incentives, often sidelining more effective but redistributive or structural reforms. The result is that while such initiatives can produce visible, short-term benefits, they ultimately reinforce the very systems that created the problems in the first place, locking in elite advantage and gradually diluting or constraining the long-term gains for the causes they claim to support.

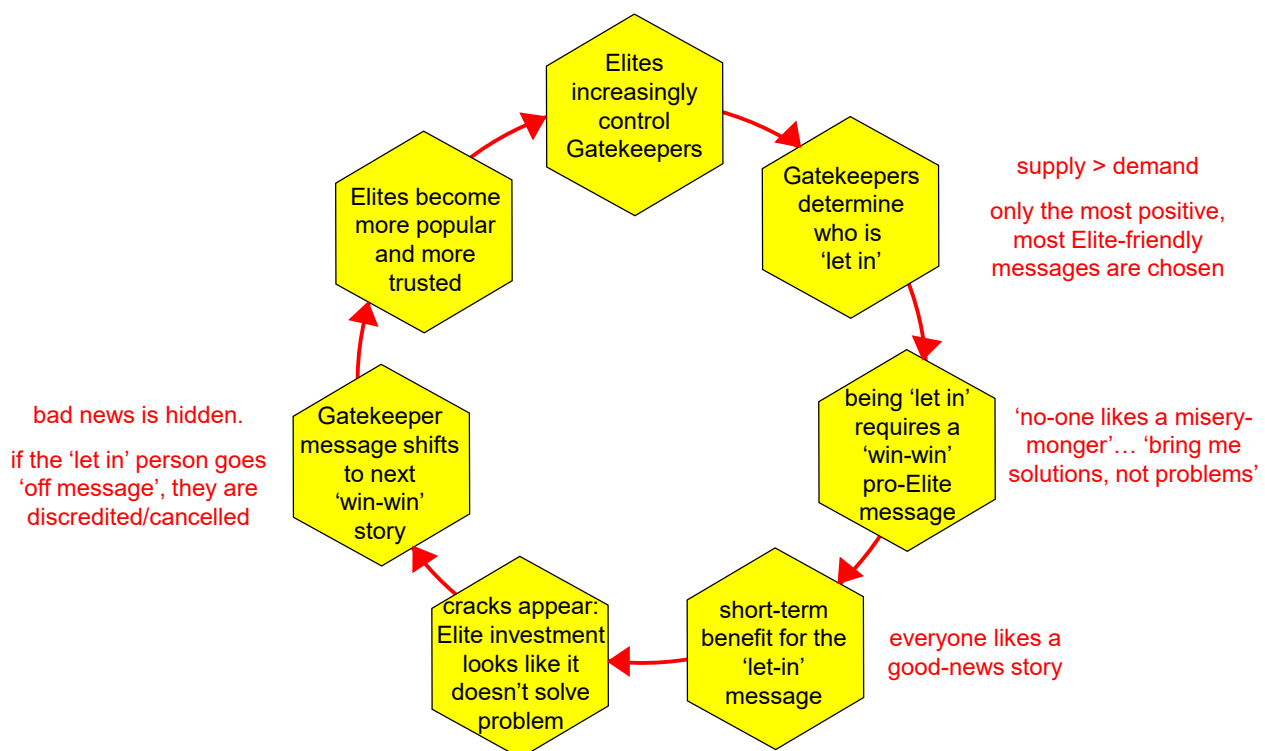
Put more starkly, increasingly the only way for a change message to go mainstream these days is to create a solution that protects the interests of an Elite funder, while simultaneously allowing them to show the world that they're supporting great (environmental, societal, etc) work, that might have a chance of delivering some short-term feel-good benefit before disappearing from public view and dying an inevitable unseen death.

Or, put even more starkly, creating some kind of a high-fiving short-term win while simultaneously ensuring that it protects the long-term future of the Elites and hence worsens the long-term future of everyone else in Society.

A smart person would perhaps sensibly throw up their hands in despair, and stay home and grow vegetables in the garden.

Again, I am not that smart person. Despite (or perhaps because of) my minimal 'critical Mass' resources. No-one likes a David-versus-Goliath story more than me.

And here's one, where, right now, my Critical Mass, says all I can do is deploy our SI tools to better understand the problem. Enter the usual Perception Mapping exercise, and a Map that revealed this vicious cycle:

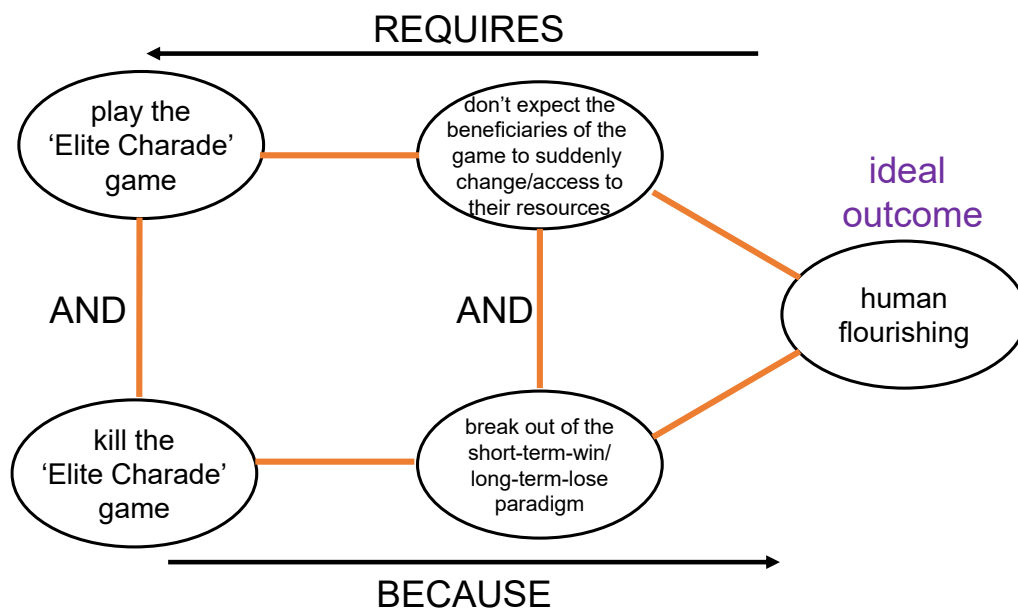


The first thing to say is that if we were looking at this cycle from an Elite perspective, we'd have to nod sagely and say that what they've managed to pull off is some kind of contradiction-solving magic. They successfully ran towards their biggest challenge – 'Truth To Power' protestors – and turned them into win-win allies. Giving them a short-term feel good hit, while all the time ensuring the Elites become not just even more elite, but lauded by all as philanthropic geniuses. Especially in the eyes of the 'gatekeepers', whether they're the media or, increasingly, government officials... two more groups of stakeholders that get to bask in the glory of the short-term wins and avoid any negatives from the long-term fall-out. If you were an evil genius archetype, you'd be rubbing your hands with glee.

The problem, now – six years after Giridharadas first exposed the 'genius' – is that the inevitable rule of the s-curve and 'what goes up must come down' means the long-term

'fall-out' can no longer be ignored. The 'long-term' fallout in this case being that the new contradiction centres around the planet-destroying business models of the Elites. The Elite Charade is a racket that achieves the precise opposite of 'human flourishing'. The thing we (Society at large) would like to improve is human flourishing, and the thing that's stopping us is a vicious cycle that essentially benefits massive numbers of not just Elites, but the Gatekeepers that also benefit from the vicious cycle. The current system-of-doom, in other words, is heavily locked in.

Having come to that realisation, I don't think I've ever spent longer trying to work out and articulate what the 'actual' contradiction needing to be tackled is, but here, after several days of testing ideas, scribbling them out, going away to incubate, coming back to scribble more ideas, is where I think we're at:



Once defined, it is easy to start conceiving potential solutions to the problem (think Trojan Horses and some of Sun Tzu's strategies for dividing powerful opponents by way of starters), but somewhat more difficult to work out where to find an early win success story to convince the unconvinced that this Hero's Journey is possible, And that then demands a next step to increase our Critical Mass. With a following wind, we're hoping to convince Anand Giridharadas that he should come and talk to us on DangerMouth. Watch this space. And, in the meantime, you could do an awful worse than getting hold of a copy of Winners Take All (or his 2022 follow-up, The Persuaders, which has a few more solution suggestions), grit your teeth, and run towards some existential difficult stuff.

Not So Funny – Belgium



I've always had a sneaking love of Belgium. In no small part thanks to a school project I did when I was 12. The assignment was basically to research and write about a country. I can't remember why I chose Belgium, but I can't remember seriously contemplating writing about any other country. I'd never been to Belgium at this point in my life, but I had heard that no-one could name three famous Belgians. My project aimed to put that right. I got an A- and a note from my teacher saying, 'strange choice'. This was, of course, long before Belgium started breaking world records for the longest time without a government and I started working with a variety of Belgian countries. If anywhere can thrive without a government, I now reflect, it would be Belgium. Or maybe, at least, the Flemish speaking northern half?

Two telling moments from my time in Belgium. The first, working with a large automotive OEM manufacturing facility with, for some reason, a strange split between a French-speaking plant and a Flemish speaking plant. As you walked from the Flemish side of the facility into the French side, there was a big expensive banner hoisted over the doorway. It said, 'on this side of the wall we speak French'. Then, when we walked under the banner, entered the French side and looked back, we saw a somewhat more humble, homemade banner over the doorway back into the Flemish side. It said, 'on this side of the wall we work.'

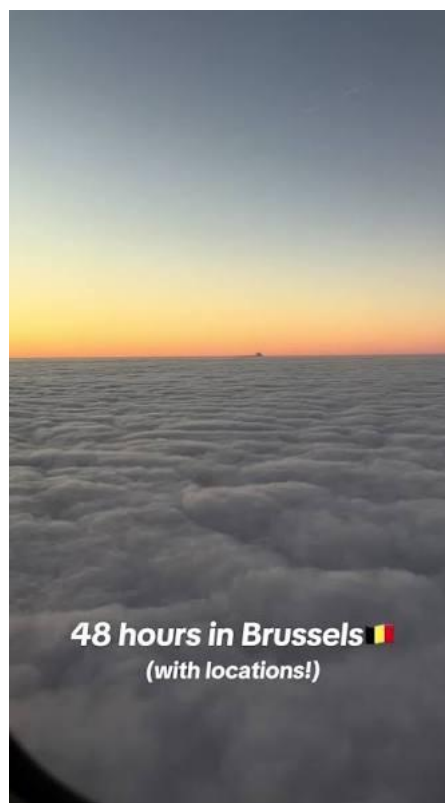
The second one, also taking place in an automotive OEM manufacture plant, albeit a different one to the first, was an exploratory meeting we had with management to try and convince them that they needed to do some work with TRIZ. We suggested starting with a series of workshops in which teams would bring along some of the intractable problems they were working on. We ran a kind of mini-example there in the room with the managers. After about thirty minutes we'd got them to generate about a hundred ideas for solving the problem they chose to play with. The room went silent. It was one of those, whoever-speaks-next-loses kind of moments. We stayed quiet. Sat there watching the

managers looking at one another. In my mind they looked bedazzled. Thinking of all the problems that would now start getting solved across the factory. I started thinking, 'we got'em'. Then the boss looked at us, put out his hands in that annoying palms-up kind of way French managers of a certain age have, and says to us, 'but what will we do with all these ideas? If everyone is generating all these ideas?' This remains the first and only time we didn't get the job because TRIZ was going to be too good.

Looking back now, of course, a time in history where everyone is beginning to realise that AI is giving us avalanches of (admittedly mostly rubbish) ideas and that the real problem is knowing which ideas are the 'right' ones, I can perhaps see a touch of prescience in the words that came out of that manager's mouth.

Belgium was that far ahead of the rest of us.

And yet, it probably continues to have something of a bad rap in terms of why would anyone want to actually go there. Like for a vacation. In true Belgian fashion, here's a recent advertising poster from the people in charge of encouraging visitors to come and enjoy what Belgium has to offer:



All of this is mere pre-amble to what happened this month. Before July, no-one knew anything about or cared anything about Belgium. Now, the whole world loves them. Or almost. What happened? The World Cup happened. And the Belgian Tourist Authority came up with a genius plan to recruit Donald Trump to their cause.

In case you were off the planet for most of July, the World Cup was hosted in North America. 48 countries battled it out for footballing glory. All three of the host nations made it through the group stages and into the round of 32 knockout stage. The US won their first knockout game, but, unfortunately, had one of their key players sent off. This meant that he would receive the usual one-match ban and they would have to go into their round-of-16 game without him. Every other country would have accepted this situation. Especially

given that these were the rules everyone had signed up to. The round of 16 game would be fought against Belgium.

This gave the Belgian Tourist Authority their opportunity.

Enter The Donald and a phone call to the FIFA president, Gianni Infantino. A one on one, genius to genius conversation. The genius's decided that the ban could be 'suspended' and that the player, Folarin Balogun, was eligible to play the Belgium game. Step one of the new advertising campaign was thus put into place – make people sit up and notice. Social media rapidly filled with cries of 'you cheating bastards' or words to that effect.



Step two, leverage emotions. Maybe they could get a journalist to ask Donald to share what happened. Maybe he might say something dumb...

"All I did was ask for a review. I didn't say, you have to do this," Trump said at a White House media briefing Monday. "This man is a smart, tough man, Gianni Infantino. He's a smart, tough man, and his stock has gone through the roof because the job he has done has been great. I feel like we have to have all the best players on the field."

Trump went on to say he didn't initially know what a red card was or what its consequences were. When he found out that it could keep Balogun out of Monday's match against Belgium, Trump said he felt compelled to intervene.

"That's very unfair," he said. "How do you penalise them for a game that hasn't been played?"

He said the red card, issued after a VAR review, was a "horrible" call, arguing that the slowed-down replay made it look worse than it was.

"I didn't think it was a foul," Trump said. "I thought it was two great athletes that crashed each other and got entangled."

"I saw the play, and I'm a person that loves sports ... that wasn't a foul. That wasn't even an infraction ... this referee, who is a little bit suspect if you check his past. He made a call that nobody could believe ... he's our best player, or one of our best players. And he gave him a red card. I didn't know what that meant."

"Yes, I asked for a review by FIFA. [Balogun] didn't do anything wrong, and he's our best player or one of our best players."

Step two completed. Now everyone loves Belgium.

The game goes ahead with Balogun on the pitch and 7.7billion Belgium supporters watching. It was time for Step Three, the Karmic Balance step. Belgium win with an emphatic performance. World's New Favourite Nation 4, Never-Admit-You're-Wrong-Trumpland 1.

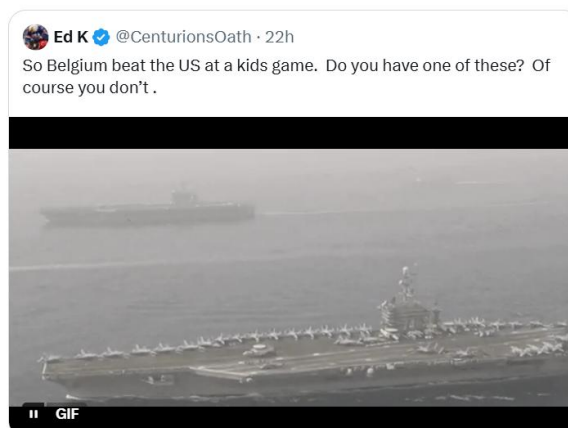
Step 4, the unexpected coup-de-grace step. Belgian striker Romelu Lukaku after putting in the fourth goal includes the Trump dance in his celebration. The rest of the team join in. The rest of the world joins in.



Social media goes wild. The Gulf Of Mexico gets renamed again, this time Mexico agrees...



American social media, meanwhile also goes wild...



At the time of writing, Donald Trump has not declared war on Belgium. The Belgium Tourist Authority is debating whether it would be a good thing or not. Watch this space.

In the meantime, we can exclusively reveal that the Tourist Authority TRIZ experts have shared with us how they got the idea:

production
capability

Improving Feature	Worsening Feature	Design				Production			
		1	2	3	4	1	2	3	4
Design	1. Design Speed	1	2	3	4	1	2	3	4
	2. Design Cost	2	1	4	3	2	1	4	3
	3. Design Flex	3	4	1	2	3	4	1	2
	4. Design Risk	4	3	2	1	4	3	2	1
Production	5. Production Speed	5	6	7	8	5	6	7	8
	6. Production Cost	6	5	8	7	6	5	8	7
	7. Production Flex	7	8	5	6	7	8	5	6
	8. Production Risk	8	7	6	5	8	7	6	5
Supply	9. Supply Speed	9	10	11	12	9	10	11	12
	10. Supply Cost	10	9	12	11	10	9	12	11
	11. Supply Flex	11	12	9	10	11	12	9	10
	12. Supply Risk	12	11	10	9	12	11	10	9
Support	13. Support Speed	13	14	15	16	13	14	15	16
	14. Support Cost	14	13	16	15	14	13	16	15
	15. Support Flex	15	16	13	14	15	16	13	14
	16. Support Risk	16	15	14	13	16	15	14	13
Customer	17. Customer Speed	17	18	19	20	17	18	19	20
	18. Customer Cost	18	17	20	19	18	17	20	19
	19. Customer Flex	19	20	17	18	19	20	17	18
	20. Customer Risk	20	19	18	17	20	19	18	17
Items	21. Item Speed	21	22	23	24	21	22	23	24
	22. Item Cost	22	21	24	23	22	21	24	23
	23. Item Flex	23	24	21	22	23	24	21	22
	24. Item Risk	24	23	22	21	24	23	22	21

customer
loyalty

24 13
10 1

Actually, they said to us, the process generated too many ideas.

On that front, rather than the, we now see, too abstract Principle 24, Intermediary provocation, we're thinking of making Donald Trump, Inventive Principle 41.

Then the plan is to get a friendly journalist to ask him about TRIZ and how he came up with the 41st Inventive Principle... how he's a TRIZ expert...

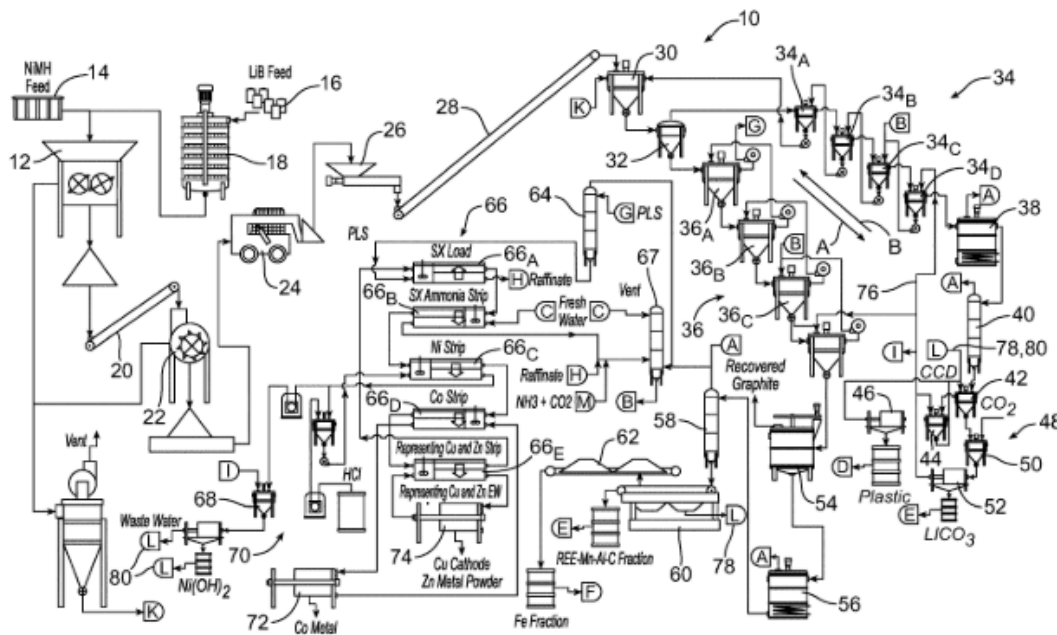
...then it goes viral...

...then 7.7 billion people all buy a copy of Hands-On Systematic Innovation for Business & Management. (10% discount for the first 100 buyers.)

Karmic Balance #2.

(Karmic Balance #3... the referee sues Trump for \$10B... you heard it here first.)

Patent of the Month – Recovering Critical Battery Materials



As electric vehicles and renewable energy storage become mainstream, attention is increasingly turning to what happens when their batteries reach the end of their useful lives. Recycling these batteries is no longer simply an environmental issue, it has become a strategic necessity for securing future supplies of lithium, cobalt, nickel and other critical materials.

Granted to five inventors at the University of Kentucky on July 7, US Patent 12,676,351 presents an elegant solution to this challenge. Rather than viewing battery recycling as a straightforward extraction problem, the inventors have developed an integrated separation process in which each stage prepares the material for the next. The process begins by shredding spent batteries, wetting the resulting material with an ammonium carbonate lixiviant, separating the mixture into light and heavy fractions, and then processing these fractions through parallel counter-current leaching circuits to recover a wide range of valuable materials.

Although the new process could simply be characterised as a (Principle 35) ammonia-based alternative to conventional acid leaching, the real invention lies in how the entire sequence has been engineered to resolve several competing objectives simultaneously.

Contradiction 1 – Recover valuable materials without destroying them

Traditional battery recycling has largely relied on pyrometallurgical processing. While smelting is robust and commercially attractive, the high temperatures result in the loss of lithium and the destruction of valuable graphite. Hydrometallurgical approaches improve recovery but are generally more complex and frequently depend upon aggressive inorganic acids. The contradiction needing to be solved here is straightforward:

The recycling process preserve the highest-value materials for recovery, but it should also should be simple and economical.

Here's how we might best map that conflict pair onto the Contradiction Matrix:



The (named after the lead inventor) ‘Werner Process’ resolves this by replacing smelting with the aforementioned Principle 35, selective ammoniacal leaching system. Lithium remains recoverable as lithium carbonate, graphite survives the process, and transition metals can be recovered in downstream separation stages. Rather than accepting inevitable material losses as the price of simplicity, the inventors redesign the process so that valuable materials remain available throughout the recovery chain.

Contradiction 2 – Process many battery types using one recycling system

Modern recycling plants increasingly receive mixed waste streams containing both lithium-ion and nickel-metal hydride batteries. Traditionally these chemistries have required different treatment routes because they contain different combinations of valuable materials. The contradiction therefore becomes:

The recycling system should be flexible enough to process multiple battery chemistries, but each chemistry requires different recovery conditions.

(Adaptability versus Compatibility: Principles 1, 5, 3, 28)

Instead of creating separate recycling plants, the inventors exploit differences in density and selective leaching behaviour. After shredding and wetting, the material naturally separates into relatively light and relatively heavy fractions. These streams then enter (Principle 1) separate counter-current leaching circuits, each (Principle 3) optimised for the materials it contains. One stream concentrates lithium recovery, while the other targets nickel, cobalt, copper, zinc and other valuable constituents. The result is a single integrated process capable of handling mixed battery feedstocks without sacrificing recovery efficiency.

Contradiction 3 – Dissolve the valuable metals without dissolving everything else

Conventional acid leaching often creates a new problem by dissolving almost every component of the battery. Recovering the desired metals then requires a long sequence of purification operations. The contradiction can be expressed as:

The leaching solution should efficiently dissolve valuable metals, but it should avoid dissolving materials that complicate downstream separation.

(Function Efficiency versus System Complexity: Principles 2, 15, 19, 28, 35)

The patent resolves this through the use of (Principle 35) ammonium carbonate chemistry, which (Principle 2) selectively leaches nickel, cobalt, copper and zinc while leaving iron, aluminium, manganese, graphite and rare earth-bearing solids largely undissolved. Instead of maximising dissolution, the inventors maximise selectivity. This significantly

reduces downstream separation complexity and allows each material stream to be processed more efficiently.

Contradiction 4 – Use an effective chemical without continually consuming it

Even environmentally benign reagents become commercially unattractive if they must be continually replaced. The contradiction therefore becomes:

The process should make effective use of ammonia, but reagent consumption and waste should remain low.

(Productivity versus Loss Of Substance: Principles 35, 12, 2, 34)

Throughout the process, ammonia is (Principle 34) repeatedly evaporated (Principle 35), stripped (Principle 2), condensed and recycled back into the leaching circuits. Similar recycle loops are incorporated into the lithium precipitation and metal recovery stages. Rather than treating ammonia as a disposable reagent, the process treats it as a circulating process fluid. This improves both operating economics and environmental performance while reducing overall waste generation.

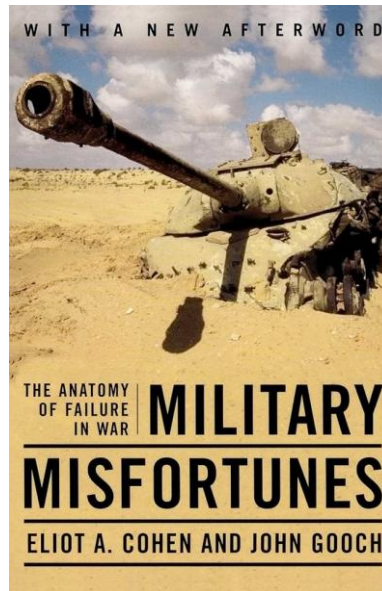
A Systems-Level Invention

Looking across these four contradictions, it becomes clear that the patent is not fundamentally about inventing a new leaching chemistry. Nor is it simply another battery recycling process.

Its real contribution is the integration of multiple physical and chemical separation techniques into a coherent system in which each stage creates favourable conditions for the next. Density separation, selective ammoniacal leaching, counter-current processing, precipitation, solvent extraction and reagent recycling are combined into a coordinated sequence that simultaneously improves recovery, reduces waste and simplifies downstream processing.

For students of Systematic Innovation, I think this patent provides an excellent example of how inventive solutions often emerge not from a single breakthrough, but from carefully resolving a network of interacting contradictions. Also pretty cool, that the Matrix manages to capture each part of the network and all of the Principles used by the inventors.

Best of the Month – Military Misfortunes



As the momentum picks up on our TRIZ/SI Failures case studies book, we're re-discovering that there is something uniquely compelling about studying failure. While success stories often conceal as much as they reveal, catastrophic failures expose the underlying mechanics of a system in ways that routine performance never can. This is one of the enduring lessons of Systematic Innovation: if we wish to understand how systems really work, we learn faster if we study the extremes.

It is precisely this philosophy that makes our Book of the Month this month, Eliot Cohen and John Gooch's *Military Misfortunes*, such an engaging read. First published in 1990, the book has deservedly become a classic analysis of military failure. Rather than focusing on incompetence or poor leadership, the authors ask a much more interesting question: how do capable organisations, staffed by intelligent and experienced people, suffer unexpected catastrophe?

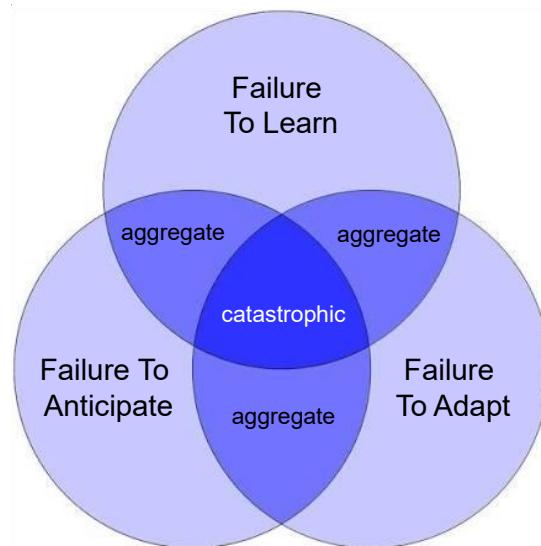
Their answers are explored through a series of fascinating case studies. Why did the American-led coalition struggle for so long to wage an effective counter-insurgency campaign following the fall of Baghdad? How was Israel's highly respected intelligence apparatus so comprehensively surprised by the combined Arab offensive during the 1973 Yom Kippur War? How did a handful of German U-boats inflict such devastating losses on Allied shipping off the American east coast during 1942? And what transformed the Gallipoli campaign into one of the bloodiest disasters of the First World War?

As with all good military history, the book is entertaining, meticulously researched and full of lessons that extend well beyond the battlefield. The authors conclude that military failures typically arise from one or more of three primary mechanisms: failure to learn, failure to anticipate and failure to adapt. They then show how these combine to produce more complex "aggregate" failures involving two of the mechanisms, and the rare but devastating "catastrophic" failures in which all three occur simultaneously.

Their classification is both elegant and memorable.

Yet from a Systematic Innovation perspective it also prompts a further question. Are these actually causes of failure? Or are they descriptions of failure? The distinction matters

because if we mistake description for cause, we risk learning very little that can be translated into better practice.



A systems perspective suggests that failure to learn, failure to anticipate and failure to adapt are not root causes at all. They are symptoms. The more interesting question is why an organisation became incapable of learning, anticipating or adapting in the first place.

This is where the work of John Boyd provides a useful bridge. Boyd's famous OODA Loop is often presented as a sequence – Observe, Orient, Decide and Act – but its real power lies in recognising it as a dynamic system. Observation depends upon the effectiveness of sensing. Orientation is the engine that constructs meaning from what has been observed. Decision coordinates action. Action changes both the environment and the organisation itself, generating the feedback upon which future observations depend.

Viewed through this lens, military misfortune is no longer simply a failure to learn, anticipate or adapt. It becomes the inevitable consequence of a system whose feedback loops, orientation processes or adaptive mechanisms have become progressively degraded.

Or, expressed another way: (yet again) **the system decides.**

Leaders undoubtedly make decisions. But the range of decisions they are capable of making – and the likelihood that they will make the right one – is determined long before the crisis arrives by the structure of the system within which they operate. From this perspective, Cohen and Gooch's three failure mechanisms appear to have a common underlying characteristic: a progressive loss of requisite variety.

Ashby's Law tells us that only variety can absorb variety. Organisations lose because the complexity of the challenges confronting them eventually exceeds the diversity of responses their systems are capable of generating. Sensors become selective. Orientation becomes constrained by established assumptions. Coordination becomes rigid. Adaptation becomes increasingly difficult. Long before catastrophe becomes visible, the system has already begun deciding its own fate.

This shift from events to systems also transforms the practical usefulness of the book. Rather than simply recognising categories of failure after they occur, leaders can begin designing organisations specifically to prevent them.

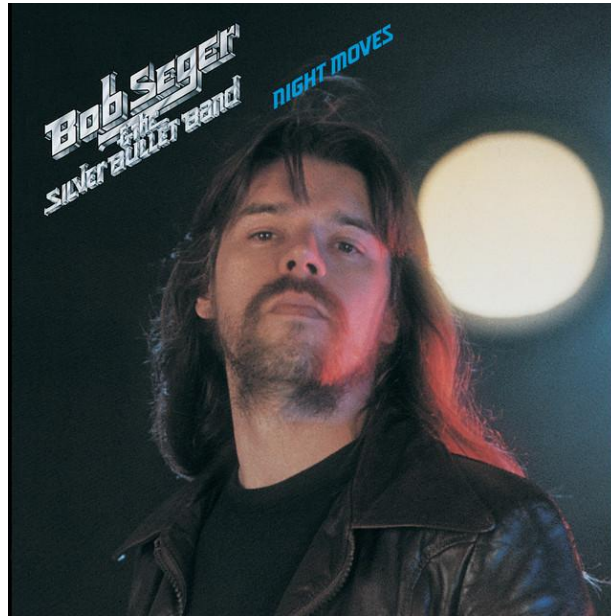
Several principles emerge.

- Diagnose systems rather than decisions. Individual decisions are usually consequences of deeper system structures.
- Assume every catastrophe has a detectable precursor signature. If failure appears sudden, it is often because the sensing system has already failed.
- Recognise that optimisation creates blindness. Every optimisation inevitably reduces variety somewhere else.
- Remember that orientation dominates observation. Organisations rarely fail because they did not see events unfolding; they fail because they interpreted them through outdated mental models.
- Treat learning as a structural property rather than a training issue. Better education cannot compensate for poor feedback architecture.
- Above all, remember that the system decides. Leaders choose actions, but systems determine which actions become likely.

Thirty-five years after its publication, *Military Misfortunes* remains one of the finest analyses of how competent organisations drift towards unexpected catastrophe. What has changed is our ability to act upon its insights. By viewing military failure through a systems lens, Cohen and Gooch's descriptive taxonomy becomes an operational framework. Not just for military leaders, but for anyone responsible for navigating complex adaptive systems.

That challenge has never been more relevant. Whether the context is military operations, business strategy or Artificial Intelligence, success is becoming less dependent upon generating more options than upon recognising which options should never be pursued. The bottleneck has moved. Our task is no longer simply learning what to do. It is learning what not to do.

Wow In Music – Night Moves



There is a comforting mythology surrounding great popular music. The masterpiece, we are told, arrives early. Raw hunger produces the debut; youthful brilliance sharpens the second album; by the third, the artist achieves transcendence before familiarity, exhaustion or self-consciousness begin the inevitable decline.

Which is what makes *Night Moves* so fascinating.

Bob Seger did not emerge fully formed from the gates. By the time the album appeared in 1976, he was already on his ninth album. He had spent nearly a decade grinding through bars, theatres and Midwestern club circuits, building fierce regional loyalty around Detroit and the industrial Midwest. The previous eight records contained plenty of evidence of talent: toughness, authenticity, energy, blue-collar charisma, flashes of songwriting insight. But they gave remarkably little indication that he had a **Night Moves** inside him.

And then suddenly, there it was.

Not merely a successful album, but one of those strange records that seems to achieve total coherence. An album in which accumulated craft, lived experience, geographic rootedness, and artistic contradiction suddenly snap into focus. The kind of record where every (Principle 22) imperfection somehow becomes essential to the whole.

The truly interesting question is not why *Night Moves* succeeded commercially. The interesting question is: what changed?

Certainly not effort. Seger had always worked relentlessly. Nor was it authenticity; he had possessed that from the beginning. More likely, emotional maturity finally caught up with technical capability. Somewhere between albums eight and nine, Seger stopped trying to sound important and simply started sounding true. He had crossed the Rubicon and entered his thirties. The various identities that had previously competed within his music – garage rocker, soul singer, folk storyteller, bar-band frontman, Midwestern observer – suddenly stopped pulling against one another and began (Principle 40) reinforcing each other.

Innovation often looks exactly like this. Not invention, but integration.

The album's opening track immediately announces that something unusual is happening. Rock and Roll Never Forgets arrives at full speed, all swagger and propulsion, but beneath the bravado lies something almost defensive. "So you're a little bit older and a lot less bolder..." Seger sings, before insisting that the old fire still burns. The title itself carries an anxiety it tries to deny. Rock and roll, of course, does forget. Bodies age. Scenes disappear. Summer ends. The song's energy comes precisely from the tension between rebellion and mortality.

That tension haunts the entire album. Most rock records are about love, sex, escape or heartbreak. Night Moves is fundamentally about time.

Nearly every song is shadowed by the awareness that moments vanish even as we live them. Youth becomes memory while still unfolding. Desire already contains nostalgia. The past survives not as fact, but as emotional residue.

This reaches its fullest expression in the title track itself, one of the great perspective shifts in rock music. Night Moves initially presents itself as a vivid teenage memory: awkward lust, summer fields, sweat, secrecy, hormones and freedom. The details are tactile and specific enough to feel almost documentary. But then Seger delivers the subtly devastating pivot:

"Started humming a song from 1962..."

In that instant, the song changes dimension. The narrator is no longer inside the memory; he is observing himself remembering. Suddenly three (Principle 7) nested layers of time coexist simultaneously: the adolescent experience, the adult recollection, and the present-moment awareness of aging itself.

This is where Seger earns the description "the Proust of Detroit." Not because he is ornate or literary in style, but because he understands the ambush power of memory. Like Proust, he recognises that the past does not return intellectually; it returns physically, involuntarily, carrying entire emotional worlds behind tiny sensory triggers. By the song's closing autumnal lines, what began as nostalgic reminiscence has quietly transformed into something much larger and sadder: a meditation on the speed with which life disappears.

Part of the album's power comes from its extraordinary sonic duality. Five tracks were recorded with Seger's own Silver Bullet Band, whose sound embodied Detroit grit: muscular, urgent, loud, restless. The remaining tracks were cut in Alabama with the legendary Muscle Shoals Rhythm Section, bringing a completely different emotional texture: spaciousness, soulfulness, melancholy, patience.

Most albums fractured by two radically different recording environments would lose coherence. *Night Moves* gains coherence from the (Principle 12) contrast. The hard-driving Midwestern rock songs give the softer tracks emotional weight; the soulful introspective pieces humanise the swaggering rockers. The album succeeds because neither identity wins. It is neither pure bar-band bravado nor pure singer-songwriter introspection. Again, the breakthrough comes through integration rather than selection.

That integration also appears in Seger's portrayal of working-class America. Comparisons with Bruce Springsteen are inevitable, but revealing. Springsteen often mythologises blue-collar life into something almost biblical: highways, redemption, destiny, escape. Seger's lens is smaller, smokier, more local. His America consists of dancers, bartenders, lonely men, aging rock fans, strippers, drifters and people sitting quietly at the end of the bar. No

grand heroes. No epic redemption arcs. Just ordinary people trying to preserve some dignity against economic limitation, loneliness and fading possibility.

That may be why the album ages so well. It resists inflation. It never mistakes ordinary lives for symbols, yet somehow reveals the universality inside them.

Mainstreet perhaps captures this best. It is one of the least judgmental songs ever written about loneliness and desire. The narrator simultaneously romanticises, observes, distances himself from and implicates himself in the world he describes. Even the famous saxophone solo feels less like performance than recollection itself – memory arriving slowly through smoke and neon haze.

Throughout the album, Seger's voice plays a crucial role in holding these contradictions together. Earlier records demonstrated power; **Night Moves** reveals authority. The rasp in his voice no longer sounds merely energetic. It sounds lived-in. Experienced. Earned. A younger singer could not have carried these songs with the same credibility because the material itself requires mileage. The emotional centre of the record depends upon hearing someone who has already begun to understand loss.

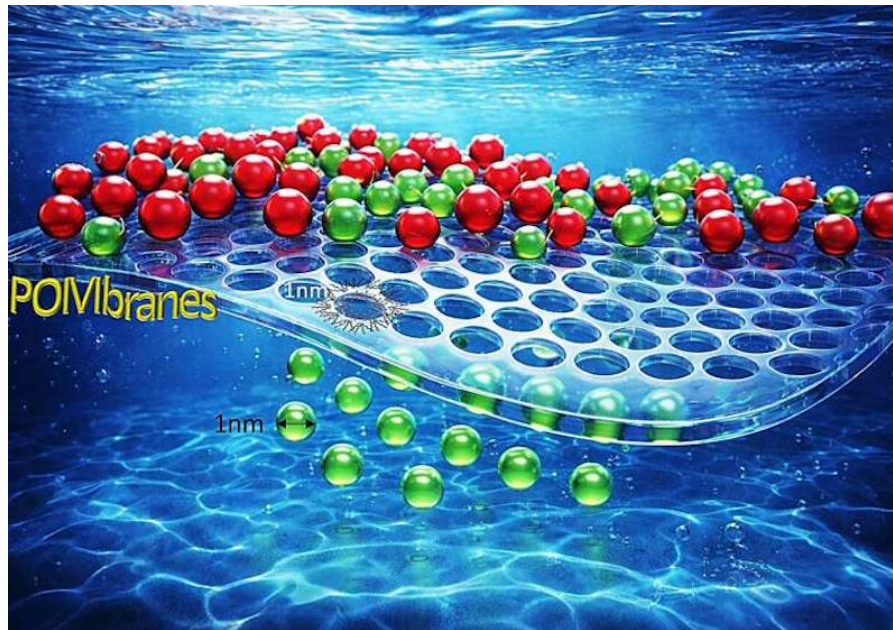
Which returns us to the central mystery of *Night Moves*: why did the breakthrough arrive so late?

Perhaps because some forms of artistic greatness cannot emerge until experience itself accumulates sufficiently. Certain works require contradiction, disappointment, survival and unresolved tension. They require enough years for memory to become emotionally textured rather than merely autobiographical. They require someone old enough to recognise time passing, but still young enough to resent it.

Great innovation is often described as disruption: radical novelty appearing suddenly from nowhere. But some of the most profound breakthroughs arrive differently. They emerge when disparate fragments of identity finally cohere into an authentic whole.

Night Moves was Bob Seger's ninth attempt at becoming Bob Seger.

Investments – Pombranes



Nature Doesn't Care What Material You Use. One of the recurring themes in Systematic Innovation is that difficult engineering contradictions have often already been solved. Just not by engineers. Nature has been tackling functional problems for well over three billion years, and although biological solutions rarely transfer directly into engineering, the underlying strategies frequently do. This month's investment provides an excellent example.

Researchers from India and Singapore have developed a new class of molecular filtration membranes, 'POMbranes', capable of separating molecules with almost ten times the precision of today's polymer membranes, while remaining flexible, chemically stable and suitable for large-scale manufacture.

The engineering contradiction is familiar. Industrial membranes need pores that are extremely small and precisely controlled if they are to separate similar molecules accurately. Unfortunately, making pores smaller usually makes them less uniform, less stable and more difficult to manufacture economically. Conventional polymer membranes gradually suffer from changes in pore geometry, reducing their performance over time.

The researchers' investment was not to search for a slightly better polymer. Instead, they asked a different question. How does Nature solve the problem?

Biological cells have faced exactly the same challenge for hundreds of millions of years. Proteins known as aquaporins transport water molecules through cell membranes with astonishing precision, using channels whose dimensions are controlled at the molecular level. Rather than attempting to reproduce the biological mechanism itself, the research team extracted the underlying design principle.

The solution lay in creating billions of tiny inorganic molecular rings, each containing a permanent one-nanometre opening. These 'building blocks' then self-assembled into an ultrathin membrane in which every transport pathway was already precisely defined.

In other words, instead of manufacturing a membrane and then trying to control the size of its pores, they (Principle 13) manufactured perfectly defined pores first and allowed the membrane to build itself around them (Principle 25).

Perhaps most importantly, the POMbrane reminds us that the real value of biomimicry lies not in copying biology literally but in understanding the functional strategy that evolution has already optimised.

The finished membrane is not biological.

It simply behaves as though it had learned one of Nature's tricks.

Too often, engineers dismiss biological inspiration because living systems appear too complex or use entirely different materials. Successful biomimicry rarely copies the materials. It copies the contradiction resolution.

This month's investment is therefore less about membranes than about innovation strategy. When an engineering problem appears trapped between conflicting requirements, it is often worth asking whether evolution has already encountered the same contradiction. If it has, the biological solution is unlikely to transfer directly, but the underlying Inventive Principle often will.

Nature remains one of the richest idea libraries available to innovators.

The challenge is not to imitate it.

It is to understand what contradiction it has already solved.

Read more:

Priyanka Dobariya, Vinay Thakur, Amrutha A, Karan Marvaniya, Ashish Maurya, Pradip Pachfule, Prashant Kumar, Raghavan Ranganathan, Shilpi Kushwaha, Ketan Patel. Large-Area Supramolecular Crystalline Thin Films of Polyoxometalates with Controlled 1-nm Pores Enabling Ultra-Selective Molecular Transport. Journal of the American Chemical Society, 2026; 148 (3): 3280 DOI: 10.1021/jacs.5c17644

Generational Cycles – Perceived Existential Threat: A Feedback Explanation for the Four Turnings

One of the enduring attractions of Strauss and Howe's *Fourth Turning* model is that it appears to describe a recurring pattern in history. Periods of confidence and institution-building give way to questioning, fragmentation and eventually crisis, before society somehow resets and begins the cycle again.

Whether the cycle really lasts eighty or ninety years is almost beside the point. Many readers instinctively recognise the pattern. What has always been less obvious is *why* the oscillation occurs.

For students of Systematic Innovation, oscillation usually has a familiar cause. Delayed feedback. Engineers encounter it everywhere. Turn the shower tap. Nothing happens. Turn it further. Still nothing. Turn it almost fully on. Suddenly the water becomes far too hot. The delay between action and feedback naturally creates oscillation.

The same phenomenon explains why thermostats overshoot, why economies boom and bust, and why supply chains produce the famous 'bullwhip effect'. Whenever feedback is delayed, systems rarely settle smoothly. They hunt. Perhaps societies do exactly the same thing.

The hidden state variable

Discussions of the Four Turnings often revolve around economics, politics or culture. Suppose instead we consider something much more fundamental. Perceived existential threat. Not actual danger. Perceived danger. How dangerous does the world appear? Will tomorrow probably resemble today? Or could everything disappear?

The answer to those questions quietly influences almost every important societal decision.

High perceived threat encourages cooperation, sacrifice, discipline, long-term planning, investment, and strong institutions.

Low perceived threat encourages something entirely different. Individualism. Experimentation. Consumption. Tolerance of risk. Questioning established authority.

Neither condition is inherently better. Each is appropriate under different circumstances. The problem arises because the perception of threat is always based upon the past.

The forty-year delay

In the same way that armies always seem to prepare for previous wars, parents naturally prepare their children for the world they themselves experienced. That is exactly what good parents should do.

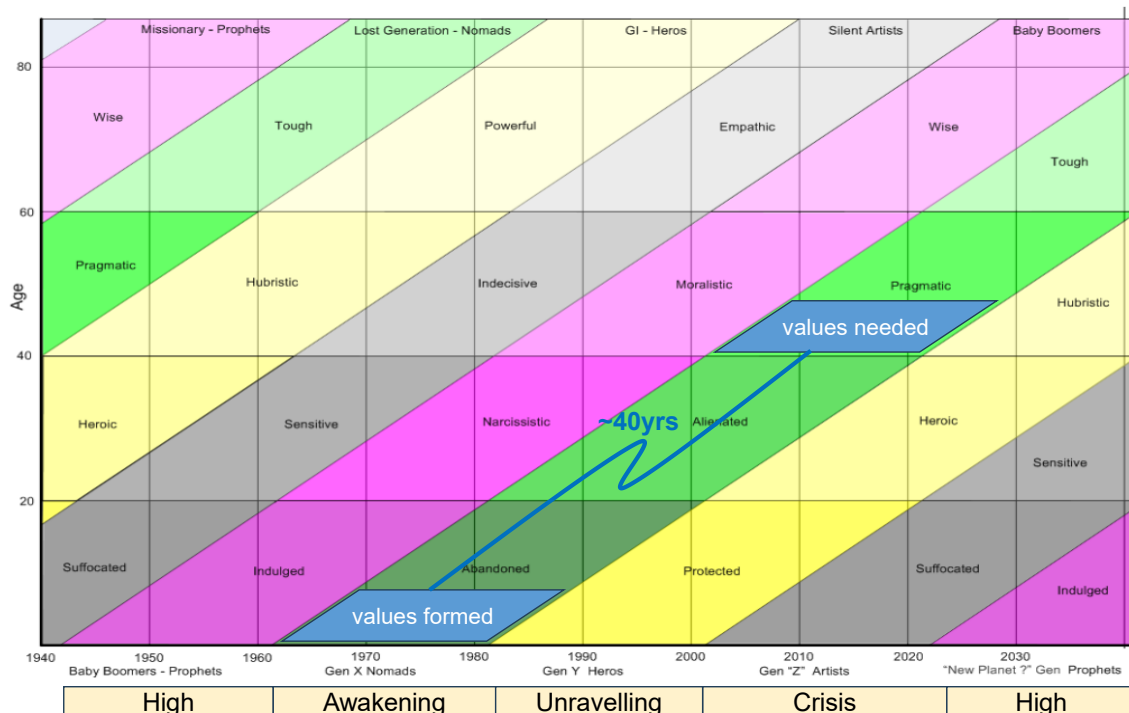
Those who lived through depression teach thrift.

Those who lived through war teach resilience.

Those who experienced instability teach caution.

Those who experienced abundance teach confidence.

Children absorb values during perhaps the first fifteen years and particularly the first seven. The difficulty is that children do not become society's principal decision-makers until roughly forty years later. A remarkably long feedback delay. Long enough that, by the time a generation reaches positions of influence, the environment that shaped their worldview has largely disappeared.



Today's leaders are in effect solving yesterday's problems. Not because they are foolish. Because those were the problems that formed them.

The contradiction

Parents face a contradiction that can never be completely resolved. On one hand they need to protect children, on the other they need to prepare children. Too much protection creates fragility. Too little protection creates trauma.

Every generation naturally attempts to optimise the balance according to the dangers it personally experienced. Ironically, this almost guarantees over-correction.

A generation shaped by hardship tries to eliminate hardship for its children. Those children grow up with little direct experience of existential threat. As adults, they naturally conclude that many protective institutions are unnecessary. The perceived threat falls further. Individual freedom expands. Institutional discipline weakens. The environment gradually changes until the next generation encounters genuine instability once again. The cycle repeats.

Losing the will...

This perspective also suggests a different way of viewing societal S-curves. Perhaps societies do not suddenly collapse because they "lose the will to defend themselves", as James Burnham famously observed. Perhaps that is simply the final stage in a much longer sequence.

First, societies lose the will to question. Successful institutions become assumptions. Then they lose the will to risk. Preserving existing success becomes more attractive than pursuing uncertain opportunities. Exploration gradually gives way to optimisation.

Investment shifts from creating new capability to maintaining existing capability. Eventually the willingness to embrace significant change disappears altogether. By the time the will to defend finally weakens, the society has already spent decades progressively reducing its willingness to commit to an uncertain future. Military decline becomes a symptom rather than a cause.

Why the oscillation continues

Control engineers recognise this pattern immediately. Delayed feedback almost always produces oscillation. The longer the delay, the greater the tendency to overshoot. Societies appear to possess one of the longest feedback delays imaginable. The experiences that shape our values occur largely during childhood. Those values do not begin influencing the direction of society until perhaps forty years later, when that generation reaches positions of leadership. By then, the world that created those values has already changed.

Each generation therefore becomes exquisitely adapted to solving yesterday's problems. Unfortunately, yesterday's solutions often create tomorrow's contradictions. Nobody needs to make a mistake. Parents protect their children. Teachers pass on what worked. Leaders apply the lessons of experience. The oscillation emerges anyway.

The contradiction behind the contradiction

Seen from this perspective, the Four Turnings may not be driven primarily by economics, politics or demographics. They may be driven by a much simpler contradiction. As stated earlier, every parent wants to both *protect and prepare* their children. The difficulty is that these objectives are not the same. Protecting children from uncertainty can reduce the resilience they will one day need. Preparing them for hardship may expose them to more discomfort than any loving parent wishes to inflict.

Every generation naturally calibrates that balance according to the dangers it remembers. That is both entirely rational and almost guaranteed to produce over-correction. The future is rarely shaped by the dangers we remember. It is shaped by the contradictions we fail to anticipate.

A different question

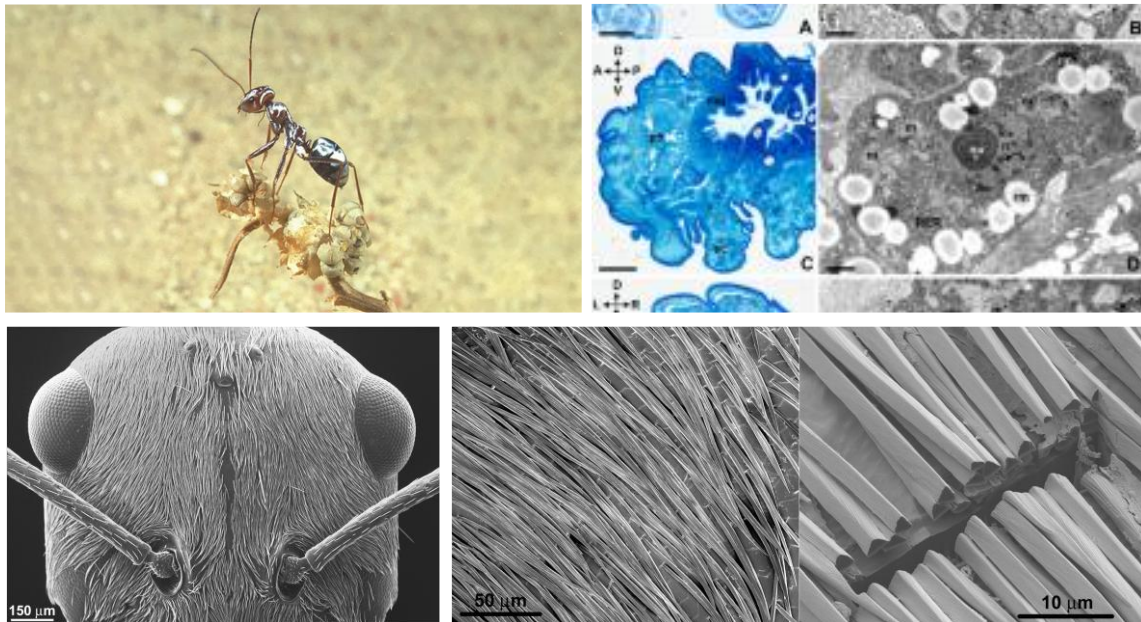
Whether Strauss and Howe's four-turning cycle proves historically precise is, perhaps, not the most interesting issue. The more interesting possibility is that the cycle is simply the natural behaviour of any large adaptive system operating with an unresolved contradiction and a forty-year feedback delay.

If so, history is not repeating itself because people fail to learn. It is repeating itself because each generation learns exactly the lessons that prepared the previous generation for success.

The challenge, then, is no longer predicting the next Turning. It is breaking the oscillation.

Which leads to a question that feels surprisingly relevant to the world of Systematic Innovation. Can we teach parents to optimise not for the world they survived, but for the world their children will inherit? That may prove to be one of the most important contradiction-solving challenges of all.

Biology – Silver Ant III



The gift that keeps on giving. Back in 2007, we first encountered the remarkable Saharan silver ant and its ingenious use of reflective surfaces to survive one of the harshest thermal environments on Earth. Then, in 2013, we revisited the story after discovering another layer of sophistication: extraordinarily long legs and a curious four-legged running gait that allowed the ants to move rapidly across scorching desert surfaces while minimizing heat transfer from the sand beneath them.

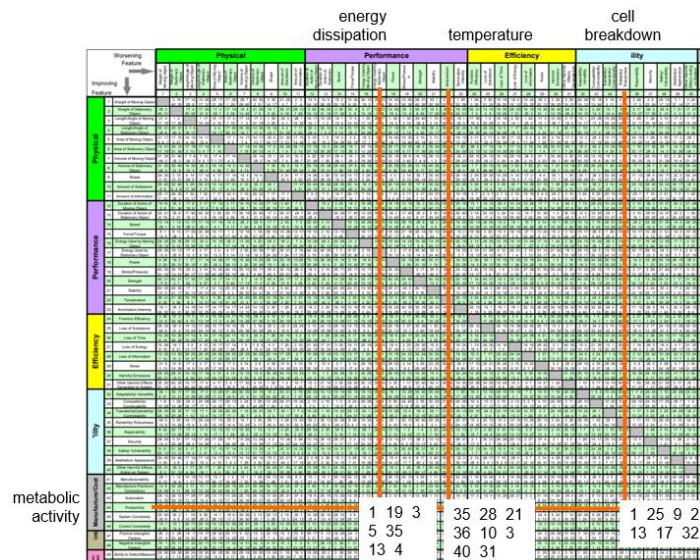
At the time, both discoveries seemed independently impressive. Reflection solved one contradiction. Long legs and selective gait usage solved another. As it turns out, however, both stories were merely surface manifestations of something considerably deeper.

More recent discoveries reveal that the Saharan silver ant is not simply using a couple of clever tricks to survive the desert. It is deploying a multi-layered thermal management architecture operating simultaneously at optical, thermodynamic, biomechanical and molecular levels. And the further researchers dig into the system, the clearer it becomes that the ants are solving one of the hardest contradictions in biology: How do you remain metabolically active in an environment hot enough to destroy the very proteins required for metabolic activity?

This is a considerably more difficult problem than merely “staying cool.”

The Saharan environment presents a brutal set of simultaneous constraints. Ground temperatures can exceed 60–70°C during the middle of the day, while the ant’s own lethal body temperature lies only slightly above 53°C. Predators such as lizards retreat underground during these peak temperatures, creating a tiny ecological window in which the ants can forage relatively safely for the corpses of heat-stricken insects and animals. Evolutionary success therefore depends not on surviving the desert continuously, but on surviving it briefly. The ants typically remain above ground for only a few minutes at a time. Their challenge is not comfort. Their challenge is strategic excursion into an otherwise impossible operating environment.

Here’s how we might map the different aspects of the contradiction onto the Contradiction Matrix:



And this is where the story becomes especially interesting from an innovation perspective. Breakthrough systems rarely solve contradictions at a single level. The silver ant succeeds because it attacks the same thermal contradiction simultaneously through geometry, optics, thermodynamics, behaviour and biochemistry.

The familiar silver appearance of the ants turns out to be far more sophisticated than first imagined. The reflective “fur” covering the ant’s body is composed of dense arrays (Principle 1) of microscopic hairs. Initially, these hairs were thought to function simply as tiny mirrors, reflecting incoming sunlight away from the body. But closer examination revealed something remarkable: the hairs are not cylindrical. They possess a (Principle 1& triangular cross-section, complete with (Principle 3) corrugated upper surfaces.

And that opens up several new capabilities. The triangular geometry allows the hairs to act simultaneously as microscopic prisms and highly efficient (Principle 4) directional reflectors. Incoming visible and near-infrared solar radiation is reflected away across a (Principle 3) wide range of incident angles. This matters because near-infrared wavelengths carry a substantial proportion of the sun’s thermal energy. In effect, the ant has evolved a passive optical (Principle 40) metamaterial.

And yet the real elegance lies not merely in reflection, but in (Principle 3) selective reflection. Traditional thermal insulation systems often create a secondary contradiction. They reduce incoming heat, but they also trap internally generated heat. The silver ant’s triangular hairs solve both sides of the problem simultaneously. While reflecting incoming solar energy, the structure also enhances the emission of mid-infrared wavelengths associated with body heat radiation. In simple terms, (Principle 4) the hairs help internal heat escape while preventing external heat from entering.

This is an extraordinarily elegant contradiction solution: the system must reject heat from outside while simultaneously encouraging heat flow from inside. Most insulation systems solve one side by worsening the other. The silver ant resolves the contradiction through (Principle 3) wavelength-selective geometry.

And the geometry performs yet another function. The hairs slightly (Principle 17) elevate the body surface away from the surrounding hot air layer, introducing a (Principle 31) gap that helps reduce conductive heat transfer while improving convective cooling. Once again, a single structural feature resolves multiple interacting constraints simultaneously.

At this point, we might imagine the problem solved. Reflect enough heat and dump enough internal energy and survival becomes possible.

Except it doesn't.

Even with these extraordinary thermal-management capabilities, the ants still routinely experience body temperatures high enough to damage proteins and destabilise metabolic processes. Which means evolution required yet another level of defence. This is where the newly discovered (Principle 21) heat-shock proteins enter the story.

Proteins are delicate structures. Beyond certain temperatures they begin to unfold, misfold or denature entirely. Since proteins govern almost every metabolic process required for life, thermal damage rapidly becomes catastrophic. In most organisms, prolonged exposure to such temperatures would quickly lead to system collapse.

The silver ant, however, possesses an extremely rapid heat-shock response system. Heat-shock proteins function as (Principles 3, 5) molecular chaperones: specialised protective proteins whose role is to (Principle 10) stabilise other proteins during periods of thermal stress. Some prevent proteins from unfolding in the first place. Others (Principle 25) actively rescue and refold partially damaged proteins before irreversible failure occurs.

This is a profound shift in system philosophy. The ant is no longer attempting to prevent all damage. Instead, it assumes damage is inevitable and develops rapid recovery mechanisms capable of maintaining function despite it (Principle 9).

The contradiction therefore changes form: the system must operate beyond normal thermal limits while preserving biological functionality.

Traditional biological systems solve this problem by avoiding thermal stress altogether. The silver ant instead tolerates brief (Principle 19) excursions beyond equilibrium and repairs the resulting damage dynamically. Not robustness. Resilience. Or perhaps even anti-fragility.

The implications of this layered architecture are important. The reflective hairs alone would be insufficient. The heat-shock proteins alone would be overwhelmed. The behavioural adaptations alone would not buy enough time. But together, each layer compensates for the limitations of the others.

At the optical level, incoming heat is reduced.

At the thermodynamic level, internal heat is expelled.

At the biomechanical level, contact with hot surfaces is minimized.

At the molecular level, unavoidable thermal damage is repaired.

No single breakthrough mechanism exists. The breakthrough emerges from coordinated contradiction management across multiple system levels simultaneously.

And perhaps that is the deepest lesson of the Saharan silver ant. Nature's most sophisticated solutions rarely eliminate hostile conditions. More often, they create tiny temporary asymmetries that allow life to operate briefly where competitors and predators cannot. The desert does not become less deadly. The ants simply become just survivable enough to turn the deadliest part of the environment into an ecological advantage.

Short Thort – The Price of Trust

For most of history, information was expensive. Books were scarce. Expertise was scarce. Publishing was difficult.

Today, information is effectively free.

Previously we argued that this abundance makes wisdom more valuable because extracting signal from noise becomes progressively harder.

Information abundance creates a wisdom shortage.

Artificial information abundance creates a trust shortage.

Every new communication now carries an additional question: *Can I believe it?*

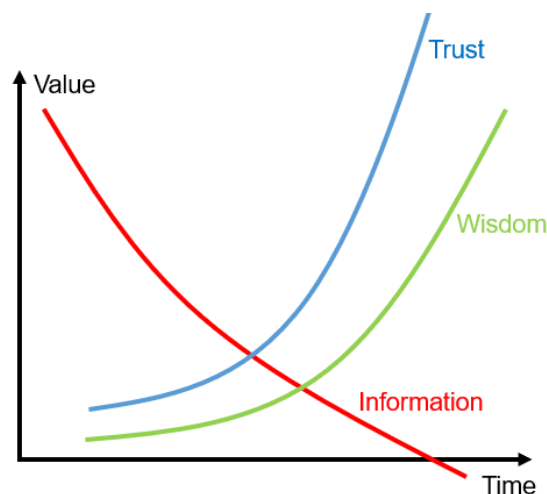
We are entering an economy where trust – not information – is becoming the scarcest resource.

The organisations that prosper will not be those producing the most content. They will be those whose judgement, provenance and integrity consistently survive scrutiny.

In an increasingly Babelian world overflowing with information, trust becomes the ultimate competitive advantage.

- **Information** becomes abundant.
- **Wisdom** becomes scarce because filtering becomes harder.
- **Trust** becomes scarcer still because even the filters themselves become suspect.

The limiting resource keeps moving one level higher in the hierarchy. Fifty years ago we paid for information. Today we increasingly pay for judgement. Tomorrow, we'll pay primarily for sources whose judgement we trust.



"Trust is a mechanism for reducing social complexity."
Niklas Luhmann

"The task is not to build trust, but to build trustworthiness."
Onora O'Neill:

News

Solving Ethical Contradictions

We're happy to announce that the Ethics Press has just launched the paperback and ebook versions of Darrell's book. Both the Paperback and eBook versions are listed at £29.99 on the Ethics Press website. SIEZ subscribers are entitled to a 15% discount, reducing the price to £25.99 (excluding carriage) by clicking on this link:

<https://www.ethicspress.com/products/solving-ethical-contradictions/?INTEGRITY>

Everythink (DE)

The German ebook edition of Everythink is now available from the SI shop. Check it out here: <https://si-shop.org.uk/everythink-german-translation-pdf/>

More New Workshops

Following the announcement last month of a revised FutureProof workshop and the new TRIZ Failure Case Studies workshop, visitors to our online shop will see that two additional new workshops have been added to the roster this month. 'How To Measure Anything' will run in December, and 'Innovation Architecture: Designing Human-AI Collaboration' will run in January 2027. Both will follow the usual format of two four-hour sessions, spaced a week apart. More detail and booking at the usual place:

<https://si-shop.org.uk/workshops-and-training/>

Podcasts

The 29th and final episode of Season #3 of our DangerMouth podcast was just released. Always looking to go out on a high, it features a conversation with Kalyan Banerjee, a soul-in-the-game hero busy re-inventing education. You can find it here:

<https://bathmikec.podbean.com/>. We'll be back again in mid-September for Season #4 and a host of scarily big-hitting innovation-world guests. In the interim, the 1%ers: How New Things Get Done podcast will continue its weekly pulse rate through the summer.

ICSI'17

By the time you read this, the 17th International Conference on Systematic Innovation in Taipei will have ended. At the last minute, Darrell was asked if he could step in and give a keynote address. His response, 'Knowledge Wants to be Free. Wisdom Wants to be Expensive: AI, Systematic Innovation and the Coming Trough of Disillusionment' was duly prepared and presented on July 19. Anyone wanting to see and hear a recording of the presentation can find it via: <https://i-sim.org/icsi2026/invited-plenary-speeches/>

TRIZCON'26

Speaking of keynotes, Darrell has also been invited to come and give a keynote at this year's Altshuller Institute conference, being held in Guanajuato, Mexico on the 3rd, 4th and 5th of November. The request is for a review of the current state of TRIZ in the 21st century. Which probably means the title will include the words 'Mount Stupid' in it somewhere. It will, of course, also be full of optimism for the future.

Altshuller Institute

Speaking of the Altshuller Institute, we are very happy to announce that they recently awarded Darrell with TRIZ Master certification. Needless to say, he feels very honoured.

New Projects

This month's new projects from around the Network:

Electronics – Cross-Company SI Deployment
Energy – Consulting Projects
Healthcare – Start-Up Business Planning Project
NGO – Expansion Planning Project
Automotive – TRIZ/SI Workshops
FMCG – GenerationDNA Project
Apparel – New Venture Project
Education – TrenDNA Project
Consulting – Frustration Mapping Project

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