Systematic Innovation

e-zine

Issue 169, April 2016

In this month's issue:

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

Readers' comments and inputs are always welcome.
Send them to **darrell.mann@systematic-innovation.com**

Case Study: Of David's And Goliath's

This is a true case study relayed to me at a recent workshop.
TRIZ/SI was not explicitly used during the definition or solution of the problem.
Rather, the case study is intended as an illustration of how Systematic Innovation would have tackled the situation. That said, I hope you will agree with me that the problem-solver responsible for the case is what we might think of as one of the world's 'natural TRIZ thinkers'.
The names of the companies involved has been changed to protect confidentiality issues.

The story begins with a large national retailer. The company in question – let's call them 'RetailQ' – has a long-established reputation across the population for high quality and very high standards of customer service. The company is about to launch a new initiative to retail white goods, and, in keeping with their reputation, is looking to be able to offer a complete installation service. Cost projections suggest that the best option will be to out-source this delivery and installation work, and they have prepared and circulated a Request for Proposals.

Three organisations have responded to the RFP:

- Goliath N – a formerly nationalized utility company with an existing nationwide team of plumbers, electricians and installers.
- Goliath P – another large nationwide network of installers, this time based in a privately owned corporation that already offers a similar service to that being requested by RetailQ for other white-good retailers.
- David C – a small, privately owned company comprised of two installers, based in the town close to the headquarters of RetailQ.

The RetailQ management team arranged a series of interviews with the management team of each of the three bidders. When they arrived at the David C premises, it seemed clear to the head of the company that the RetailQ team were slightly confused as to why they were visiting a tiny office in a local industrial park. During the brief meeting, they admitted as much. 'How do you think you will be able to support our nationwide network of stores with two people? Based here?' they asked, waving their hands around the too-compact room the four of them were squeezed into. The David C boss smiled. 'Who else is bidding?' he asked. The RetailQ told him about the two Goliaths. He smiled again, 'so you got your three quotes?' The RetailQ team's turn to smile now, 'we did,' they nodded.

Then there was silence. Everyone looked around. The RetailQ team, almost as one, picked up their cups and made a collective show of drinking the last of the contents. The meeting, it seemed, was over.

The David C boss coughed. 'Just before you go,' he casually asked, 'I was interested in your recruitment process.'

The RetailQ team looked at each other. Was he asking them for a job?

'How many applicants do you get when you advertise for a job?' the David C boss continued, 'how many will you interview?'

The most junior of the RetailQ managers looked at his colleagues before answering, 'we'll usually get a couple of hundred. Typically, 5% will get an interview.'

‘And once you’ve chosen the right person. What happens then?’

‘We’ll train them. They’ll spend a couple of weeks before they see a customer. Then another month before they’re allowed to work in a store un-supervised.’

‘Wow, that’s tough. Expensive.’

‘It’s how we make sure we keep our reputation,’ the most senior of the RetailQ team interjected.

‘Hmm,’ the David C boss sat back in his chair, ‘so how do you think the Goliath installers are going to shape up going through that?’

The RetailQ team looked at each other. It wasn’t clear who was going to answer this time. The pause got longer. Finally it looked like the junior got the short-straw, ‘they’re already trained,’ he whispered.

The David C boss nodded, ‘as installers, sure. Goliath P are good. But their way isn’t the same as yours is it? They’re good, but not as good as you guys.’

‘What are you suggesting?’ the RetailQ senior again.

The David C boss shrugged his shoulders, ‘it just feels like, if you want the Goliath’s to represent themselves the RetailQ way, they’re going to have to do a lot of un-learning before they start to know how to do things your way.’

The RetailQ team collectively nodded.

‘I don’t have a team,’ the David C boss continued, ‘so there’s no un-learning.’

‘But if you don’t have any people, there’s no-one to learn either. What would you teach them?’

‘My idea is this,’ the David C boss scratched his chin, ‘you teach us how you teach your employees. You give us the teaching materials, you tell us what you look for when you’re recruiting, you make sure you’re happy with who we recruit, the way we teach others, and we build the team for you.’

The RetailQ team looked at each other again. ‘Wouldn’t that take a long time,’ the junior asked.

The David C boss shook his head, ‘it doesn’t have to. The only problem from our side would be the time we spend learning how you do what you do. If you gave us an upfront payment we could be up and running in – how long did you say your induction programme lasted?’

‘Six weeks.’

‘Six weeks it is. It’ll take you twice as long as that to negotiate a deal with either of the Goliaths. We’ll be up and running locally in two months. Rolling out nationally in three. With installers doing things your way, and us worrying about looking after them, so you don’t have to. It’ll be like out-sourcing without the pain of out-sourcing.’

The following morning, the David C boss received a call from the RetailQ team offering him the national contract. That was five years ago. Today, the RetailQ reputation

continues. Their reputation as white-goods installers is second to none. They are already bigger than Goliath N, and look like they'll pass Goliath P this year. David C now has a team of fifty RetailQ-DNA installers based around the country and receives regular enquiries from companies – including two from Goliath P – to see if they are for sale. They're not.

The David C boss said he didn't know about his plan until the RetailQ team were draining their coffee cups during the meeting. It just came to him.

From a Systematic Innovation perspective, looking at the problem from the RetailQ perspective, their desire to offer an affordable high-quality out-sourced white-goods installation service (Support Capability, Support Cost) gave them a clear contradiction: how to ensure that their reputation for service wasn't compromised (Supply Risk, Belonging).

When mapped on to the upcoming 2016 version of the Business Contradiction Matrix, which now includes 'Belonging' as a specific parameter, we obtain the following ranked list of Inventive Principles:

1, 10, 24, 13, 22, 35, 25, 33, 3

The heart of the David C outsource (Principle 24) solution is, I think, the adoption of the RetailQ recruitment and training 'DNA'. In effect, every David C installer is indistinguishable from any other RetailQ employee. Interacting elements have been 'made of the same material'. Which makes for a lovely illustration of the (rarely seen) Principle 33, Homogeneity.

Does Innovation Capability Improvement Make Sense?

Here's the kind of innovation data guaranteed to make me smile:

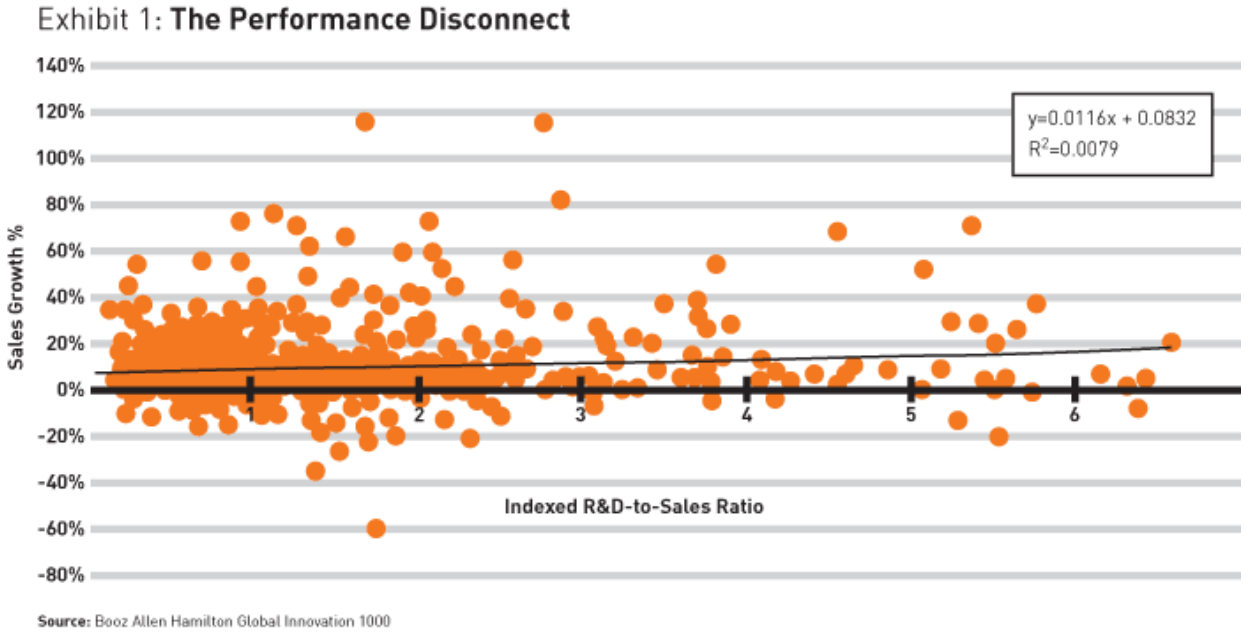


Figure 1: Data And Crackpot Rigour (Reference 1)

Not so much because of the original intent – which was, I think, to establish possible correlation between R&D spend and business performance – but because of the decision to deploy mathematics to try and make sense of the data. Rather than trying to think about what's going on.

The amusing part of the Figure, in other words, is the surreal hypothesis that sales growth equals 0.0116 times R&D sales ratio + 0.0832. While the equation might come from a mathematically valid (least squares) calculation of the results from the1000 companies included in the analysis, I can't imagine there's an accountant on the planet that is going to make any kind of meaningful use of the data. For a start the CTO would laugh at them.

If anything, what the graph is really saying is that there is effectively zero correlation between sales growth and sales growth. The mathematics is meaningless because it's not possible to simply plot published company R&D sales ratio and growth figures and expect them to be meaningful. Sure, such data is readily available – companies are legally obliged to publish the relevant data in their annual accounts – but just because something is easy to obtain, doesn't mean that it should make any kind of sense to correlate it.

There are several fundamental flaws in the logic shown in the graph. Here are three:

1) R&D spend this year doesn't translate to Sales Growth this year. There is an inevitable lag between the two things. This lag varies according to the 'pulse rate' of the industry. If the company is in a high pulse rate industry – say consumer electronics or telecoms – then the lag between R&D spend and Sales Growth might be quite low (less than a year right now). If the company is in a slow pulse rate industry, on the other hand – such as aerospace, marine or mining – the lag might be measurable in decades. Unless this industry-specific pulse rate is brought to bear in the calculation, the result will be meaningless.

2) Even more difficult to isolate in the Sales Growth axis of the Figure 1 graph is how much of the growth can directly be attributed to R&D and the creation of new products and services. Versus, for example, the growth that is merely attributable to the way in which the economy is changing (the 'rising tide lifts all ships' effect) in general and how far up its evolutionary s-curve the specific products and services of the company in specific detail. These kinds of things are not published in company annual accountants. Mainly because the accountants have no idea how to compensate for these effects. Most, in my experience, think s-curves have something to do with driving their Porsche's around dangerous bends in the Swiss Alps.

   Some researchers have tried to solve this problem with another kind of crackpot rigour: Likert scale questionnaires ('rank the level of aesthetic design capability in your organisation from 1 to 5') sent to the wrong people (designers!) followed by an intricate but utterly meaningless mathematical analysis of the summed questionnaire results to produce pictures like this:

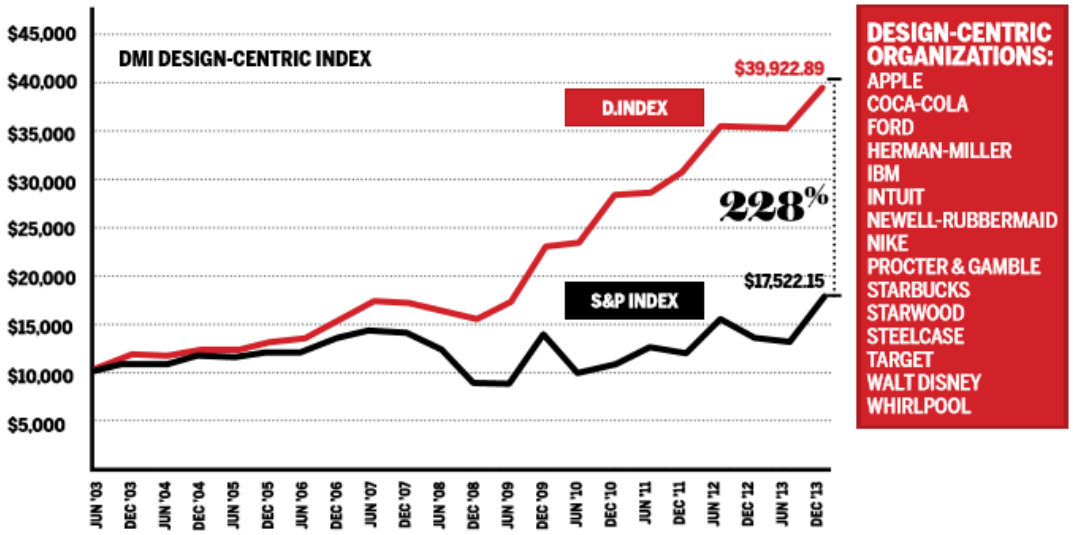


Figure 2: More Crackpot Rigour – 'D.Index' (Reference 2)

   The only sensible way to try and isolate the 'how much of the growth is attributable to the R&D spent in the organisation is to either get down-and-dirty with the C-Suite leaders of the organisation, or to have an objective means of plotting the maturity of an industry… such as Evolution Potential!

3) The third logic flaw in the Figure 1 graph is an assumption that the innovation capability of each of the 1000 companies in the analysis is equal. Some companies are operated with a 'pioneer' business model. Others are happier operating as 'fast-followers'. The former might benefit from greater technical innovation capability; the latter is likely to win by possessing greater business innovation capability… which raises an even bigger question of how do you calculate the amount of money invested in business innovation? That sort of information is far less likely to appear in the annual accounts. In no small part because most organisations have no idea what 'business innovation' is still.

The real research question behind the crackpot rigour of Figure 1 is not about what the average of the 1000 data points (the 'average' is, as ever, almost always meaningless in the innovation context) tells us, but what, if any, are the differences between the data

points at the top of the graph versus those at the bottom? After, of course, the above three problems (and probably others) have been duly accounted for.

To be honest, it's a question we're still trying to plough through the details of. When you elect to do something 'bottom-up' instead of 'top-down', the amount of work you have to do increases exponentially. That's why accountants prefer top-down. That's why the results they publish are almost invariably meaningless at best and positively toxic at worst. Fortunately, these days the contradiction between top-down-or-bottom-up gets resolved by tools like PanSensic that allow us to scrape through lots of data from a bottom-up algorithm design perspective. The big analysis is still ongoing. But one thing has already emerged as extremely significant in terms of understanding the relationship between R&D spend and Sales Growth.

That thing is Innovation Capability Maturity. We got a first hint of the link from this picture:

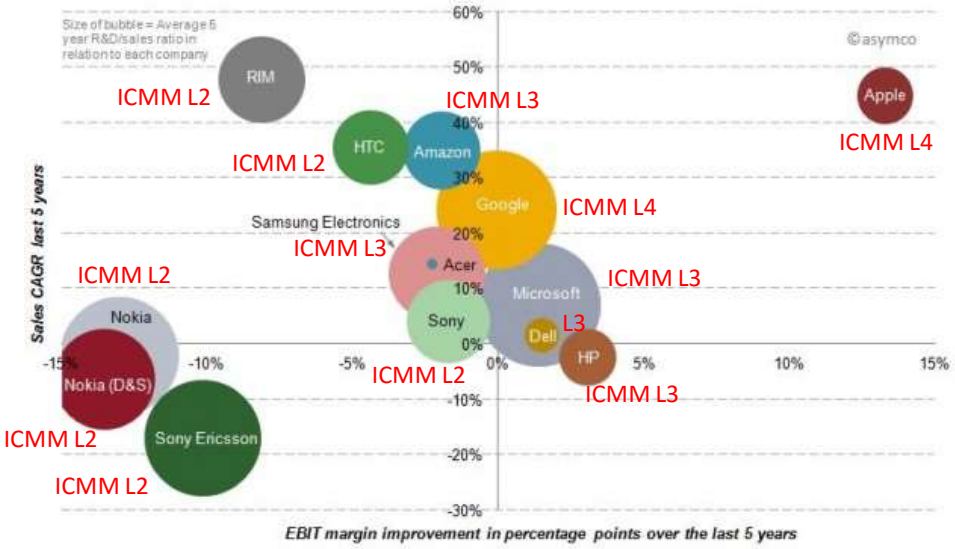


Figure 3: EBIT-versus-Sales CAGR-versus ICMM Level

And here's what the Sales Growth story looks like when we plot ICMM Level against pulse-rate and rising-tide/s-curve-maturity-corrected Sales Growth Figures (Figure 4).

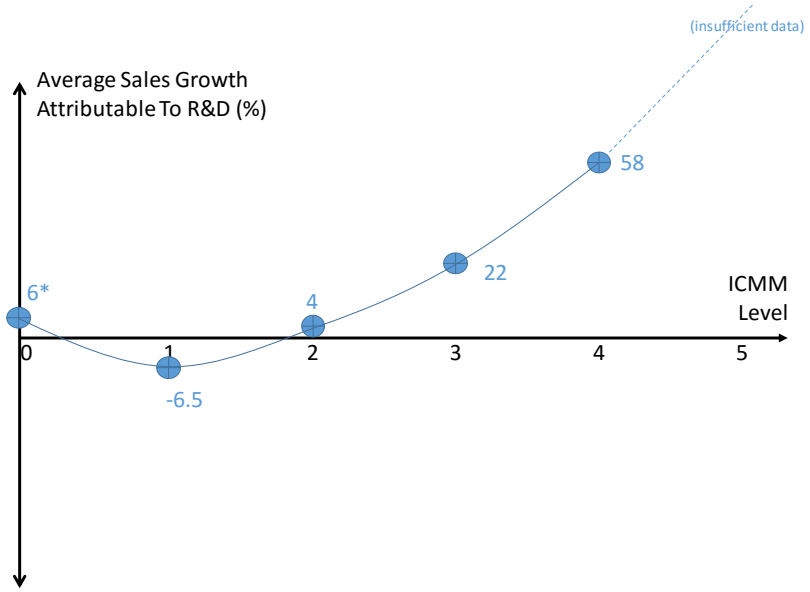


Figure 4: Sales Growth Versus ICMM Level

(* Level 0 companies = start-ups. 75% of all innovation comes from Level 0 companies, but the success/failure curve is heavily skewed: 1 scaled success compensates for 9 failures hence the 'average' (mean) 6% sales growth figure needs to be taken with a fair sized pinch of salt – the good news is that innovation is overall better than a 'zero-sum' game, but the 6% average came from a small number of 'rockets' compensating for a much higher number of lemons.)

ICMM Level 1 companies, on average, will lose 6.5% sales each year. Not shown on the graph, but consistent with the original Reference 1 data, there is no correlation between sales growth (or 'loss' in this case) and the actual amount of R&D spend. ICMM Level 1 companies will, on average, shrink by 6.5% each year whether they spend nothing on R&D or whether they spend all of their income on it.

The lack of correlation between Sales Growth and R&D spend continues when we look at ICMM Level 2 organisations. Again, if you are ICMM Level 2, it doesn't matter how much you spend on R&D, at least in terms of business performance. The good news, on the other hand is that your average Sales Growth will be around 4%.

This 4% figure rises to a whopping 22% for the ICMM Level 3 companies. And if you're one of the relatively few Level 4 organisations on the planet, your average sales growth will be well over double that of the ICMM Level 2 companies, at a staggering 58%.

We're still trying to unravel the Sales-Growth/R&D correlation for these two ICMM Level companies. We think there's a positive correlation - i.e. greater R&D spend gives greater Sales Growth – but it doesn't look like a linear relationship.

We'll no doubt be publishing more on this story as the ongoing research analysis digs deeper. In the meantime, we thought it was a worthwhile exercise to publish the Figure 4 finding now in order to – hopefully – solicit some support from readers to either help verify (or not!) the finding inside their own organisations. Or (perhaps even better) to challenge the logic of what we're trying to do.

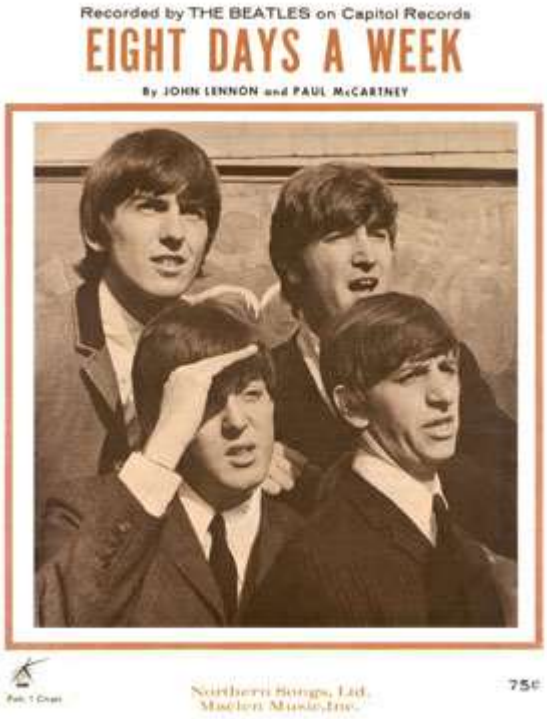
The reason both of those things are important is that, if we're right, the decision of a company to invest in Innovation Capability building suddenly becomes something of a no-brainer: if I can expect to increase my sales by over 10% by climbing from ICMM Level 1 to Level 2, that increase pays for an awful lot of training, innovation tools and methods. The only question then becomes one of time to payback… which, sadly for some, depends a lot on the prevailing pulse rate of their industry.

References

1) http://www.strategy-business.com/article/05406?gko=3705a
2) http://c.ymcdn.com/sites/www.dmi.org/resource/resmgr/Docs/DMI_DesignValue.pdf

Not So Funny – Slightly More, Slightly Less

Aah, Inventive Principle 16, where would we be without you?
Where would The Beatles be without Ringo's cunning glass-over-half-full malapropism?



Just missing the mark can be a great way of signaling which side of the glass-half-full neutrality mark you are. Glass-half-empty people live on Cloud Eight; Glass half-full people (especially GenY) get to live on Cloud Ten:

Think of any aphorism with a number in it, and there's bound to be a handy Principle 16 joke nearby.
Especially if you're a brewery:

SYSTEM ·ATIC INNOVAT· ION

…which kind of brings a new meaning, too, to the idea of glasses and their relative fullness. Depends, I guess, on whether you live next door, or across the street.

Of course, it doesn't always work. 'The Whole Nine Yards' movie was really bad. But the sequel was even worse…

..but then maybe the idea was that I should've known because the title told me? Personally, I'd be up for producing the prequel, The Whole Eight Yards – a film in which Bruce Willis under-acts for the first time in his career. And Mathew Perry plays a character that bears no resemblance to his Friends character. For the first time in his career.

Likewise, I'd be up for a few other as yet unmade movies:

Catch-23 – an even more impossible conundrum. Set in a cake-shop in the North East of England… which is where there is an actual Catch-23 bakery.

Catch 21 – a slightly less impossible conundrum. Sort of like a Sudoku puzzle with 95% of the numbers already filled in.

Fifth of July - a play set in rural Missouri in 1977, revolving around the Talley family and their friends, and focusing on the disillusionment with America in the wake of the Vietnam War. Oh, wait, they already did that one…

Third Of July – the same, except set in 1957, and focusing on how great the next ten years look set to be.

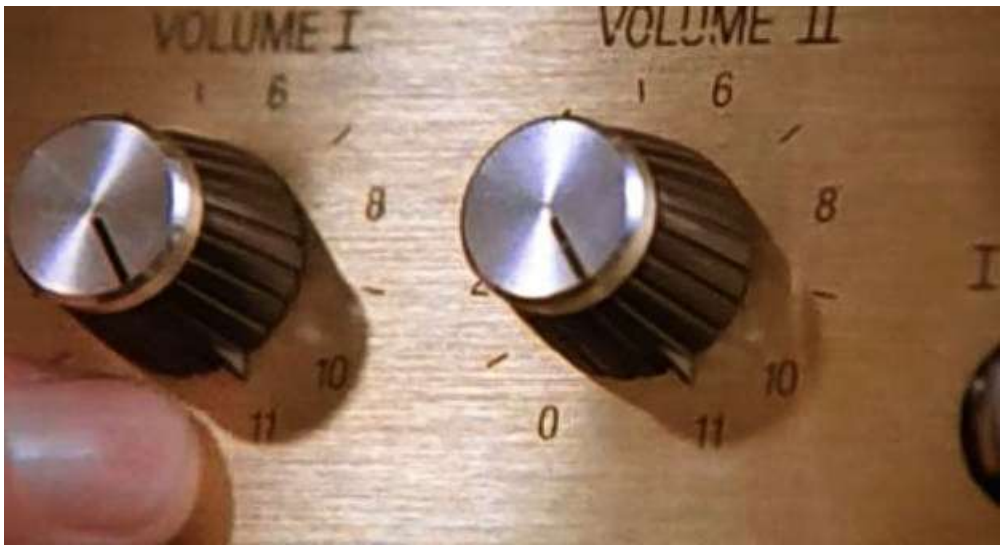
Thursday the 12th – in which the Talley family start to realise things are okay, but perhaps not so bright and rosy after all…

Saturday the 14th – in which the Talley family pessimism turns out to be well-founded.

Route 67 – a slightly more rock'n'roll version of Chuck Berry's life.

Route 65 – you get the idea…

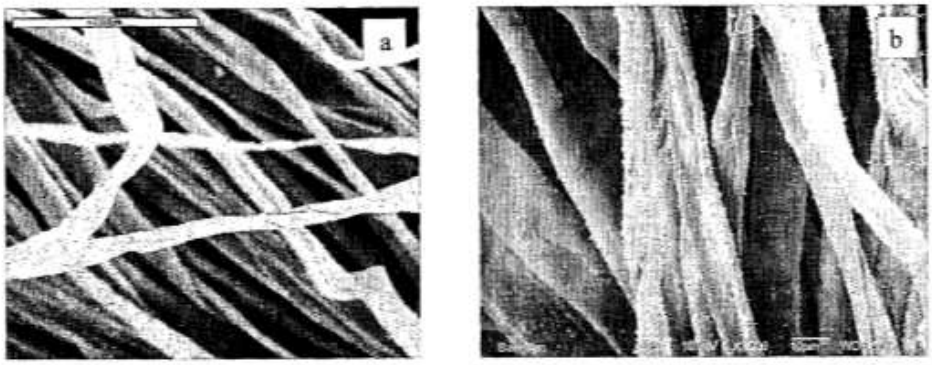
Failing that, we can (should) always revert to the wisdom of Spinal Tap:



…which would suggest to me that there is still a space for a (GenX grunge-band) sequel in which the amps go up to nine.

You heard it here first.

Patent of the Month – Sonochemical Coating



Patent of the month this month takes us to a group of inventors at the Bar-Ilan University in Israel. US9,315,937 was granted to the team on 19 April. Here's what their succinct invention disclosure tells us about the problem they have sought to resolve:

Antibacterial fabrics are widely used for production of outdoor clothes, under-wear, bed-linen, and bandages. Antimicrobial resistance is very important in textile materials, having effects amongst others on comfort for the wearer. The deposition of metal oxides known to possess antimicrobial activity, namely ZnO, MgO and CuO, can significantly extent the applications of textile fabrics and prolong the period of their use.

Zinc oxide has been recognized as a mild antimicrobial agent, non toxic wound healing agent, and sunscreen agent. Because it reflects both UVA and UVB rays, zinc oxide can be used in ointments, creams and lotions to protect against sunburn and other damage to the skin caused by ultraviolet lights. At the same time ZnO is an inorganic oxide stable against temperatures encountered in normal textile use, contributing to its long functional lifetime without color change or oxidation. The antibacterial properties of MgO and CuO nanoparticles were also demonstrated.

An antimicrobial formulation containing ZnO powder, binding agent, and dispersing agent was used to protect cotton and cotton-polyester fabrics. This formulation was applied to fabrics under high energy radiation of Co-60 .gamma. or electron beam irradiation and then subjected for fixation by thermal treatment. A superior antimicrobial finish was achieved with cotton fabrics containing 2 wt % ZnO and with cotton-polyester fabrics containing 1 wt % ZnO. The particle size of ZnO in these samples according to SEM measurement was 3-5 .mu.m. In spite of good antimicrobial activity, the disadvantages of this method are the use of additional binding and dispersing agent, and requirements of high energy radiation and an additional stage of thermal curing… [and a] special stabilizing agent, namely, acrylic binder is used which should undergo the additional stage of polymerization at 140.degree. C.

Hence, an improved method of dispersion metal oxide nanoparticles onto textiles is still a long felt need.

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

IMPROVING PARAMETERS YOU HAVE SELECTED:

Amount of Substance (10) and Manufacturing Precision/Consistency (42)

WORSENING PARAMETERS YOU HAVE SELECTED:

Energy used by Stationary Object (17) and Temperature (22) and Loss of Substance (25)

SUGGESTED INVENTIVE PRINCIPLES:

3, 35, 24, 2, 31, 26, 10, 19, 13, 17, 18, 4

The title of the patent probably already gave away the clue to the (Inventive Principle 18) solution, but let's hear it from the inventors' mouth directly:

A method comprising: immersing a textile in a mixture of metal acetate added to a water-ethanol solution; adjusting a pH of the mixture to a range of about 8-10 by adding aqueous ammonia; and ultrasonically irradiating the mixture via ultrasonic waves at a frequency of approximately 20 kHz, the ultrasonic waves (i) sonochemically causing bubbles to form in the mixture; and (ii) sonochemically causing the bubbles to collapse, wherein the collapsing of the bubbles: create metal oxide (MO) nanoparticles from the M(AC).sub.2; and form microjets near fibers of the textile that embed the MO nanoparticles into the fibers of the textile.

It's amazing to me that the chemists of the world don't embrace the use of sono-chemistry more. I suspect the main reason is that it's not chemistry.

Also amazing is how this application took six years to go through the grant process. We first read about the technology in 2011. Maybe the patent examiner was a chemist too. Maybe they couldn't believe the level of increased coating durability and massively reduced energy consumption during the manufacture process.

Read more here:https://www.beilstein-journals.org/bjnano/content/pdf/2190-4286-7-1.pdf

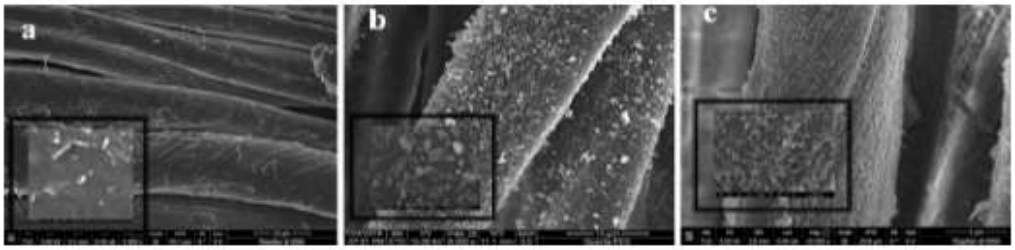
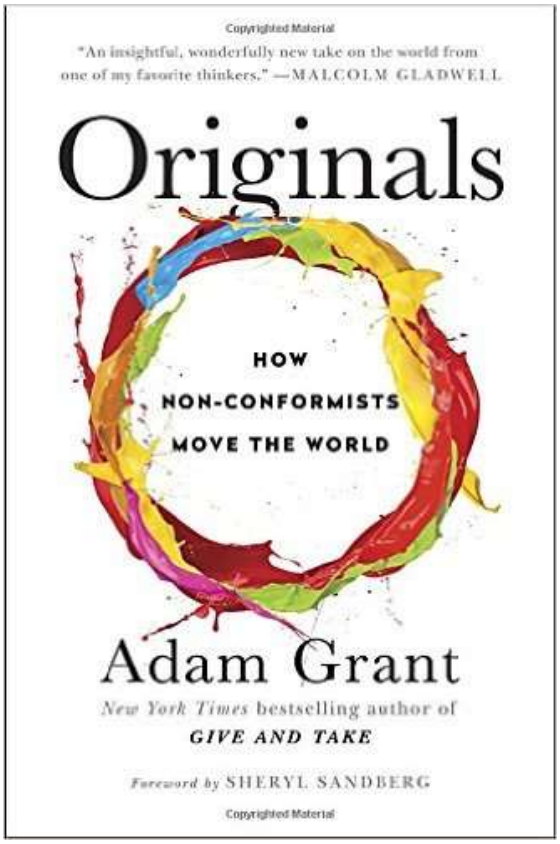


Figure 4: HRSEM images of (a) RB5 sonochemically deposited on cotton, (b) ZnO coated in the presence of RB5, (c) CuO coated in the presence of RB5; insets were taken in higher magnification.

Best of the Month – Originals



Here's one for the hard-working, introverted would-be innovators. And especially the ones that enjoy wrestling with counter-intuitive ideas.

This is Adam Grant's second book. His first one, 2013's 'Give and Take', revealed how those who contribute more than they get back can rise to the top. It was a hit. I suspect Originals will follow the same path. Mainly because Grant, a professor at the University of Pennsylvania's Wharton business school is too smart and too restless to settle for more of the same. *Originals* stamps the same hallmarks — fresh research, counter-intuitive insights, lively writing, practical calls to action — on a different theme.

The book attacks the assumption that nonconformist innovators are all bold, young risk-takers, churning out one fantastic idea after another. In fact, they are often cautious late adopters. Their masterworks emerge — often unrecognised by their authors — because of the sheer quantity of average work they produce along the way. They "procrastinate strategically . . . testing and refining different possibilities" before making breakthroughs.

For instance, Martin Luther King's "I have a dream" speech borrowed from earlier variations on the theme. As King walked to the podium he was still editing the text and its signature passage was a spur-of-the-moment improvisation.

Even hereditary traits are malleable. Later-born children are more rebellious than older siblings. However, "by adopting the parenting practices that are typically applied primarily to younger children, we can raise any child to become more original," Grant writes.

SYSTEM ATIC INNOVAT ION

The sheer quantity of ideas and examples in *Originals* sometimes threatens to overwhelm its central thread — the book lists 30 “actions for impact” in a final summary — and its insights can at first read be seen as not quite as striking as those of *Give and Take*. Take a step back, however, and I think a bigger theme emerges. Perhaps one that even Grant himself hasn’t fully appreciated.

The importance of being open to diverse opinions runs through the book but Grant shows you cannot merely shout “diversity” to every question. Research has proved that a surfeit of cohesiveness is not the reason that organisations succumb to groupthink. Instead, a commitment to promote dissent is the vital element that separates a strong culture from a dangerous cult.

Such a commitment is central to the way, as one of the book’s case studies reveals, Ray Dalio runs Bridgewater, the hedge fund group Grant studied as a part of his research. Despite his admiration for Bridgewater’s demanding, principles-based approach, Grant comes away troubled that Dalio will not test his intuitions with experiments.

As the book makes clear, the gut instinct of successful people is a sometimes fatally unreliable guide to their success in new and unpredictable domains.

Grant has a deserved reputation as an original thinker. This book will add to it. But by championing evidence-based management and nudging leaders towards more scientific ways of answering the cultural questions that so often trouble them, he is starting to build an even more valuable legacy.

Cohesive dissent? Strategic procrastination? (my favourite!). Evidence-based gut-thinking? Hey, that step-back, bigger theme is contradictions. It’s a book about contradictions. And how ‘originals’ are contradiction solvers. What’s not to like?

Wow In Music - Miles Around Midnight

Miles Davis' celebrated career included an elaborated succession of styles which in many ways summarize the history of 20th century jazz music: "from the laid-back tempos and intricate arrangements of cool jazz to the experimental, avant-garde qualities of free jazz; from the fast pace and instrumental virtuosity of bebop to the harsh beat and slower, blues-based tempos of hard bop; and from modal jazz's avoidance of chord progressions to the electric rock elements, R&B rhythms and funk grooves of jazz fusion".

The transformations led by Miles in collaboration with many other gifted musicians were documented in many "landmark recordings and legendary live performances", among which the 1956 rendition of Monk's 'Round About Midnight became one of his masterpieces. In this recording, Miles features his "signature relaxed, melodic tone - thanks, in part, to the Harmon wah-wah mute (Principle 35) that, by blocking all of the air emanating from the bell of his trumpet, provided it with a warm, high-pitched buzz".

It is educational and, at the same time inspirational to know a bit about the history behind this music, from the memories of the engineer involved with the recording sessions, Frank Laico: "... after forming what would come to be known as his 'First Great Quintet' - featuring pianist William 'Red' Garland, famous for his block-chord style of playing the notes of each chord all at once; influentially improvisational bassist Paul Chambers; his all-time favourite drummer, Philly Joe Jones; and a then-relatively unknown tenor sax player named John Coltrane - Miles Davis recorded 'Round About Midnight in three sessions, produced by Avakian, at Columbia's 30th Street facilities in New York."

"The contributions of each and every person are now committed to history. Yet, nearly 55 years after his first recording session with Miles Davis, Frank Laico still recalls the anticipation that he felt beforehand, as well as how the two of them bonded."

"I admired his playing and I basically admired Miles, too," he states. "I know other people found him to be obnoxious and arrogant, but once he and I began working together we became very good friends. He didn't make any comments to me when I set him up with the band. He just looked around and talked to the guys, asking them if they were happy where they were, and when they said they could hear each other we just went from there."

“All of those musicians - Davis, Coltrane, Garland, Chambers, Jones - were great. They knew their instruments and they enjoyed playing together. They used to sit there and just go crazy, playing and playing and playing (Principle 20). After a while, I realised they were having fun warming up, and once we were ready to record they were all set, both mentally and physically. That's why the sessions always proceeded very quickly and very easily. Miles never insisted on sheet music. He would just hand them some kind of music that had his own notations (Principle 2), they would figure out what the hell he meant, and then they'd just go ahead and play. That's how it was with 'Round Midnight' and the other tunes on that record.”

“In fact, the first time I really saw Miles using arrangements was when he did the Porgy & Bess album [in 1958] with Gil Evans. That was a challenge, because it was a good-sized group, and even there I set up the strings and everybody else close to each other so that it was a real live sound. 'Round Midnight', on the other hand, was a great tune, and one that the musicians already knew. George Avakian, Columbia's jazz man, was involved with the arrangements and also as a sounding board, and the musicians loved him. He was a very nice person and very talented, and whatever he suggested seemed to please them. They would always rehearse before we started to record, and we would just let them do what they had to do, talking to each other while making their own corrections and suggestions. Then, once they thought they were ready, Miles would say, 'OK, let's put one down,' and away we'd go. It was very easy.”

If you also want to enjoy Miles’ recording, check this out:
https://www.youtube.com/watch?v=GIgLt7LAZF0

And here is the link to the original article on Sound on Sound magazine:
http://www.soundonsound.com/sos/apr10/articles/classictracks_0410.htm

Investments – Microwaved Biofuel

Weaning cars and trucks off of gasoline and diesel made from fossil fuels is a difficult task. One promising solution involves biodiesel, which comes from natural oils and fats, but it is costly. Using a microwave and catalyst-coated beads, scientists have devised a new way to convert waste cooking oil into biodiesel that could make it more affordable. They report how they did it in ACS' journal *Energy & Fuels*.

Biodiesel has many advantages over traditional fuels. It is renewable, biodegradable and emits less carbon dioxide. It can also easily take the place of conventional diesel without the need for carmakers to modify engines. However, producing biodiesel at a low cost remains a challenge. Waste cooking oil is currently the most appealing source because it doesn't compete with the demand for virgin cooking oil. However, the process to convert it to fuel is complicated and expensive. Aharon Gedanken and colleagues wanted to find a simpler and less expensive method.

The researchers developed silica beads coated with a catalyst and added them to waste cooking oil. Then, they zapped the mixture with a modified microwave oven to spur the reaction of the beads with cooking oil. In just 10 seconds, nearly 100 percent of the oil was converted to fuel. The researchers could also easily recover the beads and reuse them at least 10 times with similar results.

Contradiction-wise, here's everything you need to know:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Manufacturability (41)

WORSENING PARAMETERS YOU HAVE SELECTED:

Energy used by Moving Object (16)

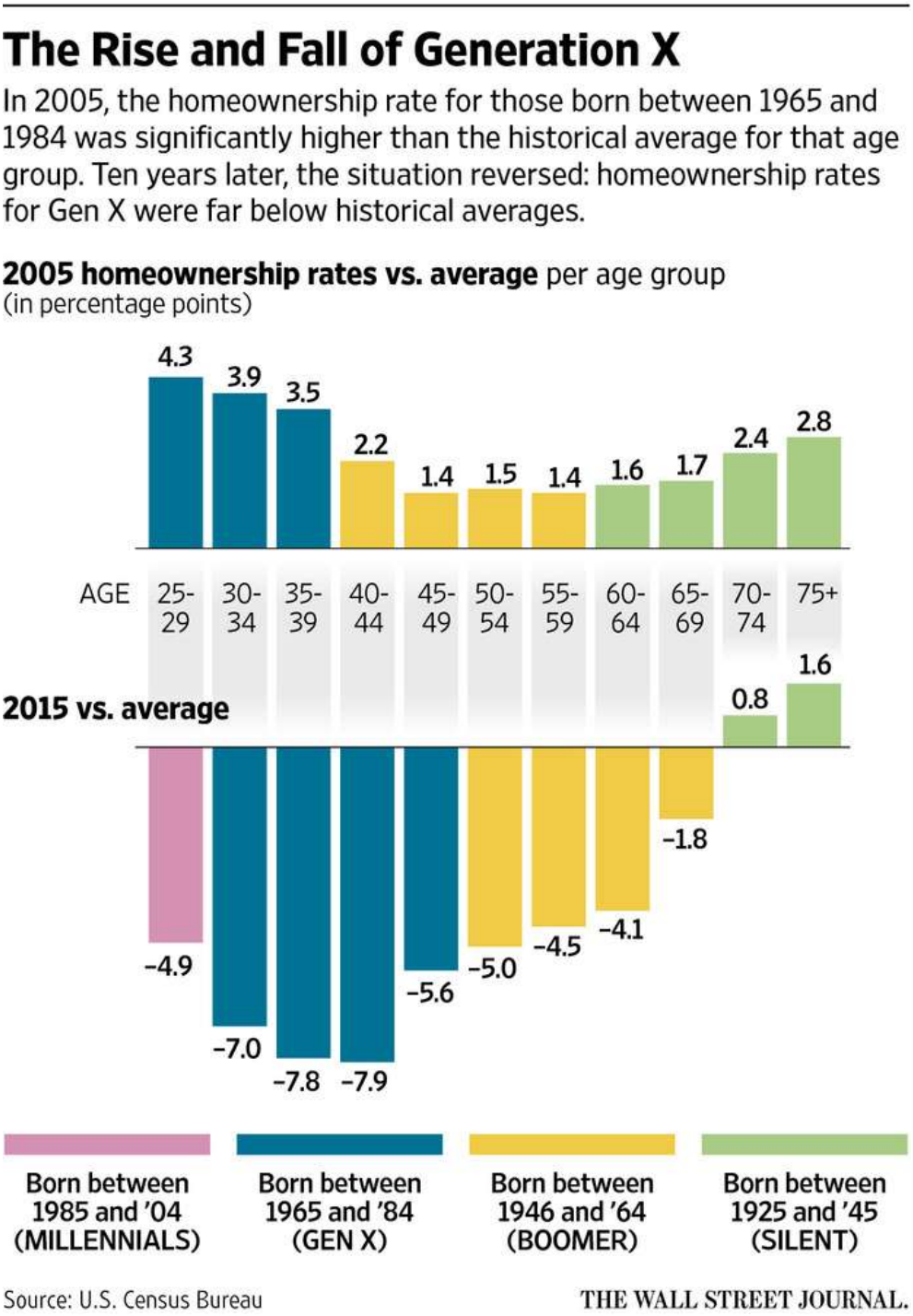
SUGGESTED INVENTIVE PRINCIPLES:

28, 1, 10, 26, 35, 7, 39, 19

Read more here:

Alex Tangy, Indra Neel Pulidindi, Aharon Gedanken. SiO_2 Beads Decorated with SrO Nanoparticles for Biodiesel Production from Waste Cooking Oil Using Microwave Irradiation**.** *Energy & Fuels*, 2016; 30 (4): 3151 DOI: 10.1021/acs.energyfuels.6b00256

Generational Cycles – GenX Housing



This from the Wall Street Journal this month:

The group of Americans known as Generation X has suffered more than any other age cohort from the housing bust, according to an analysis of federal data, suggesting homeownership rates for that group could remain depressed for years to come.

The data show an enormous swing in the fortunes of people born between 1965 and 1984, the group defined by the Harvard Joint Center for Housing Studies as Generation X.

Compared with previous generations, Generation X went from the most successful in terms of homeownership rates in 2004 to the least successful by 2015, according to the data, which date to the early 1980s.

The culprit: a historic bull market for housing, fueled in part by easy-to-get mortgages, that encouraged record levels of home buying until the financial system cracked and the housing market collapsed. Earlier generations such as baby boomers, who entered the market before the frenzy of the early 2000s, have fared better.

Generation X "came into the market at precisely the wrong time," said Rick Sharga, executive vice president at Ten-X.com, an online real-estate brokerage. "We've effectively wiped out a group of homeowners who historically would have been on their second or third properties by now."

In 2004, people then-aged 25 to 34, the core of Generation X, had a homeownership rate of 49.5%, the highest for that age group since the U.S. Census Bureau started regularly collecting such data in the early 1980s.

Last year, by contrast, the homeownership rate for 35-to-44-year-olds was at a more than three-decade low of 58.5%, down from an average of 65.8% for that age group. The upshot: Generation X experienced a much smaller increase in homeownership rates than previous generations as they hit middle age.

Much of the discussion of the future of the housing market centers on millennials, the group born between 1985 and 2001, according to the Harvard Center. Their tendency to live at home with parents and delay getting married has raised concerns about long-term homeownership trends.

But Generation X's travails promise to disrupt traditional real-estate patterns as well. The housing market can be viewed as a progression through time: younger people start out renting, save enough to buy houses, build equity and then trade up to more desirable homes.

Now that trajectory has been interrupted, with fewer middle-aged buyers trading up, which would open up the inventory of smaller homes for younger buyers.

The challenge is compounded because the population of Generation X is significantly smaller than the roughly 87 million millennials. By 2025, millennials are expected to grow to 93 million, mainly due to immigration, while the size of Generation X will remain steady.

There's a tendency to assume that because GenX is a small 'baby-bust' generation, they play a relatively small role in the ongoing Crisis period. The WSJ article makes for a very elegant counter to the argument: if the flow of rising-up-the-housing-ladder is interrupted, it has knock-on consequences for everyone.

'Watch this space' on this one. I suspect it's going to come back and bite in the next few years.

Read the full story here:
http://www.wsj.com/articles/housing-bust-lingers-for-generation-x-1460142759

Biology – Farming Amoebae

Humans aren't the only farmers out there. Five years ago, the Queller-Strassmann lab at Rice University, now at Washington University in St. Louis, demonstrated that the social amoeba *Dictyostelium discoideum* - affectionately nicknamed "Dicty" - can maintain a crop of food bacteria from generation to generation, giving these farmers an advantage when food is scarce.

Now, new research from the same team shows that these microscopic farmers also rely on their symbiotic bacteria to protect themselves from environmental toxins, a little-studied but increasingly clear role microbes can play for their hosts. And by studying Dicty's relationship with its bacterial residents, scientists are learning more about the dynamic interactions between hosts and their microbiomes. Research scientist Debra Brock led the new work, published April 20 in the *Proceedings of the Royal Society B*.

These amoebae are content to be loners when food is abundant, but when it's depleted they come together in the tens of thousands to cooperate. They transform into a mobile slug that migrates in search of fairer conditions and then produces hardy spores to release into the environment and wait out the lean times:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Stability (21)

WORSENING PARAMETERS YOU HAVE SELECTED:

Amount of Substance (10)

SUGGESTED INVENTIVE PRINCIPLES:

5, 24, 31, 40, 35, 15, 39, 13

The slug has a tiny pool of specialized cells, called sentinels, that protect it from pests and poisons by ferrying them away. "The sentinel cells pass through the body, mopping up toxins, bacteria, and essentially serving as a liver, a kidney, and innate immune system and being left behind in the slime trail," said Joan Strassmann, PhD, the Charles Rebstock Professor of Biology in Arts & Sciences.

But it wasn't clear how the farmers prevented their sentinel cells from carrying away and discarding the bacteria they depend on for food. "Our question was: If you have to be nice

to your bacteria because you want to carry them along as food, how do you have this sentinel cell system at the same time?" Brock said.

So Brock predicted that farmers would have fewer sentinel cells, in order to avoid sloughing off all their symbiotic bacteria. Looking for the tell-tale signs of sentinels in the slug's slime trails, the researchers found that farmers had only half as many sentinel cells as their non-farming relatives. "Our prediction was true," said Brock. "But that's never the end of the story."

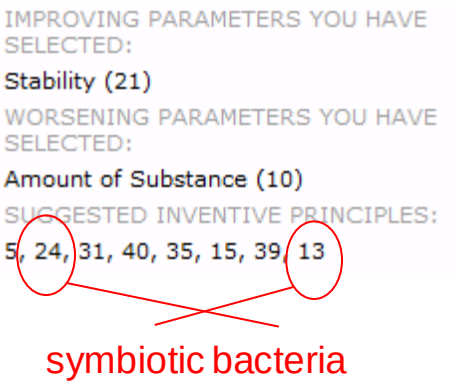
Following the (slime) trail
With fewer protective sentinels, how would these farmers fare against toxins?
"I just figured the farmers have fewer sentinel cells, so it's likely they'll do worse than the non-farmers when exposed to toxins," said Brock. "The farmers actually did better, surprisingly."

While non-farmers were crippled by toxins and produced fewer offspring, the farmers didn't seem to mind at all -- with or without the toxin, they produced the same number of viable spores, out competing the non-farmers.

Brock thought the bacteria farmers carried with them might explain this unexpected finding.

So she "cured" the farming Dicty of their symbiotic bacteria and then exposed them to the toxin again. This time, fertility plummeted in the presence of the toxic chemical. Without their bacteria, the amoebae succumbed to the toxin.

Somehow, the bacteria that farmers carry with them not only help them bring along a food source but also protect their hosts from toxins, even making up for fewer detoxifying sentinel cells.



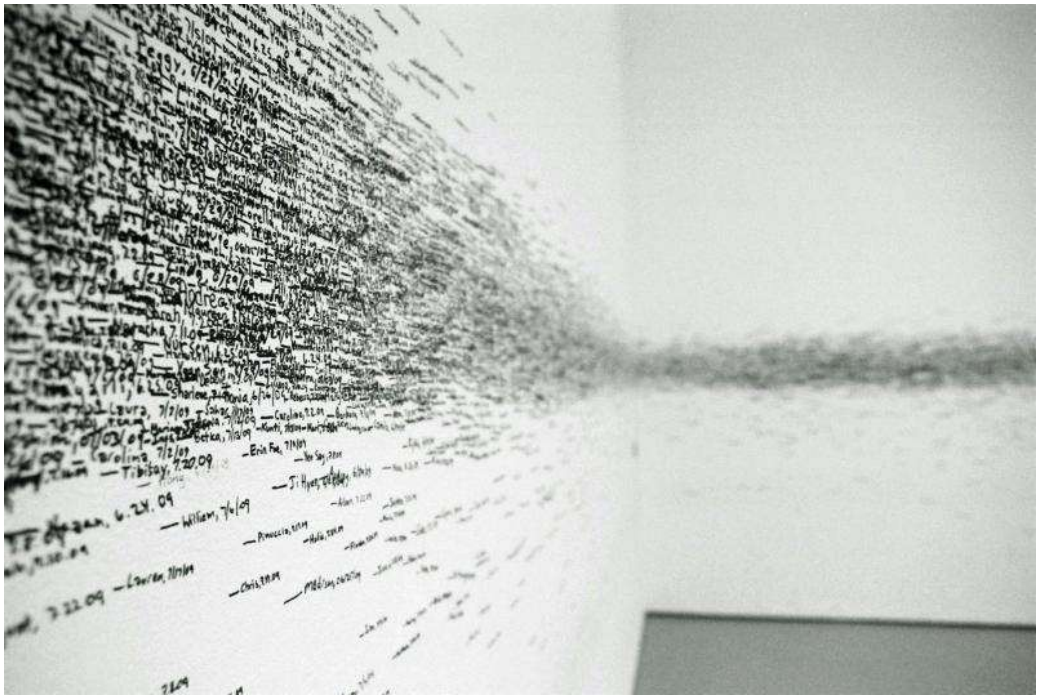
Just how these bacteria provide protection remains a mystery. They could act as a sponge (Principle 31), taking the brunt of the damage and shielding their hosts from the toxin's effects. Or they could actively degrade the toxin (Principle 35), even using it as food. I think the Contradiction Matrix agrees!

Similar detoxifying roles for symbiotic bacteria have been discovered across biology, from neutralizing insecticides and fungicides, to allowing mammals like sheep and goats to feed on otherwise toxic plants.

Read the full story:
Debra A. Brock, W. Éamon Callison, Joan E. Strassmann, David C. Queller. **Sentinel cells, symbiotic bacteria and toxin resistance in the social amoebaDictyostelium discoideum**. *Proceedings of the Royal Society B: Biological Sciences*, 2016; 283 (1829): 20152727 DOI: 10.1098/rspb.2015.2727

Short Thort

"…I've come to realize that the only truths that matter to me are the ones I don't, and can't, understand. What's mysterious, ambiguous, inexplicable. What doesn't fit into a story, what doesn't have a story. Glint of brightness on a barely-there chain. Patch of sunlight on a yellow wall. The loneliness that separates every living creature from every other living creature. Sorrow inseparable from joy."
Donna Tartt, The Goldfinch



"Be patient toward all that is unsolved in your heart and try to love the questions themselves, like locked rooms and like books that are now written in a very foreign tongue. Do not now seek the answers, which cannot be given you because you would not be able to live them. And the point is, to live everything. Live the questions now. Perhaps you will then gradually, without noticing it, live along some distant day into the answer."
Rainer Maria Rilke

News

University Of Buckingham
Following very favourable feedback from the Design Thinking For Managers Masterclass early in this month, the next two one-day workshops at the university have been confirmed: Measuring Real Waste & Big Data Analytics – June 21, and Systematic Service Innovation – 18 October. More details here:
http://www.buckingham.ac.uk/event/big-data
http://www.buckingham.ac.uk/event/systematic-service

US
Darrell's next trip to the US will be taking place in August, between the 4th and the 12th. There are a couple of un-allocated days if anyone is interested in making use of them.

Software Beta Testers?
We're about a month away from launching the first of the on-line versions of our three main software tools – Matrix+, EvPot+ and PercepMap+ - if any of our readers are interested to join a small cohort of beta testers, please get in touch with trevor.smith@systematic-innovation.com.

IMechE TRIZ Day
Darrell's next '21st Century TRIZ' workshop is confirmed at IMechE headquarters in London on 18 May. More details and booking here: http://www.imeche.org/training-qualifications/training-details/21st-century-triz

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

- Media – SI Workshops
- Automotive – Innovation Strategy Project
- Automotive – Innovation Project Management Workshops
- FMCG – TrenDNA workshop
- Industrial – Problem Solving Workshop
- Industrial – Problem Solving Workshop
- Education – SI workshops
- Financial Services – TrenDNA Study
- FMCG – IP workshop
- Industrial – Next Generation Technology Workshop
- Consulting – Design Thinking Workshops