Systematic Innovation

e-zine

Issue 171, June 2016

In this month's issue:

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.
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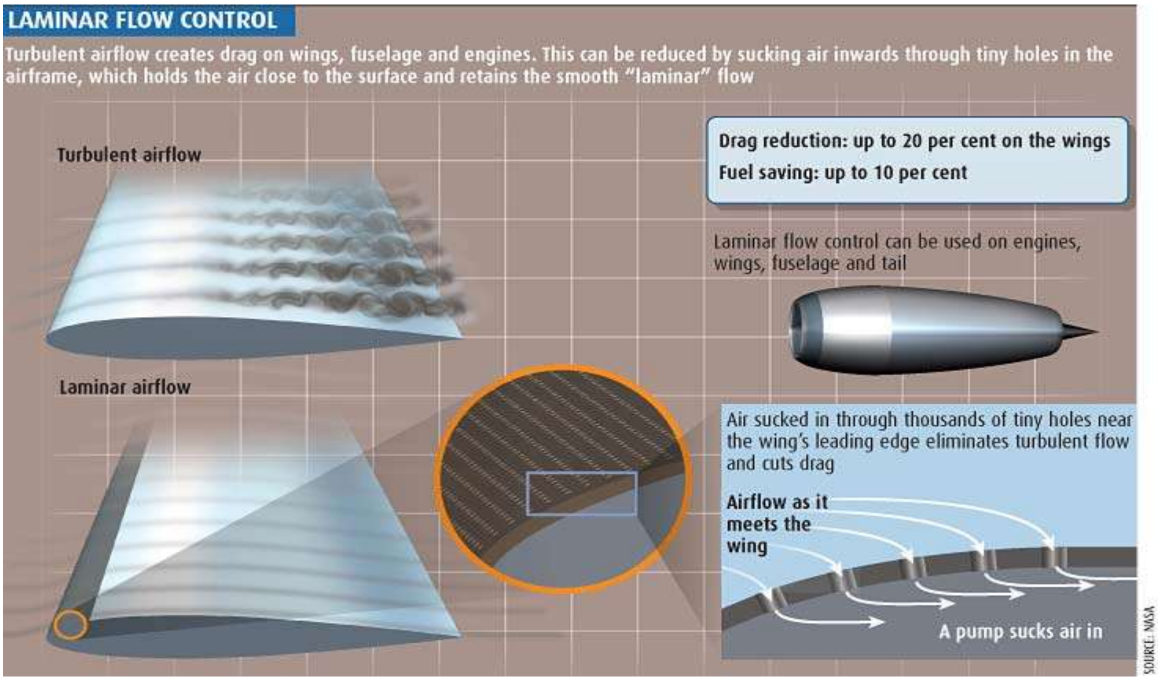
Managing The (4H) Unknowns



A few years ago, I had the dubious fortune of working on a research project looking at laminar-flow wings for aircraft. The basic idea – the brainchild of a group of long-time bored aerodynamicists – was that if we could prevent the airflow over the surface of a wing from becoming turbulent, we could achieve a substantial reduction in drag. The big idea centred around the creation of several million tiny holes in the surface of the wing, through which air would be sucked. Simple enough conceptually, but something of a challenge as far as the manufacture team was concerned. That said, they already knew how to make small holes, so their challenge was 'merely' to increase the quantity by an order of magnitude or two without increasing the cost. The fact that there was a multi-million dollar research grant to support the required R&D served to sweeten the pill somewhat for both the aerodynamicists and the manufacturers.

In a former life I used to be an aerodynamicist, so in many ways it should have been a dream project. Unfortunately, part of my time in the aerodynamics world was spent worrying about environmental factors like sand, rain, ice and other 'foreign objects'. My first instinct when I saw the first prototype sheets of holey-wing material was, 'won't they get blocked?'

To which the answer from the in-house project team was basically, 'who let this idiot into the room?' I decided to keep quiet for a while. Until, as it happens, just after the first real world flight of a holey laminar flow wing. It was a beautiful summer day. The multi-million dollar project had now become a multi-tens-of-millions-dollar project. Building new aircraft is an expensive business. Instrumenting them to see how well your laminar flow drag saving hypothesis worked even more so. Especially when you want to see the results 'live' as the aircraft does its thing.

So everyone is basically looking at their drag reduction read-outs and the flight begins. There's a collective 'hooray'. The drag reduction looks impressive. The aerodynamicists prediction was pretty much spot on. Or at least it was for the first 15 minutes or so. Then it began to dip. And dip some more. Until finally, when the aircraft came in to land, the drag reduction effect had pretty much disappeared. The aerodynamicists weren't happy.

They were even less happy when they went to have a look at their beautiful holey-wing. It looked like an insect graveyard. Half the beautiful holes now un-beautifully blocked by the splattered remains of dead things. Turns out that if you hit even something as small as a midge at 400mph it can cover a fairly large area. A bit like the old joke, 'what's the last thing that goes through a fly's mind as it hits your windscreen?, answer: it's arse', we found ourselves looking at rather a large amount of midge arse.

It took about a month to strip the wing down and clear the insect detritus from the holes.

One of the aerodynamicists hypothesized that, perhaps we'd been sucking the air through the holes too hard. Another flight was duly scheduled to test the hypothesis. Same result. Another month of hard labour, flushing out several million tiny holes.

No-one had the will to try a third flight.

An awful lot of hard-fought R&D money got written off.

The point of the story?
A group of would-be innovators that fell into a very typical trap: not wanting to leave their comfort zone.

Here's the picture we should have drawn:

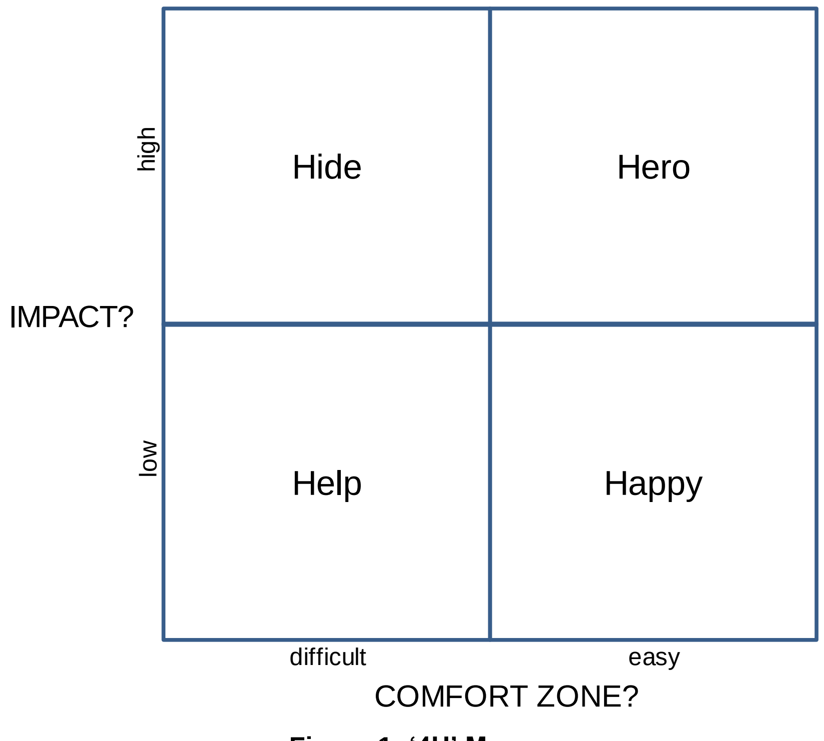


Figure 1: '4H' Map

Another 2x2 matrix. The innovator's version of the famous 'important-versus-urgent' 'Eisenhower Box'. Only this time plotting whether something has high or low impact against whether it is within or beyond our comfort zone. The four quadrants give us 4 'H's as follows:

When we're working within our comfort zone, on something that has low impact, 'innovators' tend to be at their **H**appiest: we get to work on stuff we love and are good at, and the consequences if things go wrong are pretty low. In the case of my laminar wing experience, this is the box the aerodynamicists were in: every aerodynamicist knows about the potential benefits of laminar flow, the 'boundary layer suction' technology has long been hypothesized, and the only real doubt is whether the drag reduction is 19% or 21%. For the aerodynamicists, this was a dream project: all up-side, very little downside…

…better yet, they got to off-load the difficult, high impact bit to the manufacture people. This is the top-right box in the map. The manufacture people were inside their comfort zone – they knew how to make tiny holes – but what they were now being asked to do was a big risk in terms of eventual project impact. Changing things by several orders of magnitude is the job of **H**ero's.

Meanwhile, down in the bottom let hand corner of the map is the low-impact, out-of-comfort-zone domain. Stuff that has to be done, stuff that we know is do-able, just that we don't know how to do it. This is the '**H**elp' zone. Which basically means we go and get help, and let someone else do the job. In the case of the laminar wing project, a good example of a job that had to be done that was in this quadrant was specifying the right pump to suck the air through the tiny holes. No-one in the team knew how to design pumps, but several knew how to find the right one in a catalogue.

That, finally, leaves the top-left hand box. The one marked '**H**ide'. These are the out-of-comfort-zone, high impact problems. Like, 'how will the small holes cope with insects and other foreign objects?' As far as the project team was concerned, this was very definitely outside their comfort zone, and all of their instincts were telling them to try and hide the problem. Especially so in this case, because, heaven forbid the project sponsors – the people forking out the many millions of dollars – might learn that there was something potentially able to jeopardise the success of the project.

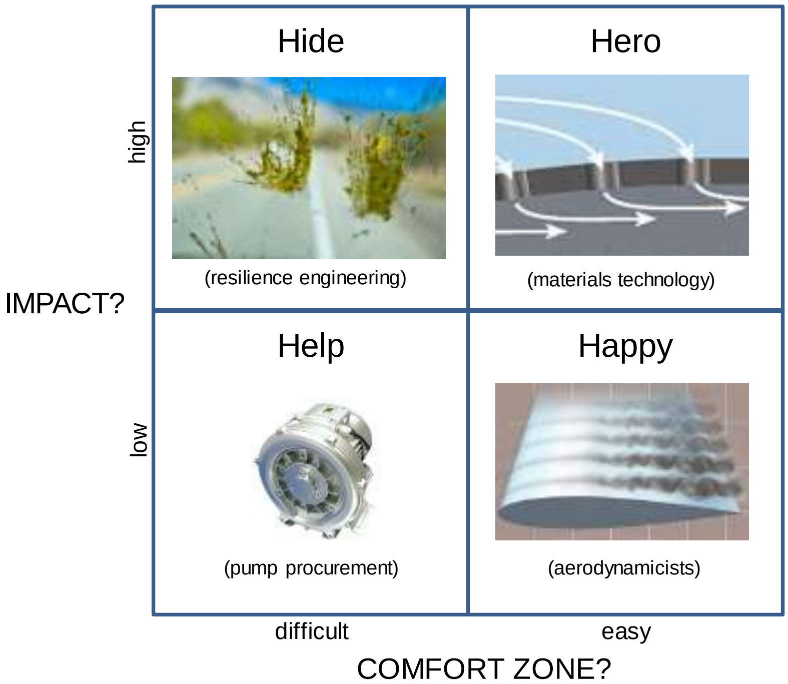
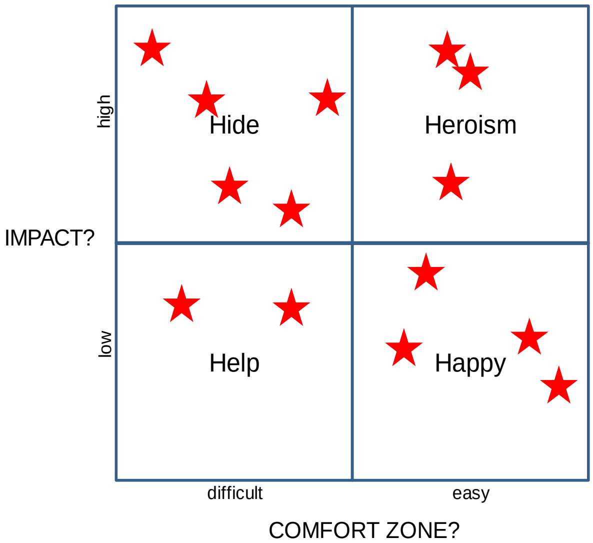


Figure 2: '4H' Map For The Laminar Wing Project

The big idea here is that what the laminar wing project team 'should' have done – what any serious innovation project team should do – is focus their time and effort on the '**H**ide' problems.

In the specific instance of the insect problem, it would have cost very little indeed to test the insect-trapping properties of a sheet of holey-material. And the resulting answer would very likely have saved an awful lot of time and money spent allowing people to work, pointlessly as it turned out in this case, on the ‘easy’, within comfort-zone problems.

To a very large extent, managing innovation projects is about managing the unknowns. Teams need to be honest and open about all the stuff that isn’t known or understood. Then they need to find a way of prioritizing how they spend their very precious time and other resources. The best way we’ve found to do that – we do it on all of our own projects (i.e. we take our own medicine) – is to plot all the unknowns onto the 4H map. Something like this:



unknown	ROI	Customer	Who?	How?	What?
How much will customers pay?		X (DM)			
How to validate the ‘wow’ TRIZ model?				X (MG)	
What software platform should we start with?					X (MG)
Who will do the ‘machine learning’ software?			X (MG)		
What functionality does the customer want?		X (DM)			
What’s the minimum functionality?		X (DM)			
What is the right business model – license/prod?					X (DM)
Who might we partner with?			X (DM)		
How can we access early beta testers? Students?			X(EM)		
How fast are competitors moving into our space?			X(DM)		
If we create an App, who will write it?			X(MG)		
What IP should we file? And when?					X(All)
‘Creative’ musicians don’t want a creative tool?		X(DM)			
Is it possible to automatically decode ‘wow’				X(MG)	
Is there a healthcare market? How to enter it?		X(EM)			
How do we obtain earliest possible revenue?	X(DM)				
How do we create market awareness?		X(MG)			
Kickstarter? Crowd-sourcing?	X(TS)				
What do we call it? Initial branding?		X(TS)			
Which market (geography) do we target first?	X(DM)				

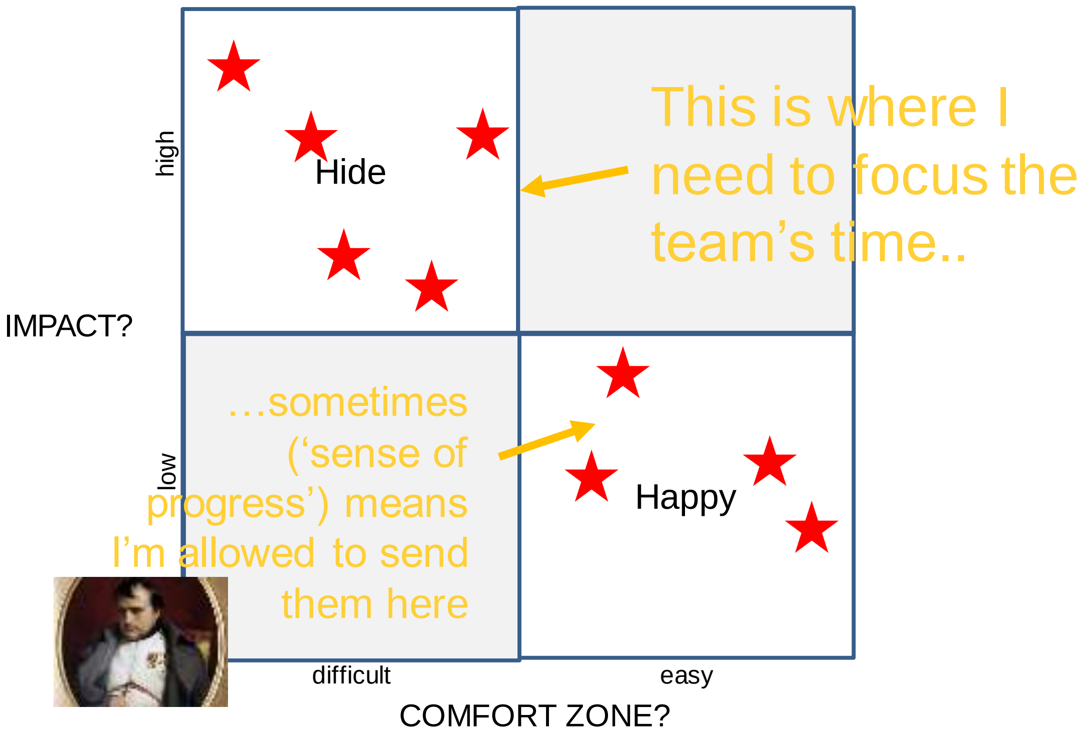
Figure 3: Typical ‘Managing The Unknowns’ ‘4H’ Map

On the right hand side of the picture is a list of all the unknowns for a typical project (just for completeness sake, we tend to classify the unknowns into five categories – ROI, Customer, Who? How? And What?), and on the left is what happens when we plot them against the Impact and Comfort Zone axes.

Managing the project then typically means working from the top-left hand corner until all the unknowns have become ‘known’. In other words, working on the high impact, difficult problems first. All the time, trying to find the cheapest, simplest means of acquiring a ‘good enough’ answer. No need to find a way to fire 400mph insects at a sheet of holey-flight-grade-aluminium. Simply drive along a highway with a sieve sellotaped to the front of the car would have been sufficient to show that this was a project-killer.

The only exception we’ve found to the ‘top-left’ rule, is that sometimes the first responsibility of the project manager is to the morale of the team. Which means creating the all-important ‘sense of progress’ we write about frequently in this ezine. Sometimes – just sometimes – ‘sense of progress’ means you allow people to work in the bottom-right hand corner of the 4H Map.

If in doubt, think like Napoleon. He knew the top-left, bottom-right trick. Or at least he did until Moscow… but that’s a different story.


This is where I need to focus the team's time..
Hide
high
IMPACT?
low
…sometimes ('sense of progress') means I'm allowed to send them here
Happy
difficult
easy
COMFORT ZONE?

Getting The Best Out Of The Contradiction Matrix

In light of the publication of the new version of the Contradiction Matrix for Business & Management problems, it felt like a good time to review different ways of using the various different Contradiction Matrix tools. We've had twenty-five years of using the various different evolutions of the Matrix, teaching others, and watching people working on real problems using it. Over that time, we've tried or noticed many different strategies and methods. Some work better than others, but when we step back from all of the variants, three strategies stand out as more effective than others:
Route 1: Finding 'The Right' Box
Route 2: 'All Possible Boxes'
Route 3: 40 Inventive Principles

Route 1: Finding The Right Box
This has become my own default method of using the Matrix. Mainly because, I think, the biggest advantage of this route is that it forces the user to spend as long as possible in 'problem definition' mode. The trick to getting the most out of using the Matrix this way is to spend time in the specific-to-generic translation:

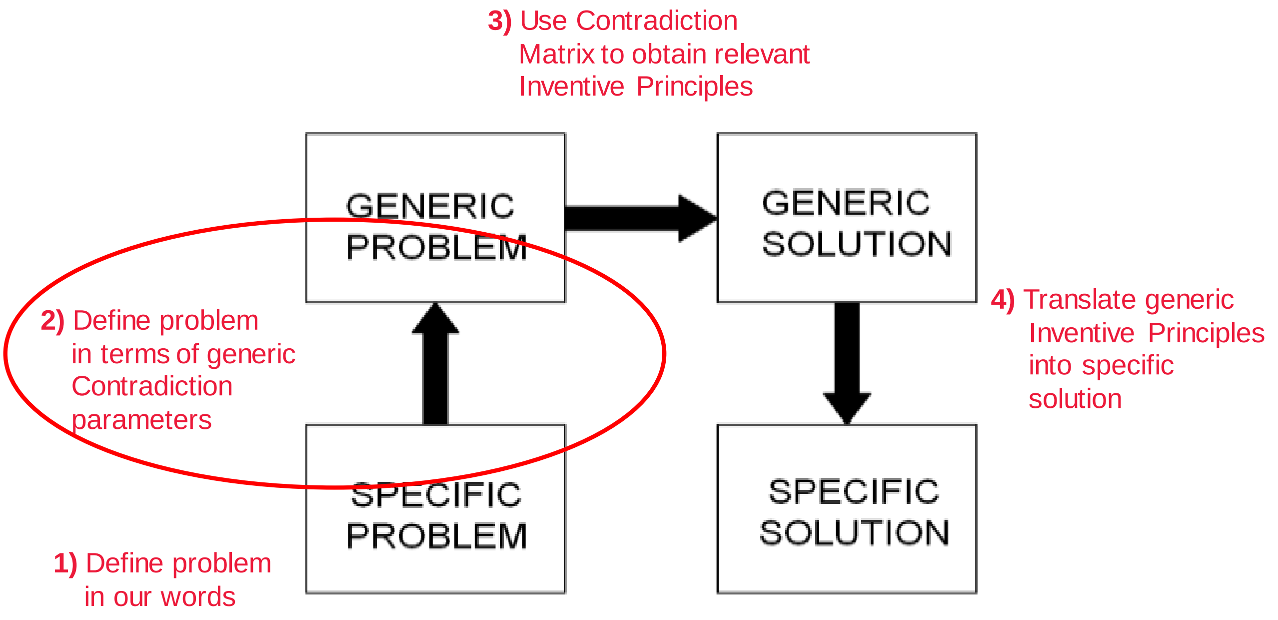


Figure 1: Route 1 Time Focus

By only allowing yourself the possibility of choosing one improving parameter and only one worsening parameter, it forces you to really think about what precisely you're trying to improve and what's on the other side of the conflict.

To take a typical example, many 'specific' problems involve cost. But, of course, there is no cost parameter in the (technical version of) Matrix, because, in effect, all 50 of the available parameters in the menu have a relationship with cost. What the list is in effect forcing the problem definer to think about is, 'precisely what aspect of cost is it that you're trying to improve?' Is it material cost, for example (Amount of Substance). Or is it an inadequate durability cost (Duration of Action or Reliability)? Is it about reliability? Or is the amount of time more important? By forcing yourself through this kind of thinking process, you're giving yourself the best shot at ensuring you know exactly what the conflict you're trying to solve is. And then, by implication, that the Inventive Principles the Matrix presents back to you after you've finally allowed to look in the relevant row and column intersection box, are all going to be meaningful and usable.

Route 2: All Possible Boxes

In many ways the opposite to the Route 1 strategy is the one that allows the user to choose as many of the Matrix parameters they think 'might be' relevant to their specific problem as they like. This effectively allows the user to spend a lot less time thinking about what the actual conflict they're trying to solve is, and to get to the solution generation part of the process as quickly as possible.

If the problem solver is using the paper version of the Matrix, the first downside of this Route 2 strategy is that it can get pretty tedious looking up lots of boxes in the Matrix. What will almost inevitably happen, however, when users do adopt this approach, is that they will quickly begin to notice the same Inventive Principles suggestions appearing in multiple different boxes. This is the 'self-correcting' nature of the Matrix coming to the fore. It happens because, turning the story around the other way, whenever the SI research team adds a new case study onto the Matrix, the strategy they use says, if we don't know which specific box to put a given solution into, we'll put the solution into multiple boxes.

If you're using the software version of the Matrix, of course, all of this 'self correction' ranking of the Inventive Principle suggestions is done for you:

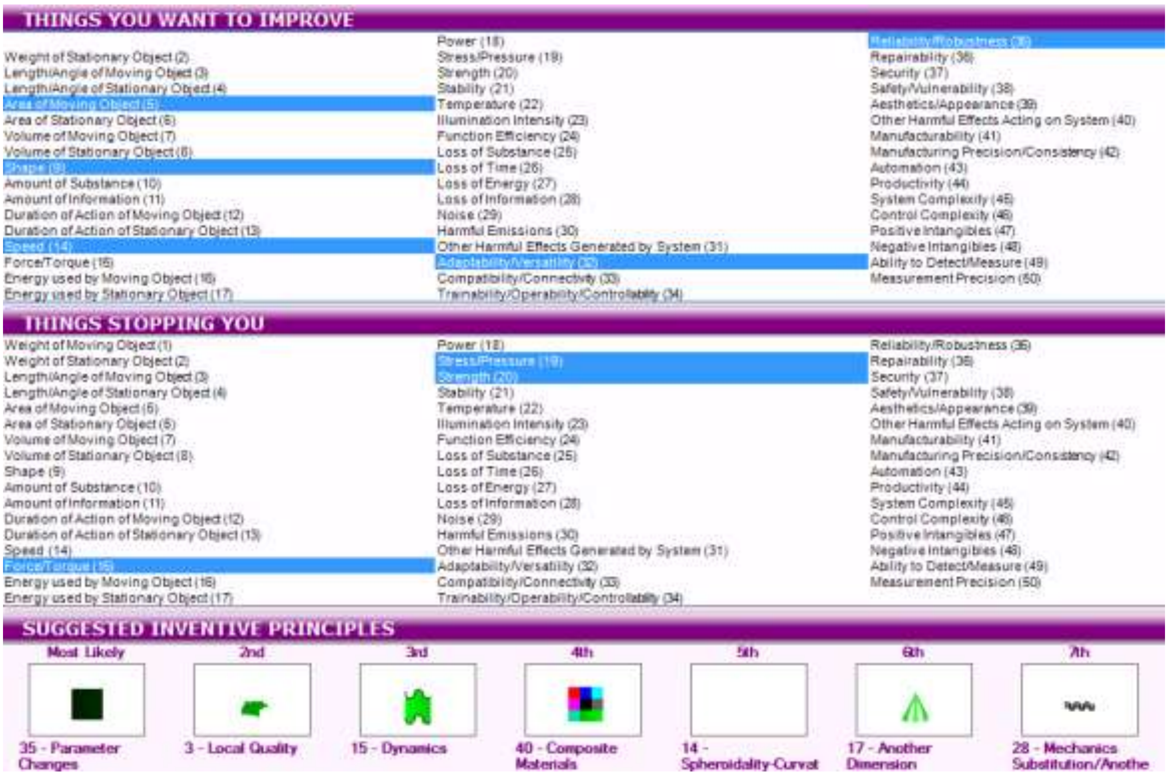


Figure 2: Route 2, 'All Possible Boxes' Matrix Strategy

The main downside of the Route 2 strategy is still to come, however, irrespective of whether you've been through the manual or automated Principle ranking task. And that is that some of the Principle suggestions will be quite difficult to connect to the problem you're trying to tackle. In no small part this problem arises because you haven't actually spent the time to really think about what your problem is. I've seen many occasions where teams have travelled this route, encountered a Principle suggestion that they have no idea how to connect to what they think their problem is, and have thus ignored it and moved on to the next Principle on the list. Whereas a later search of a patent database has revealed that many others have indeed used said Principle to derive a very elegant solution to what you eventually realise was your problem.

Route 3: 40 Inventive Principles
This is the route favoured by the Matrix-averse. On one level, their rationale is very logical: 'if there are only 40 Inventive Principles, and this is a real problem we're working on, why wouldn't we examine all 40 of them?' The most obvious advantage of this route is that it misses the first two steps of the process completely and allows users to get straight to the exciting idea generation part of the process.

The downsides are, unfortunately, somewhat less obvious. As with Route 2, one issue is that the idea generation activity is less focused because no-one in the session has really had an opportunity to really think about what the problem being solved actually is. The more insidious disadvantage is that brainstorming through 40 Principles and doing it effectively is hard work. Or rather, 'it should be'. Something I notice a lot with teams that track down Route 3 is a propensity to goof off when it comes to doing the hard work. I'll hear comments like, 'we already had that Principle' when they see that one Principle appears similar to another (e.g. Principles 3 and 4 have a very clear overlap). A truly disciplined use of the 40 Principles would involve doing the opposite of trying to find excuses to not use a Principle – the key to successful use is looking for the parts of each Principle that *don't* overlap with other ones. That's a fairly counter-intuitive and therefore difficult mindset for people to get themselves into.

Which Route?
The existence of these three different Routes is perhaps indicative of a higher level contradiction. Should I use Route 1 or route 2 or 3 is ultimately the wrong question. We know it's the wrong question because it has the word 'or' in it. If we were actually using the philosophy of the Contradiction tool, we'd do something to solve the contradiction. Which, in practical terms means knowing where, when and under what conditions the various options needs to be separated.

That story, I believe, looks something like this:

	Advantages	Disadvantages	Where/When To Use
Route 1 The 'Right Box'	Forces rigorous problem definition; best opportunity that the Inventive Principle suggestions will connect to the problem at hand	Difficult to get teams to want to devote sufficient time and effort to the 'boring' problem definition task; takes the 'fun' out of idea generation	Use Route 1 before a brainstorming session rather than 'live' within the session.
Route 2 All Possible Boxes	Very rapid transition between problem definition and solution generation; self-correcting nature of the Matrix will become apparent – helps to build confidence in the credibility of the tool	Lack of focus on the 'actual' problem often means that the Inventive Principles suggested 'don't make sense' and get ignored	Novice users of the Matrix; workshop setting where it is helpful to demonstrate and work through the 'whole' contradiction solving process

Route 3 40 Inventive Principles	Eliminates most of the process; potential to be highly comprehensive in idea generation terms	Too easy to 'goof-off' and not do the Principles justice; requires considerable persistence to do properly	'Quick & dirty' problem solving sessions; deep problems where there is time to conduct the ideation in several sessions rather than all in one session

Not So Funny – A Picture Speaks A Thousand Words

By accident I chanced upon this photograph a few weeks ago. It seemed to say more about cats than any text book might achieve… cats understand Inventive Principles 23, 35 and 13…

…it made we wonder if there might be other meaningful images that somehow managed to convey a lot in a very small number of pixels. I quite liked this one:

I'm still trying to work out if it is all about Principle 2. Or Principle 23 again?

Principle 23 seems to get around quite a bit…

This pair seemed to offer up two sides of a different (Principle 31?) coin:

I also think there's a different (but common) metaphor in play with these images. Still not sure what it might be. If I'm still trying to think my way through that one, this one still kind of explodes my brain every time I dare look at it…

A special prize for anyone that can map this back to… err, anything at all. Whereas….

Finally, in line with the recent ‘confusing’ (please can we go back to the beginning and try it again) EU Referendum result in the UK, I felt myself feeling more than a little sympathy for this timely piece of graffiti:

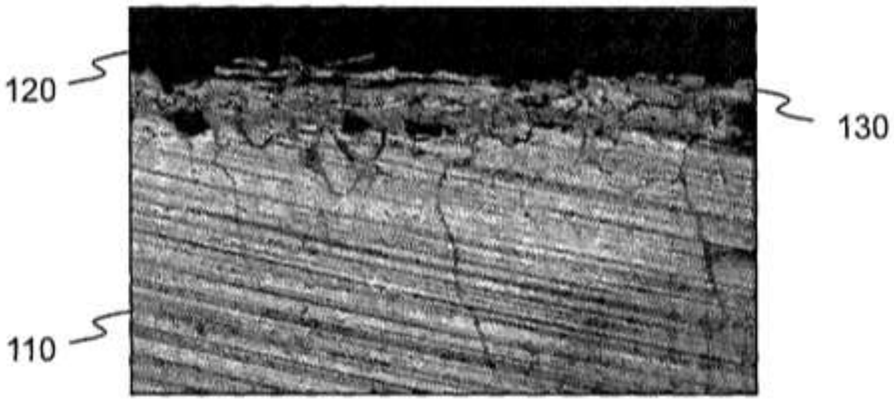
I wish.

Patent of the Month - Joining Dis-similar Materials

Our patent of the month this month takes us to a team of inventors at LeTourneau University in Texas. US9,374853 was granted on 21 June. Here's what the beautifully succinct background section tells us about the problem tackled by the inventors:

There is currently a desire across many industries to accurately and safely join two dissimilar materials. For example, there is currently a desire to join polymer/ceramics and metals for thermoelectric generator applications. There is also a desire to join polymer/ceramics and metals for very large scale integration (VLSI) integrated circuit (IC) applications, among others.

Unfortunately, joining two dissimilar materials, for example having large coefficient of thermal expansion (CTE) mismatches, is difficult. Because of the mismatch in CTE values, fracturing may occur between the two dissimilar materials if the joining is conducted improperly. Turning briefly to [the figure], illustrated is a work piece including a polymer/ceramic material 110 having undergone a joining process with a metal material 120. In this circumstance, the polymer/ceramic material 110 and metal material 120 were improperly joined, resulting in cracks 130 from thermal shock.



Accordingly, what is needed in the art is a new method for joining two dissimilar materials and a system for accomplishing the same, which do not experience the problems discussed above.

A nice easy one to map onto the Contradiction Matrix…

IMPROVING PARAMETERS YOU HAVE SELECTED:
Compatibility/Connectivity (33)
WORSENING PARAMETERS YOU HAVE SELECTED:
Adaptability/Versatility (32)
SUGGESTED INVENTIVE PRINCIPLES:
28, 10, 24, 6, 15, 7

…what is required is a strong, stable join, and the thing that prevents it is a mismatch in properties (CTE specifically) between the two different materials.

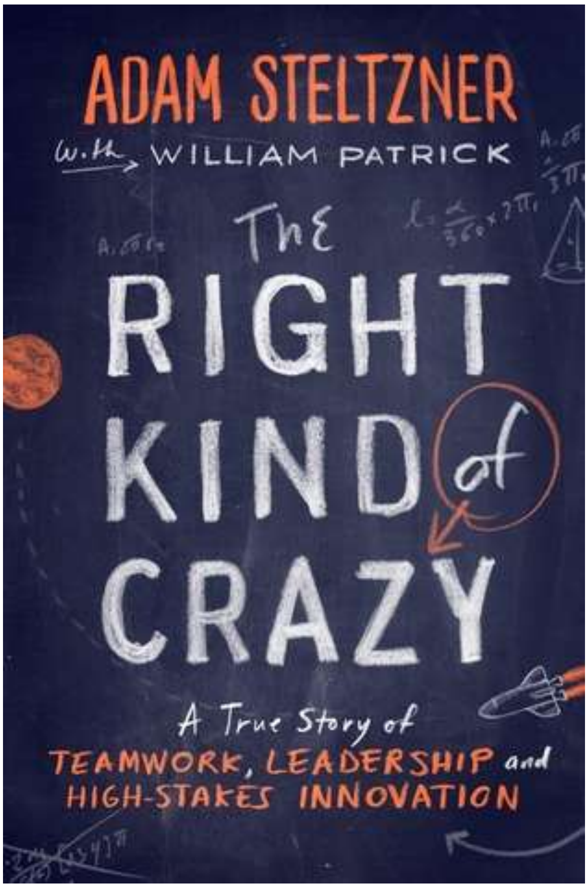
Here's how the inventors have solved the problem:

A method for joining two materials, comprising: placing an article including two dissimilar materials within a waveguide structure, the article located between a microwave source and reflective surface of the waveguide structure; and subjecting the article to microwaves from the microwave source; and feeding back change in temperature information of the article being subjected to the microwaves to a controller to continually change a relative position of the article with respect to the *reflective surface and continually adjust the output power of the microwave source, thereby dynamically changing a microwave field distribution within the waveguide and join the two dissimilar materials.*

Which all feels very consistent with the Matrix recommendations:
Principle 28, Mechanics Substitution – use of microwave
Principle 24, Intermediary – the 'reflective surface' waveguide
Principle 15, Dynamization – the changing of the relative position of article and reflective surface and output power

In that sense a pretty good illustration of the importance of combinations of ideas to solve the conflict. As well as being a very elegant solution to a tough manufacturing problem.

Best of the Month – The Right Kind Of Crazy



One for the old-school engineers. When the Mars rover Curiosity stuck its landing on the red planet on Aug. 6, 2012, it not only opened a new era of space exploration and a bright new door to NASA’s future, but it also signified a triumph of human ingenuity over staggering odds.

There was virtually zero margin of error with the $2.5 billion project, as this new book about the Rover points out, and many things could have gone wrong with a mission that depended upon the work of more than 7,000 scientists and engineers, and about 500,000 lines of computer code.

After being blasted into space by an Atlas V rocket on Nov. 26, 2011, Curiosity spent eight months hurtling some 354 million miles through space, plunging into Mars’s atmosphere at a brutal 13,200 miles an hour. For the rover to alight safely in the chosen landing zone, everything had to work perfectly in an immensely complicated system known as E.D.L. (entry, descent and landing). The process involved rocket-powered deceleration, a giant parachute and a sky crane using nylon ropes to lower Curiosity gently onto the surface of Mars and set it directly down on its wheels.

It all sounded pretty crazy, as NASA’s top administrator observed, but, as it turned out, it was “the right kind of crazy.” For more than three and a half years now, the little rover has been working diligently, trundling across the surface of Mars, looking for evidence that the planet could have once supported life, and occasionally tweeting.

“The Right Kind of Crazy” is the title of this engaging book, written by Adam Steltzner, an engineer leading the team at NASA’s Jet Propulsion Laboratory (J.P.L.) that was charged with landing the Curiosity. Written with William Patrick, the book is an inside account of the intense decade of teamwork that went into Curiosity, and it’s also the story of Mr. Steltzner’s own unlikely journey — from an aspiring musician, who barely graduated from high school, to a California Institute of Technology recruit to a team leader at the J.P.L. in Pasadena, Calif.

The book offers a gripping account of the Curiosity mission, and some fascinating insights into the engineering principles and analytics involved in pulling off the project. Mr. Steltzner — who became known at J.P.L. for his Elvis hair, his cowboy boots and his swaggering style — often talks less like a science geek than like the rocker he wanted to be as a teenager, and he displays a gift here for capturing the high-stakes, adrenaline-laced atmosphere of the Mars Science Laboratory, as the overall project was called.

On top of racing the clock, which had been “set by celestial mechanics” (at one point, the launch date would have to be moved back from 2009 to 2011), Mr. Steltzner and his colleagues were faced with inventing a landing system for the car-size one-ton Curiosity, which was filled with delicate scientific equipment and way too heavy for the air-bag cocoons used in earlier rover missions. Along the way, there would be moments in what Mr. Steltzner calls the Dark Room — that place where it’s hard to “egghead” your way through a problem, and “you know you have no solution.”

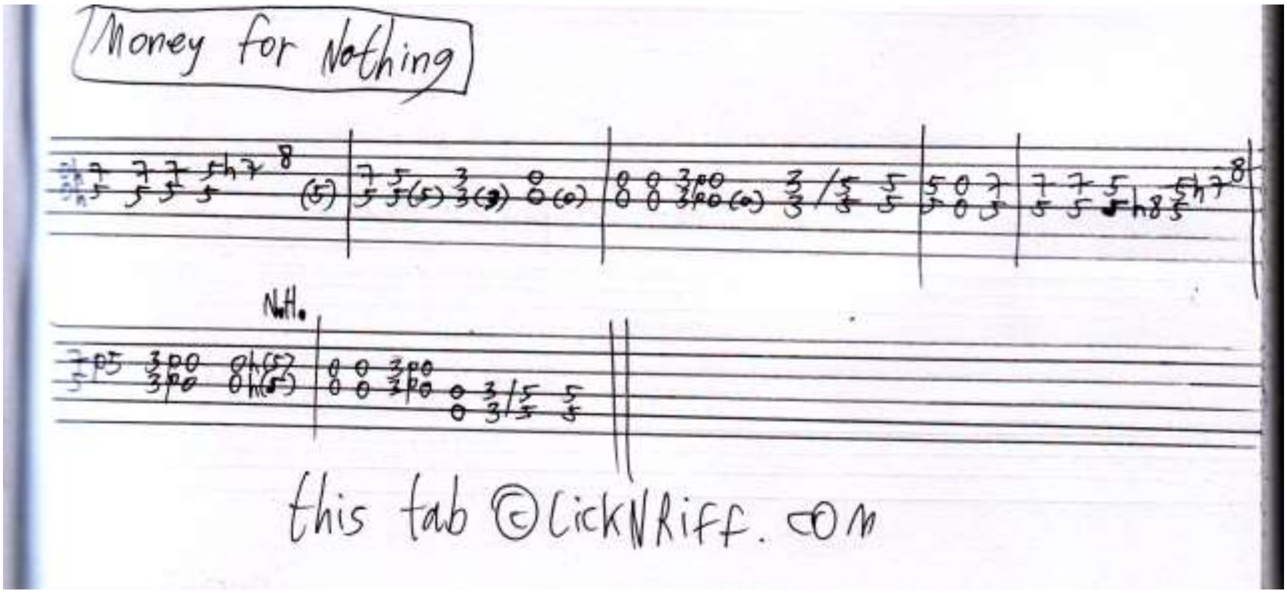
Six months from launch (“a few seconds in spacecraft development time”), something went horribly awry in a simulated landing: Radar, crucial to the process, failed to kick in. After a string of all-nighters, examining “every component for the source of the failure,” Mr. Steltzner says, they found “that all our incredibly sophisticated naughty bits had worked fine.” There was nothing wrong with the spacecraft computer or the flight software or the algorithms.

“What hadn’t worked was some run-of-the mill, everyday components” of their test equipment. In this case, the problem was caught in time to save the mission; a similarly mundane mistake that went undiscovered (one team had used English units of measurement; another used metric units) led to the loss of the Mars Climate Orbiter in 1999.

In the course of this book, Mr. Steltzner gives us an appreciation of the hard data and intuition involved in the engineering of a huge project like the Mars Science Laboratory — and the way teams learned to break down seemingly impossible problems into smaller, more manageable ones. He writes that one of the difficulties with space exploration is that “we never have enough iterations to allow us to fully learn from our mistakes.” And he describes the technology necessary for landing the rover on Mars as “tantamount to magic.”

Like when, on the first anniversary of its safe landing on Mars, hundreds of millions of miles from Earth, the lonely little rover sang “Happy Birthday” to itself. For that reason alone, you need to read this book. Call it your summer holiday treat.

Wow In Music – Money For Nothing



Having won a Grammy Award for Best Rock Performance by a Duo or Group With Vocal in 1986, Dire Straits' 'Money for Nothing' appeared on the album 'Brothers in Arms', proving "to be the London band's crowning achievement, selling more than 25 million copies worldwide, nine million of them in the US alone, while in the UK it was the biggest-selling long player of the 1980s". Recorded at AIR Montserrat also became "notable for a cameo appearance by Sting singing the song's introduction and backing chorus". "The line "I want my MTV" was the basis of the cable network's promotional campaign. They played clips of musicians saying, and often times, screaming the line between videos."

Brothers in Arms was one of the first albums to be released on CD, as "Dire Straits were early adopters of digital recording, thanks to Mark Knopfler's constant striving for better sound quality. Referring to him, Sound engineer Neil Dorfsman remembers that "One of the things that I totally respected about him was his interest in technology as a means of improving his music. He was always willing to spend on high-quality equipment, and I actually remember the night he made the decision to try digital."

"The innovative video was one of the first to feature computer generated animation, which was done using an early program called Paintbox. The characters were supposed to have more detail, like buttons on their shirts, but they used up the budget and had to leave it as is. It won Best Video at the 1986 MTV Video Music Awards."

Money for Nothing is about "rock star excess and the easy life it brings compared with real work". Knopfler has pointed out the song was written from the viewpoint of a stupid character who thinks musicians make their "money for nothing" and his stupidity is what leads him to make ignorant statements. Many of the lyrics were things they actually said. According to Knopfler : "The lead character in the song is a guy who works in the hardware department in a television/custom kitchen/refrigerator/microwave appliance store. He's singing the song. I had to ask for a pen and paper while I sat down in this mock kitchen display - which was in the front window of this kitchen electrical and appliance store - and tried to write the tune. In the back of the store, all the TVs were tuned into MTV".

Finally, and perhaps most importantly, the song features one of the all-time best guitar riffs. A stuttering (Principle 2), multi-bar extravaganza. Here's the track's co-producer Neil Dorfsman in response to a question about the unique guitar sound:

"I remember Mark's Les Paul Junior going through a Laney amp, and that was the sound of 'Money For Nothing'," says Dorfsman. "We were actually going for a sort of ZZ Top sound, but what we ended up getting was kind of an accident. Mark would be in the control room and we'd run a lead out to the main area, and I remember getting a channel set up to monitor, heading out to the room to move the mics around, and Mark's guitar tech Ron Eve getting on the talkback and telling me not to touch anything because it sounded amazing as it was.

"One mic was pointing down at the floor, another was not quite on the speaker, another was somewhere else, and it wasn't how I would want to set things up — it was probably just left from the night before, when I'd been preparing things for the next day and had not really finished the setup. Nevertheless, whether it was the phase of the mics or the out-of-phaseness (Principle 37)*, what we heard was exactly what ended up on the record. There was no additional processing on that tune during the mix.*

"Later on, we tried to recreate that guitar sound at the Power Station with the same amp, same setup and same models of microphone, but we could never get it. I'd drawn extensive pictures and had a little map of how everything was set up, but there must have been something weird going on to make the guitar sound that way in Montserrat, because in New York it sounded like a cleaner, karaoke version of the same thing. I messed around with it for a good couple of hours, but Mark was just getting bored and wanted to move on. The whole thing was very confusing.

"Later on, a lot of people asked me how I got the sound on the record, but it was just one of those happy accidents that have not happened to me very often. I don't know if something was broken, but we could not recreate that sound again. All I know is, it was the sound of Mark playing, using his fingers instead of a pick, together with the Laney amp. It felt and sounded so good that I just had him do five or six passes and later comped something together and wound up using a couple of the passes in the final mix, putting a double in at certain points even though that wasn't something he normally did.

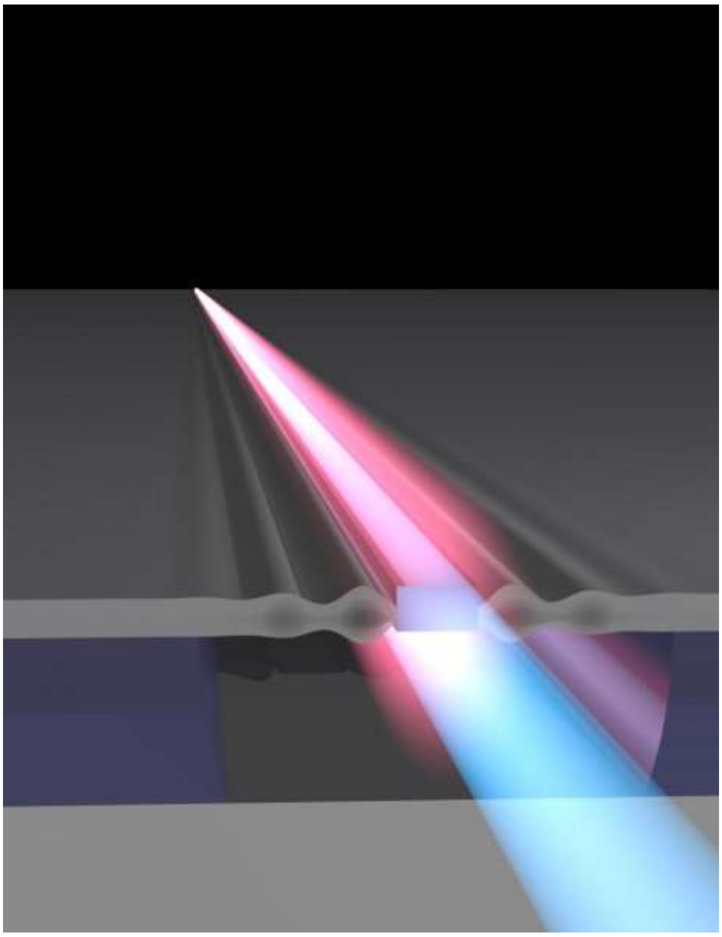
Taken all together – the riff, the new recording technology, the (Principle 13) self-mocking lyrics, the novel video animation – perhaps, ultimately, the real success of Money For Nothing is the magical (Principle 5) combination of all the right ingredients at just the right time?

If you want to revisit Dire Straits' success, here is the video clip: https://www.youtube.com/watch?v=wTP2RUD_cL0

And here some additional information regarding the recording of the track from Neil Dorfsman: http://www.soundonsound.com/node/4912422


dIREsTRAITS
money for nothing

Investments – Light Amplifier



Yale scientists have found a way to greatly boost the intensity of light waves on a silicon microchip using the power of sound.

Writing in the journal *Nature Photonics*, a team led by Peter Rakich describes a new waveguide system that harnesses the ability to precisely control the interaction of light and sound waves. This work solves a long-standing problem of how to utilize this interaction in a robust manner on a silicon chip as the basis for powerful new signal-processing technologies.

The prevalence of silicon chips in today's technology makes the new system particularly advantageous, the researchers note. "Silicon is the basis for practically all microchip technologies," said Rakich, who is an assistant professor of applied physics and physics at Yale. "The ability to combine both light and sound in silicon permits us to control and process information in new ways that weren't otherwise possible."

Rakich said combining the two capabilities "is like giving a UPS driver an amphibious vehicle -- you can find a much more efficient route for delivery when traveling by land or water."

These opportunities have motivated numerous groups around the world to explore such hybrid technologies on a silicon chip. However, progress was stifled because those devices weren't efficient enough for practical applications. The Yale group lifted this roadblock using new device designs that prevent light and sound from escaping the circuits.

"Figuring out how to shape this interaction without losing amplification was the real challenge," said Eric Kittlaus, a graduate student in Rakich's lab and the study's first author. "With precise control over the light-sound interaction, we will be able to create devices with immediate practical uses, including new types of lasers."

The researchers said there are commercial applications for the technology in a number of areas, including fiber-optic communications and signal processing. The system is part of a larger body of research the Rakich lab has conducted for the past five years, focused on designing new microchip technologies for light.

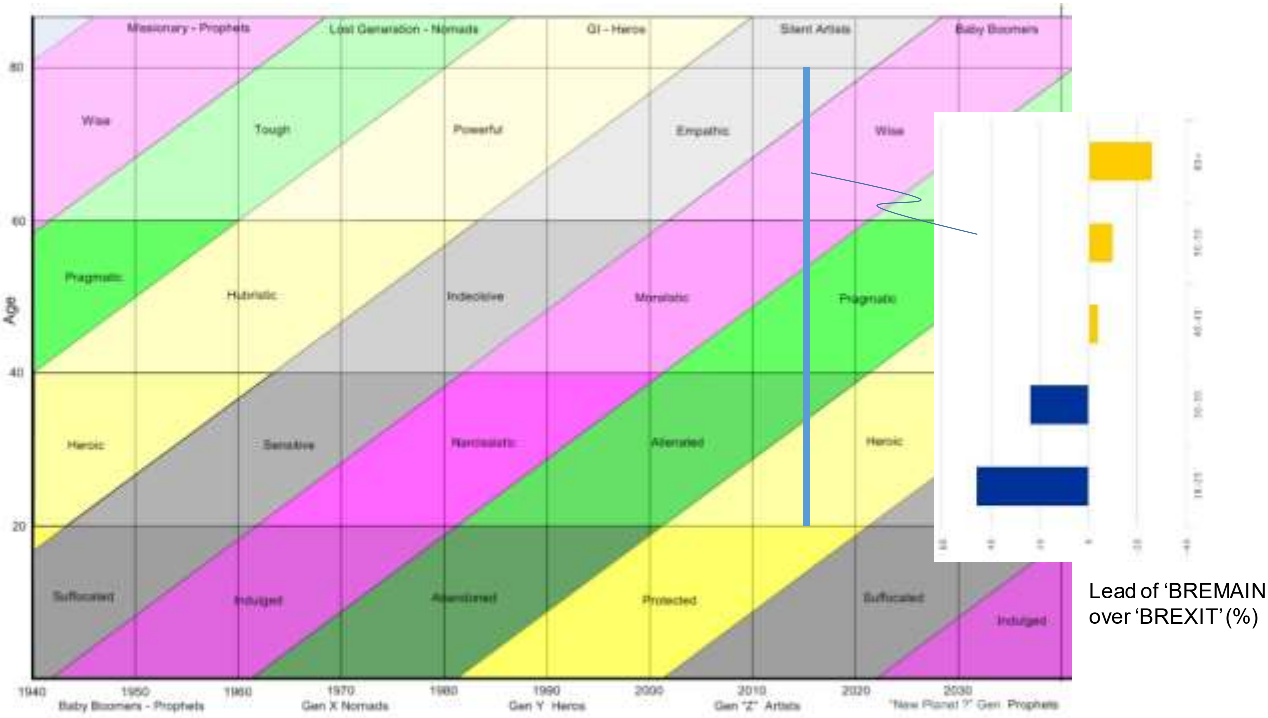
Heedeuk Shin, a former member of the Rakich lab who is now a professor at the Pohang University of Science and Technology in Korea, is the study's other co-author. "We're glad to help advance these new technologies, and are very excited to see what the future holds," Shin said.

What makes this story so interesting to me – despite the 'amphibious vehicle' analogy and use of the word 'hybrid' by the researchers – is the demonstration that some 'hybrids' are more innovative than others. Most 'hybrid solutions – e.g. a Prius – are the result of a 'one plus one is less than two' compromise where some of the benefits of one solution are traded-off in order to offer a second, also compromised, solution. The 'light plus sound' solution uncovered by the Yale team is very much in the realms of a 'one plus one is greater than two' synergy.

Now all they need to do is patent what they've found.

Generational Cycles – BREXIT

On June 23, the UK population – or at least 17 million of them – voted for the UK to leave the European Union. The voting figures across the generations was quite revealing:



One hopes that the decision of the 'Empathic' and 'Wise' older members of society to take the UK out proves to be in character as the coming months and years unfold.

Aided and abetted by the soon-to-retire Moralistic Boomers, of course.

Or maybe this is when the Hero's are really expected to step up to the plate. Empathy, Wisdom and Moralism got us into this mess safe in the knowledge that Heroism will get us out?

Meanwhile, the Pragmatists are busy resigning. Or looking to leave.

Happy days.

Biology – Arctic Ground Squirrel

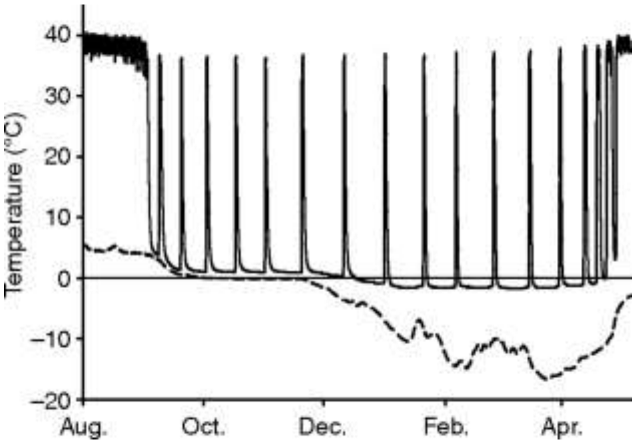
Unlike other animals, Arctic ground squirrels can lower their metabolism to 2 percent of their normal rate. They can also survive even though their core body temperature may dip to minus three degrees Celcius. Together, this allows them to essentially shut down bodily functions they don't need and, importantly, puts their organs in a state of suspended animation.

Researchers at the University of Alaska Fairbanks and Duke University collected and analyzed proteins associated with heart muscle from cooled, hibernating Arctic ground squirrels in which blood flow had been stopped. They repeated the analyses on heart proteins from active summer Arctic ground squirrels and rats, which don't hibernate.

By comparing the various proteins produced and the metabolic changes within each animal, they identified novel internal adaptive mechanisms by which ground squirrels cope with cold and other stressors.

One such mechanism is the ability of hibernators to exclusively use lipids, which include fats, vitamins and hormones, as metabolic fuel instead of burning carbohydrates.

Another involves the use of an intriguing temperature regulation cycle:



From a contradiction-solving perspective, the removal of carbohydrates and the periodic temperature boost contour represent elegant illustrations of Principle 2, ‘Taking Out’ and Principle 19, Periodic Action solutions. Here’s what the Contradiction Matrix would have recommended for anyone else looking to resolve the hibernation problem:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Safety/Vulnerability (38)

WORSENING PARAMETERS YOU HAVE SELECTED:

Temperature (22)

SUGGESTED INVENTIVE PRINCIPLES:

31, 35, 36, 3, 19, 2, 13, 4

Good to see that both Principles 2 and 19 are present in the list of recommendations. Also intriguing to note whether the Duke and UAF researchers might want to go and check out the Principle 36, Phase Transition clue to see if that reveals an insight into the ability of the squirrels to survive the sub-zero temperatures, when, by rights, they should freeze.

While a lovely illustration of contradiction-solving in nature, the arctic ground squirrel story also looks set to become another case of biomimicry in action. Look at the hibernating temperature cycle the squirrel operates and, in effect, what it’s doing is putting its heart into cardiac arrest on a regular basis. So why doesn’t cardiac arrest happen? And what might it tell us about cardiac arrest in humans?

Understanding this unique model of extreme metabolic flexibility may help scientists develop strategies that enable doctors to "switch" the metabolism of a patient who has suffered a stroke, cardiac injury or hypothermia to resemble that of a hibernator and thereby improve survival and recovery.

The researchers described the adaptations in a paper published in this month’s issue of the journal *Anesthesiology*.

"This has been an important and exciting partnership that promises transformative changes to how trauma and surgical care are provided," said Brian Barnes, study co-author, long-time hibernation researcher and director of the UAF Institute of Arctic Biology. "It comes from a better understanding of how Arctic ground squirrels overwinter in Alaska."

A person typically takes a long time to recover from cardiac surgery or organ transplant. This is in part because organ tissue is damaged when blood flow ceases or is reduced when a heart stops or an organ is removed. Tissue is also damaged when blood flow is restored and the body's metabolic machinery is not able to safely handle the returning rush of oxygenated blood.

Protection of tissues following cardiac arrest or organ transplant has remained an elusive scientific target, despite significant research and promising data. Now it seems the answer, or at least a good few clues, was known all along. By a squirrel. A classic case of ‘think of someone with a more extreme version of your problem, and they’ve had to solve it’.

Read more:

Quintin J. Quinones, Zhiquan Zhang, Qing Ma, Michael P. Smith, Erik Soderblom, M. Arthur Moseley, James Bain, Christopher B. Newgard, Michael J. Muehlbauer, Matthew Hirschey, Kelly L. Drew, Brian M. Barnes, Mihai V. Podgoreanu. **Proteomic Profiling Reveals Adaptive Responses to Surgical Myocardial Ischemia–Reperfusion in Hibernating Arctic Ground Squirrels Compared to Rats**. *Anesthesiology*, 2016; 124 (6): 1296 DOI: 10.1097/ALN.0000000000001113

Short Thort

Should the boss have all the answers?

- Japan 78%
- PR China 73%
- Italy 66%
- Germany 46%
- Poland 38%
- UK 27%
- Finland 23%
- Denmark 21%
- Norway 13%
- Sweden 7%

- India 77%
- Russia 74%
- France 61%
- Netherlands 38%

(Time Magazine, 2006. Based on 500,000 survey responses.)

News

ELEC2016
In addition to presenting a keynote address on the first day of the European Lean Educator Conference at the University of Buckingham in September, Darrell will now also be conducting a half-day ‘TRIZ for the Wary’ introduction on the final day of the conference. For more details, and to register check out:
http://www.buckingham.ac.uk/event/european-lean-educator-conference-2016-elec-2016

University of Buckingham
Speaking of the University, Darrell will be teaching a Systematic Service Innovation workshop on October 18. Sadly, we had to postpone the proposed Big Data Analytics workshop scheduled for this month. It will now take place on October 17, with a discount from the University if people opt to attend both the (complementary) 17th and 18th sessions.

China
It’s been a while, but Darrell is back in Shanghai for the last week of August and the middle week of October. Most of the trip dates are allocated to clients, but there are a couple of days currently free if anyone is interested in making use of them. Contact Darrell directly to explore possibilities in more detail.

India
Darrell will be back in India again during the second half of August. Again, most of the available dates have been allocated to clients in Bengaluru and Pune, but there are one or two available days if the intra-country logistics can be sorted.

New Projects

This month's new projects from around the Network:

Industrial – SI Certification Workshops
FMCG – Domain Project
Education – SI Certification Workshops
Consulting – Design Thinking/TRIZ Workshops
Media – TrenDNA workshop
Pharma – Innovation Culture Project
Automotive – SI Certification Workshops
Food – PanSensic Study
Construction – PanSensic dashboards