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Rethinking R&D Strategy

"Research is what I'm doing when I don't know what I'm doing."
Wernher von Braun

Look at most R&D strategies and one of the most likely things you will see is how incremental and focused on obvious directions they are. Make things faster, lighter, thinner, last longer seems to be the expected norm. All very sensible things to focus on (providing, of course, that your customer actually still wants more of what you gave them last time around), but sadly not a great way of designing an R&D strategy. Because they tend to be uni-directional and thus end up hitting brick walls. The material gets thinner but less durable. Or less dense and more expensive. R&D strategies generally focus on components and their attributes ('things') rather than the interactions between them. The '*betweens*' being the contradictions. Which, as we know from all of the TRIZ/SI research is one of only two ways to innovate. The other one being adding a new function or outcome to an existing offering. Maybe, we hypothesise here, if these really are the only two ways to innovate, surely they also show us how to structure our R&D programmes?

This shift from 'the thing' to the interaction *between* the things has subtle but – we propose – quite profound implications for R&D strategy. But, as is almost inevitably the case, nothing is ever quite as simple as it sounds. A lot depends on the capability of the R&D team and the organisation around them. They might all be better off focusing on the 'betweens', but the types of 'between' they should focus on will be different according to the available capabilities. The main idea of this article is to try and map out a few R&D strategy design heuristics as they relate to the different Levels of capability as defined in our Innovation Capability Maturity Model:

Figure 1: Innovation Capability Maturity Model (ICMM) Levels

We'll examine each of the Levels in turn, and try to best define where an R&D strategy might come from and what it might look like. Let's start with the simplest:

ICMM Level 1
Level 1 is the simplest because the only real imperative are for an R&D team to demonstrate *some* tangible success and create a 'sense of progress'. What the success actually looks like is largely irrelevant since the primary job is building trust between the team and the rest of the business that's paying for them to play in their sandpit. What we've found ourselves doing with several of our ICMM Level 1 clients is finding problems and ranking them in terms of 'deliverability'. Far better at Level 1 to finish something small

than fail at something big… even if that 'failure' might be a planned learning step along a longer journey, the rest of the organisation won't understand the concept.
Finding problems in a Level 1 organisation is easy because they're everywhere. Where there is a desire to bring some structure to the search, and help plan for a more structured future, the most effective means of creating an R&D strategy is to do it on a silo-by-silo basis. Which, given that Level 1 companies are almost inevitably 'Operational Excellence driven optimizers', will mean lots of lots of minutely silo'ed individuals. Innovating across silos is hard. Most innovation opportunities, therefore, are going to come from staying within your own silo. Being systematic within your own silo then typically means constructing a Function and Attribute Analysis (FAA) model of what you control. Probably a 'sub-system'. Construct the FAA model, and 'R&D strategy' effectively means looking at all the negative relationships, working out an 'ease-of-fix' ranking protocol, and working through the resulting list.

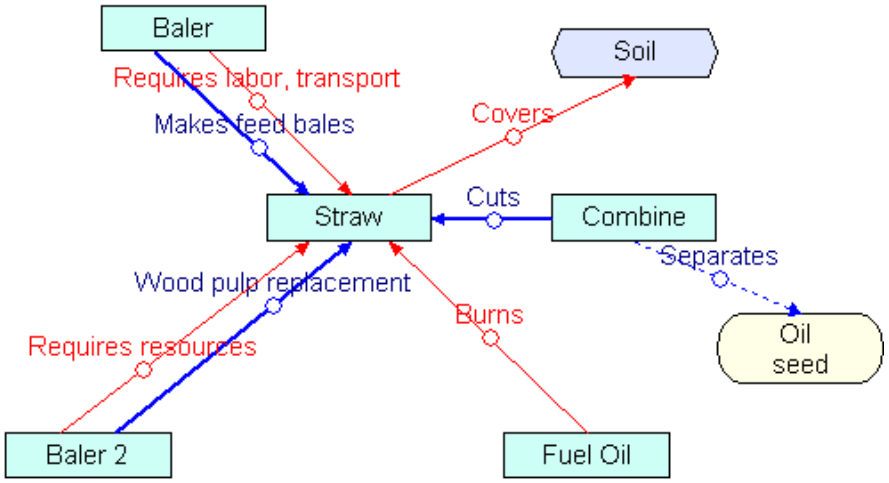


Figure 2: ICMM Level 1 Strategy Comes From Sub-System FAA Model

ICMM Level 2

By the time Level 2 has been attained, sufficient of the silo walls have tumbled to consider constructing system-level FAA models. And to be a bit more objective about ranking which negative relationships in the model deliver the most impact to the system as a whole. There is still likely to have to be a certain degree of pragmatism applied in terms of establishing who's on the innovation journey and who isn't, and defining projects according to the resources at hand ('critical mass at the critical point'), but there ought to have been a clear jump beyond the 'what's easiest' selection criterion applied at Level 1. Particularly brave Level 2 organisations might also consider building tangible/intangible customer outcome maps into their portfolio of R&D project definition tools, thus opening up the possibility of establishing R&D projects focusing on delivering new (or more likely, 'hidden') customer outcome needs. In several industries, there is a lot of low-hanging fruit right now in terms of unmet 'intangible' needs. There's probably enough, in fact, to consider making it a 'standard' ICMM Level 2 R&D strategy project opportunity finding tool.

ICMM Level 3

A Level 3 organisation is characterized in part by the disappearance of internal silo walls, including the one between Operational Excellence people and the R&D team. At least in terms of recognizing that the two need and benefit from each other's existence. The only silo wall that now hampers the definition of a meaningful R&D strategy is the one between people on the inside of the organisation, and all those outside. From a very practical perspective, this means the 'domain expert' still rules the roost. Which in turn means that

R&D strategy is most effectively built around advancing from today's knowns. A suite of FAA models for each product, service or part of the enterprise will offer up a catalogue of R&D strategy components, but these can now be complemented with overarching hierarchical models that R&D strategists can use in conjunction with a 'Trimming' perspective. Components at the bottom of the hierarchy become candidates for an R&D project to migrate their function into a higher level sub-system.
Also relevant to introduce into the R&D strategy definition process at Level 3 is the IFR Attribute map:

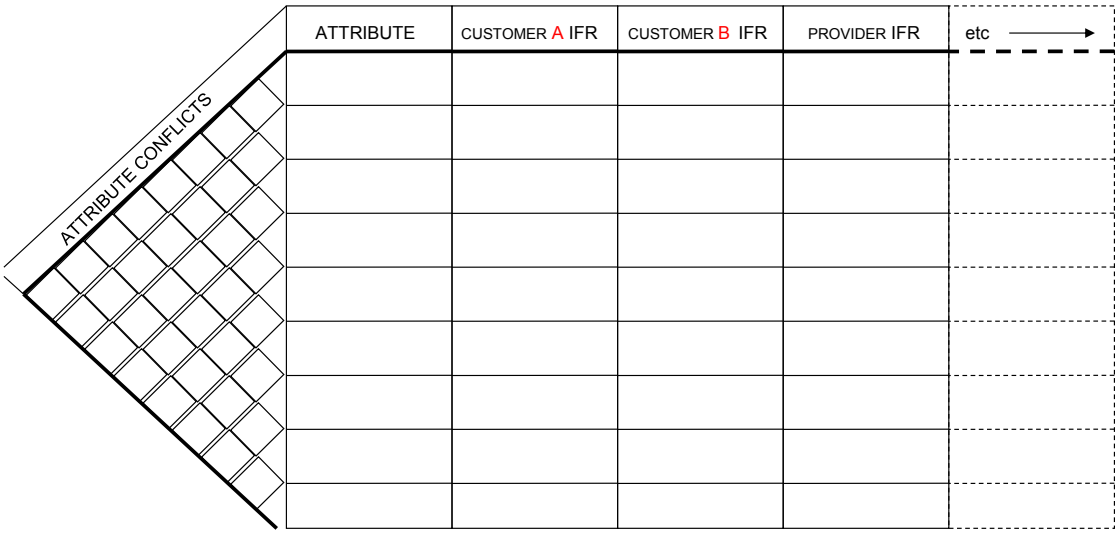


Figure 3: IFR Attribute Map As A Contradiction-Finding Tool For ICMM Level 3

What this tool brings to the story is a comprehensive means of identifying 'all' of the contradictions and unmet needs within a system. R&D strategy then basically distils down to tackling each of them in turn. The IFR Attribute Map also allows ICMM Level 3 R&D strategists to more objectively prioritise the various contradictions that get revealed in terms of their relative benefit to customers: CustomerA-versus-CustomerB contradictions being top of the impact list, followed by AttributeC-versus-AttributeD conflicts, followed by Customer-versus-Provider contradictions.

ICMM Level 4

If the dangerous concept of Ideal Final Result needs to be covertly snuck into the discussion in a Level 3 organisation – i.e. by focusing it on individual attributes of a solution rather than at the macro level – a Level 4 organisation is mature enough to know that it is the overall Customer Ideal Final Result that the R&D strategy needs to stem from. Which in practical terms means that the strategy becomes all about filling in all the details of a 'Function Cone':

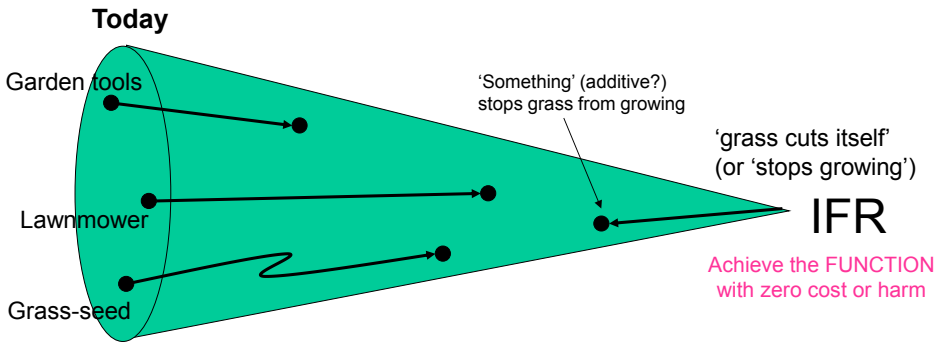


Figure 4: Function Cone As An R&D Strategy Structure For ICMM Level 4

The reason this everything-converges worldview is something a Level 4 organisation can socialize whereas Level 3 cannot is because a Level 4 organisation has successfully solved the 'domain expert' problem. Domain expertise in a Level 4 organisation is about Function-based domains rather than solution based domains. A Level 3 lawnmower company will find it very difficult to build a meaningful R&D strategy based on a 'grass stops growing' end point because all the employees tasked with making better engines, blades and grass-cutting holding capacity will see it as an attack on their expertise. People in a Level 4 company, on the other hand, will recognize that grass that stops growing is inevitable and 'better for us to do it than somebody else'. R&D strategy in a Level 4 organisation is also likely to make use of TRIZ Function Databases for the first time, and building at least a part of their R&D strategy around exploration of other means of delivering the required functions.

ICMM Level 5

Not that there are many exemplars of Level 5 organisations around to go and talk R&D strategy with, but one thing that characterizes them over a Level 4 organisation is that while the Level 4 R&D team will allow themselves the luxury of drawing one Function Cone, the Level 5 will very likely have built their R&D strategy around a constellation of different Function Cones. The general idea here being that, once they calibrate each of those Cones in terms of their pulse rate and 'ease of disruption' they've pretty much built themselves the ultimate map of the whole R&D world. And done it in such a way that they can focus available resources to consistently deliver the best 'bang per buck'.

Where – to probably hammer the initial point home one too many times – that bang-for-buck calculation ultimately comes back to finding all the 'betweens' - the Contradictions and the unmet customer needs - and going after them in a structured, repeatable manner. A bit like the mouse trying to reach the cheese at the end of the maze. Only, in the case of Level 5, where the mouse gets to decide which mazes to play in, and which to avoid.

Case Study: I Want A List, I Don't Want A List

I admit it, I'm a list-demon. I have a quadruple-hierarchy list structure: a day list, a month list, a year list and an 'important, but doesn't fit anywhere yet' list. The system has evolved over the course of the last thirty years, so in my mind it ought to be pretty good by now. Imagine my horror, then, when I'm reading one of my favourite newspaper columnists reviewing a copy of Mark Foster's new book, 'Secrets of Productive People' and I learn that any kind of list is pretty much bad news when it comes to being an actual 'productive person'.

I thought I should dig deeper. We only make progress when we find a paradox, right? And this looked like a good one: I want a list and I don't want a list. It mapped something like this:

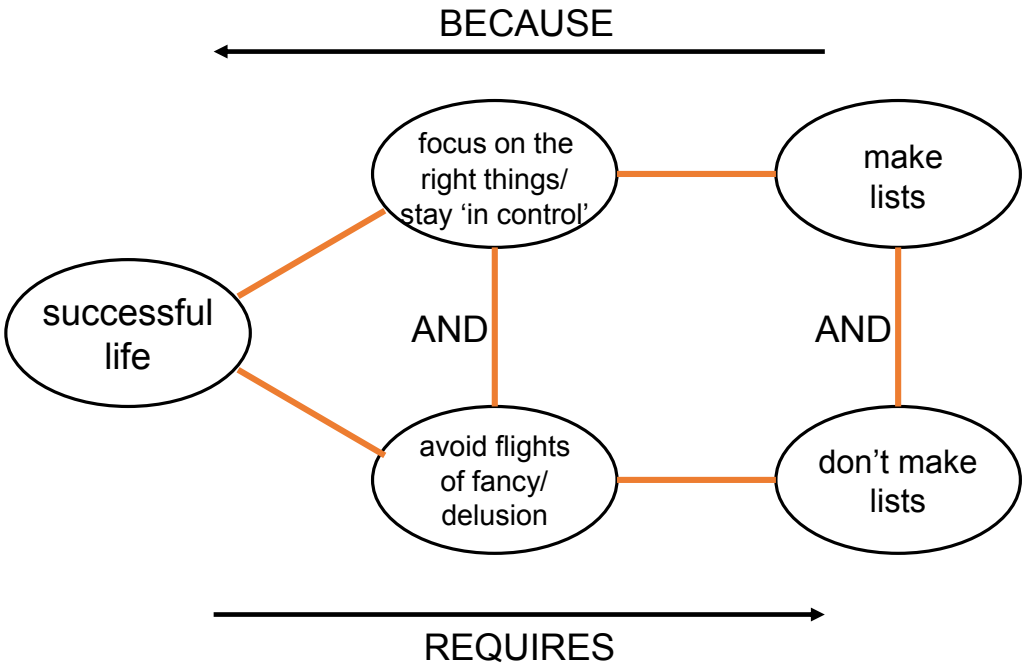


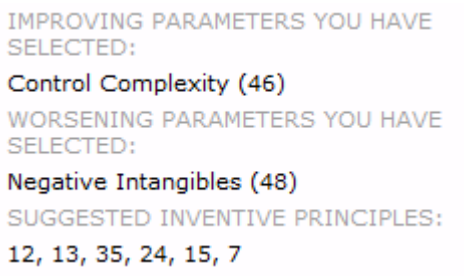
Figure 1: I Want A List And I Don't Want A List

On the ‘don’t make lists’ side of the contradiction, Mark Foster’s argument – which applies equally to back-of-the-envelope to-do lists, complex productivity systems, or “bucket lists” of life ambitions – is that lists are flights of fancy. Maybe they give you a feeling of control, but it’s a fake one. It’s far too easy to add to a list: an idea pops into your head, or a request into your inbox, and on to the list it goes, without your being forced to ask if it truly matters, or whether you’ve the bandwidth to do it. The ever-expanding list “refers to a never-never land where you magically get time to do all this work”, Forster writes. Worse, it’s out of date the moment you create it – a record “of what you might have done or could have done at a point of time which is already receding into the past”, regardless of what’s possible, or important, to do now.

Hmm. I think I can picture a bit of that (as I sit here looking at a 2015 ‘year-list’ that really hasn’t had many things crossed off).

But I also know that the real issue here is not about which side of the contradiction is right, it’s about how to solve the contradiction: I want to be in control, *and* I don’t want to allow myself to embark on any (more) flights of fancy.

Here’s what the Contradiction Matrix has to tell me about that:



One of the solutions then looks very similar to Foster’s suggestion. For us Principle 15 fans, Forster proposes a minimalist ever-dynamic system: On a piece of paper, write down only the five most important tasks you can think of. Then do them, in order, crossing them off as you go. (If you stop before completing one, add it again at the end.) Once the list is only two items long, add three more, to bring the total back to five. Then repeat.

The point of this austere approach is that you’re regularly required to ask what really needs doing, since there are only five slots. With a conventional list, there are unlimited slots – and it’s hugely tempting to plough through inessential tasks, just to cross them off. But what if you forget crucial things, using Forster’s method, because you didn’t write them down? His response: they probably didn’t matter to begin with.

I decided to replace my ‘day-list’ with this solution for a while, and have to say it almost worked. Almost, in that I found myself reverting to ‘don’t lose that thought’ mode very quickly. That’s when ‘Nesting’ came into the story: all those ideas need to get put on the fourth category list.

That made things a bit better, but it still wasn’t sticking as well as Foster said it should. So time to bring in a spot of the rather more radical Principle 13, The Other Way Around. Now, there are many ways I could’ve interpreted this, but the one I decided to try related back to a previous mind-jarring read, the amazing ‘Art Of Procrastination’ (Issue 133 of the ezine), which told me that the real secret of productive people is that that they do everything on their jobs list apart from the most important thing. Or, put more practically, if I allow myself to write down something at the top of my list that I’m very likely to

procrastinate over, while I'm procrastinating, I busy myself with the next four things on the list, and cross them off.

So now the solution looks something like this: at the start of every day, I write down the thing at the top of my new list that I'm allowed to procrastinate over. Then I write down the next four items according to Foster's advice – four important things that I'm going to do today. The next day, I do the same, only I might choose another job to procrastinate over – to keep lots of procrastination jobs bubbling away in my subconscious!

I tell you, so far – three months down the road – and it's still working like a charm.

So now here we are towards the end of the year. Time to reflect on that largely uncompleted 2015 list. Time to move my list innovation story to the next level. I still haven't used Principle 24, Intermediary, and I still haven't used Principle 7 enough. So the next level of evolution is looking something like this:

1) keep the four hierarchical lists
2) Not just the day list, but also the month and year lists are only ever allowed five things on them… each gets operated as Mark Foster's method tells me
3) Top of each of those three lists is a procrastination-appropriate item…
4) …It gets chosen by (Principle 24) someone else who's been through List 4 and I trust to see the bigger picture I can't see.

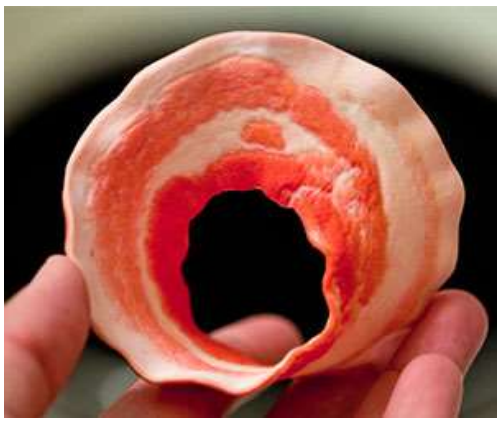
I expect big things for 2016.

Not So Funny – 3D Stupid

The 3D-printing revolution is in full swing. We can now 3D-print just about anything. Including a few things we probably shouldn't.

For some reason food seems to be an early target:

I think my favourite is Mobius-Bacon…

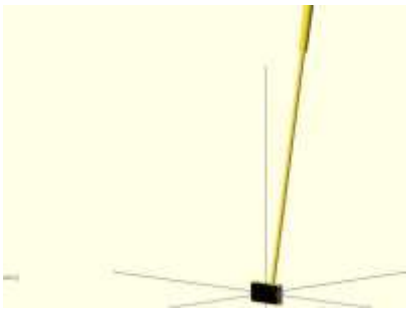


…it goes on forever, apparently.

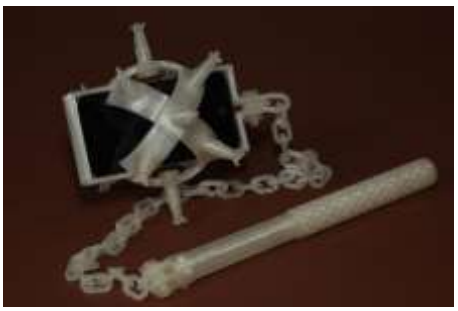
SYSTEM ATIC INNOVAT ION

Here's one for the Apple fans. A 2012 competition to 3-D print cool new iPhone accessories. Here are some of my favourites:








Given the proximity of the holiday season, people looking for those last minute stocking-fillers might want to think about the iGrill (top left) or iFlail (bottom left). For all the golfers, there has to be some kind of benefit to the iPutter (top right). Personally, I'm torn between the iPoop or the iPeel. It's a coin-toss, really.

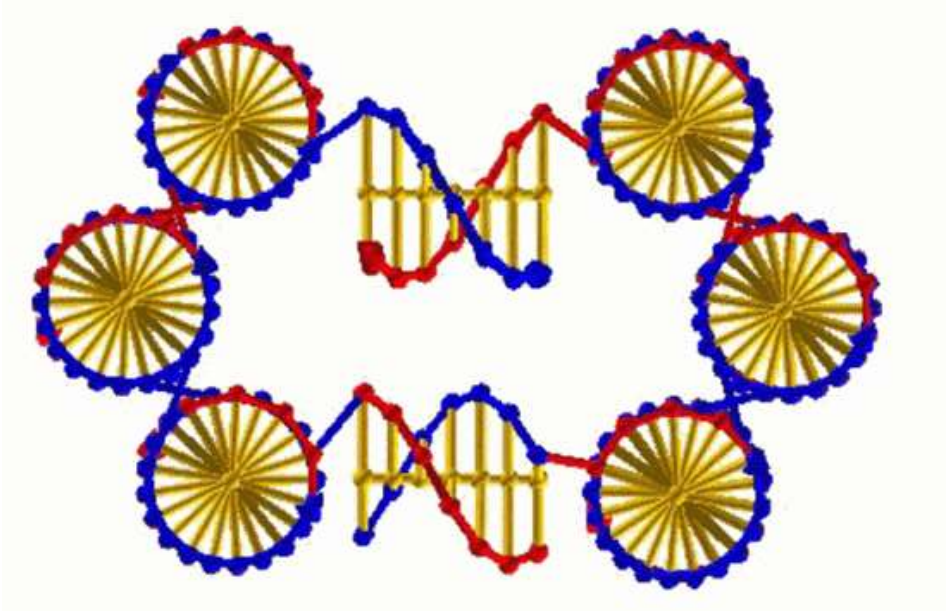
Speaking of holiday season, try to forget this image before you head to this year's office party. Photocopying your arse is so last year.

…Pray you don't get the results of this one in your Secret-Santa parcel.

Far better to start the holiday with Scott Adams…

Wake me up again when the technology boffins work out how to 3D-print pleasant British Airways flight attendants.

Patent of the Month – Self-Replicating Materials



Here's one we first started tracking back in 2012. Most 'self-' solutions are interesting. This one seemed to offer up more than most. The ultimate factory! Now, as of December 8, the patent has been granted. US9,206,471 was awarded to a trio of inventors at New York University. Here's what the background description tells us about the start point for the research work:

Technological advances allow the manipulation of extremely small units of matter, even individual atoms, opening up the possibility of macrofabrication technologies. Such technologies could be used to design nano and micro-scale machines, or to accurately control individual elements in larger materials or machines. Practical realization of these technologies is blocked by the inability to adapt experimental and small scale techniques to the larger scales required of industrial production. Conventional materials production is a linear process. Doubling the amount of material created requires twice the production time. Linear scaling of production is a critical problem if the goal is to create useful, i.e. macroscopic, quantities of microscopic building blocks with sophisticated internal structures.

Exponential growth is the most elegant and effective solution to the problem, as demonstrated by biological systems, in which a single cell generates offspring which themselves can build more copies. A single cell containing the necessary information can also divide and develop into a living organism, demonstrating that large, complex systems can be built and operated from self-reproducing units. While nature teems with organisms that readily reproduce, no one has yet succeeded in making an artificial material that can repeatedly copy itself. Making a material which self-replicates presents not only a significant scientific challenge but also the potential for applications which bridge the microscopic and macroscopic worlds. Self-replication leads to exponential growth providing a practical means to scale up production of components for nanomachines and larger scale more functionally complex assemblies. Demonstrating self-replication and developing the science behind it therefore represents an important step for nanotechnology and for enabling the practical development of the technology.

And here's how the invention works. (We've taken this text from the University's self-replication web-page as it is a little bit (!) easier to digest… here goes…)

The breakthrough the NYU researchers have achieved is the replication of a system that contains complex information. Thus, the replication of this material, like that of DNA in the cell, is not limited to repeating patterns.

To demonstrate this self-replication process, the NYU scientists created artificial DNA tile motifs — short, nanometer-scale arrangements of DNA. Each tile serves as a letter—A or B—that recognizes and binds to complementary letters A' or B'. In the natural world, the DNA replication process involves complementary matches between bases—adenine (A) pairs with thymine (T) and guanine (G) pairs with cytosine (C)—to form its familiar double helix. By contrast, the NYU researchers developed an artificial tile or motif, called BTX (bent triple helix molecules containing three DNA double helices), with each BTX molecule comprised of 10 DNA strands. Unlike DNA, the BTX code is not limited to four letters—in principle, it can contain quadrillions of different letters and tiles that pair using the complementarity of four DNA single strands, or "sticky ends," on each tile, to form a six-helix bundle.

In order to achieve self-replication of the BTX tile arrays, a seed word is needed to catalyze multiple generations of identical arrays. BTX's seed consists of a sequence of seven tiles—a seven-letter word. To bring about the self-replication process, the seed is placed in a chemical solution, where it assembles complementary tiles to form a "daughter BTX array"—a complementary word. The daughter array is then separated from the seed by heating the solution to ~ 40 oC. The process is then repeated. The daughter array binds with its complementary tiles to form a "granddaughter array," thus achieving self-replication of the material and of the information in the seed—and hence reproducing the sequence within the original seed word. Significantly, this process is distinct from the replication processes that occur within the cell, because no biological components, particularly enzymes, are used in its execution—even the DNA is synthetic.

"This is the first step in the process of creating artificial self-replicating materials of an arbitrary composition," said Paul Chaikin, a professor in NYU's Department of Physics and one of the study's co-authors. "The next challenge is to create a process in which self-replication occurs not only for a few generations, but long enough to show exponential growth."

"While our replication method requires multiple chemical and thermal processing cycles, we have demonstrated that it is possible to replicate not just molecules like cellular DNA or RNA, but discrete structures that could in principle assume many different shapes, have many different functional features, and be associated with many different types of chemical species,"

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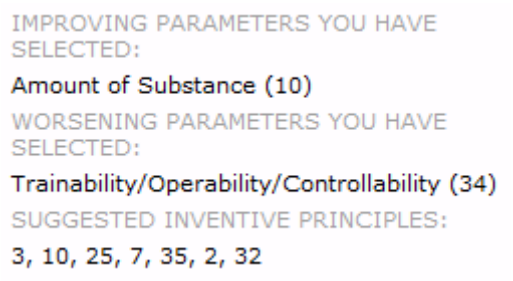
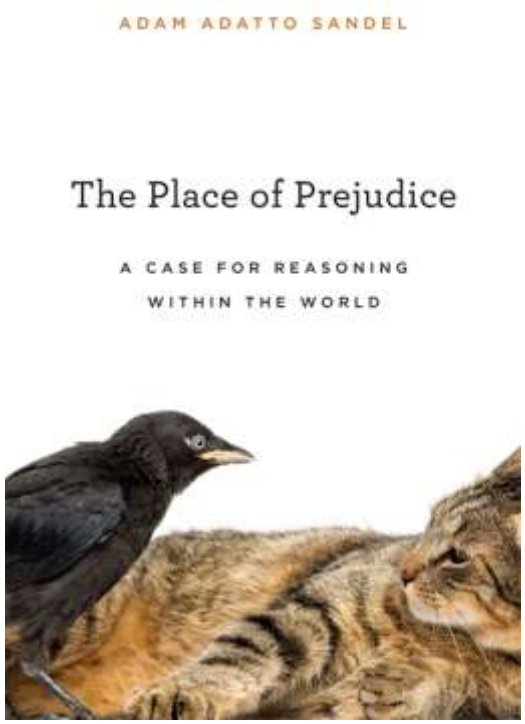
While the 'self' (Principle 25) is pretty much given away the moment you read the title of the invention disclosure, the problem being solved is a tad more difficult to imagine. Looking back to the background description, the thing the inventors are trying to achieve is 'exponential production' (i.e. beyond 'linear'), and what makes it difficult to achieve is the inability to adapt experimental and small scale techniques to the larger scales Which we think maps onto the Matrix something like this:



Thinking about it, the solution also carries a lot of evidence for Principles 3, 10 and 7 too. Maybe we're reaching a point where the Contradiction Matrix is getting so good, we can use it to give us clues as to what to go and look for in the invention disclosure? Oh that that was true!

Best of the Month – The Place Of Prejudice



Here's one we missed last year. Strange that we did, given the highly paradescent title. Prejudice is always a bad thing, right? How could it possibly have 'a place' anywhere?

Even the scantest of internet searches will immediately and definitely show that we associate prejudice with ignorance and bigotry and consider it a source of injustice. So how can prejudice have a legitimate place in moral and political judgment? In this ambitious work author Adam Sandel shows that prejudice, properly understood, is not an unfortunate obstacle to clear thinking but an essential aspect of it. The aspiration to reason without preconceptions, he argues, is misguided.

Ranging across philosophy from Aristotle to Heidegger and Gadamer, Sandel demonstrates that we inherit our "prejudice against prejudice" from the Enlightenment. By detaching reason from habit and common opinion, thinkers such as Bacon, Descartes, and Kant invented prejudice—as we understand it today—as an obstacle to freedom and a failure to think for oneself.

The Place of Prejudice presents a powerful challenge to this picture. The attempt to purge understanding of culture and history leads not to truth, Sandel warns, but to shallowness and confusion. A purely detached notion of reason deprives judgment of all perspective, disparages political rhetoric as mere pandering, and denies us the background knowledge we need to interpret literature, law, and the past. In a clear, eloquent voice, Sandel presents instead a compelling case for reasoning within the world.

Sandel employs several clever approaches throughout. The first is to point out that those who claim to have rid themselves of prejudice are, without exception, kidding themselves, even setting themselves up to be more susceptible to prejudice by creating a fictitious realm in which they are immune to it. He offers as an example the "prejudice against prejudice" itself, as Hans-Georg Gadamer put it. The detached ideal of having no

perspective is naturally quite effective at concealing the fact that it is itself a perspective, a tradition at every moment seeking to forget that it is a tradition.

To Sandel's positive case for prejudice we could add more examples. Argument influenced by prejudice is also known as *rationalization* or *motivated reasoning*: instead of a free inquiry, started from a neutral standpoint and equally open to any possible conclusion, motivated reasoning is a counterfeit, presenting itself as open when it is actually working backwards to prop up an existing opinion. But motivated reasoning can often help to elaborate and generate ideas. Think of how science, despite its airs of objectivity, often in practice advances through rival factions with rival theories, each motivated to produce novel evidence and arguments that will prove their own side right and the other wrong. Or consider our adversarial trial system: Instead of pretending that lawyers could objectively derive a single, best interpretation of the evidence, it unabashedly presents to juries two partisan interpretations, with two teams motivated to produce the best case for each. These are models of how to employ the cognitive virtues of self-interested argument to correct its very well-known vices — if not quite making a giant leap that plants us squarely at the feet of The Truth, then at least lumbering in its general direction.

This understanding of rational inquiry suggests something like the dialectic model of the ancient Greeks, in which each view aims not only to be more accurate than its rivals, but to subsume them. In part this just means that rival views must be disproved, but it also means, as the philosopher Alasdair MacIntyre describes it in *Whose Justice? Which Rationality?* (1988), that "a successful correction of a false view" requires "that we are able to explain why we might expect such a view to be generated if our overall standpoint is correct." In contrast with the detached ideal, this conception of reasoning is tentative and bound by history. To understand a theory requires not just giving its latest formulation, but telling the story of its development, including the major false ideas held along the way, and how their refutation led to the more accurate and comprehensive theories held now. This model sees our understanding as expanding not through some single and final heroic act in which we rid ourselves of all perspectives, but through a gradual process in which we encompass more of them.

The dialectic model does not do away with bad prejudices — widely held but wrong ideas, especially ones that are assumed without being recognized. But it suggests that prejudices in this sense can be condemned as such only in retrospect, from our expanded view. And so too, in political argument and personal encounter, to call out an idea as a prejudice requires an account of why it might have been held without question, and why it is false or misleading beyond the mere fact that it was held without question. From the TRIZ perspective, we know too that the dialectic – we want prejudice and we don't want prejudice – is merely a contradiction to be solved and transcended.

Sandel's broader argument is not that prejudice is advantageous or inevitable, but that properly understood it is a component of reason. Reading Aristotle, Sandel argues that an individual's character "can be understood as a 'prejudice' in the sense of a particular life perspective — a viewpoint from which certain actions appear desirable that otherwise might seem unworthy." This does not mean that "our judgment would be improved if only it could be freed" from the particularities of character. Rather, judging well, obtaining the ability to discern the good, means gaining the ability to "partake of the right perspective, the right 'prejudice.'"

There is a risk in this reading. Aristotle's view is that an individual's ability to reason well requires his or her possession of certain virtues. Differences in opinion among individuals,

then, can in part be explained through their differences in disposition, life experience, and so forth; these elements account for their differing strengths and weaknesses as reasoners. But the kind of perspective Sandel aims to describe is a more elaborate one than can really be found in Aristotle's account of character.

Aristotle, Sandel notes, contrasts two kinds of understanding. The first, craft knowledge, is abstract, formal, and explicit. The second, practical wisdom, involves an understanding of purposes and situations, is "irreducible to rules or principles," and is "embodied in the agent's action ... rather than represented in his or her mind." Hannah Arendt developed this into a contrast between *work* and *action*: "Arendt maintains that action is always situated within a 'web of enacted stories.' Only insofar as work is drawn into this web does it acquire meaning. Detached from the world of action, she argues, our ability to manipulate and fabricate things would be pointless."

What Sandel is really after here is reversing the conventional ordering of our understanding. Where the Enlightenment picture treats our given world of experiences as clouding our philosophical deliberation, Sandel aims to show that the abstract statements at which philosophy aims emerge only by our drawing out of our vast store of experiences and intertwined worldly concerns. It is just this world that gives reason its motive, after all, for it is just this world that reason aims to reveal and make coherent.

This is where Sandel's project really begins to shine. It is also, not coincidentally, where it becomes plain that the idea of judgment he is defending is something that occurs so fluidly across mental life that he would probably have been better advised to jettison the label *prejudice* entirely rather than attempt to reappropriate it. Here he also brings in the work of Martin Heidegger — and does a fine job of making Heidegger's forbiddingly jargony work accessible. Sandel argues that it is in the fundamental nature of perception and so of thought to be situated and engaged in a particular scene in the world. Our philosophical reflections, intrinsically bound by perspective, do not find their meaning by the force of abstract imperatives, but from how they arise out of a world not of our own making — the physical world, and the human recrafting of it, that we are born into. "We can reflect upon [the world] philosophically only insofar as we already exist within it, only insofar as we are engaged with the world and understand it as a world of *concern* to us," Sandel writes. "In this sense, philosophy does not teach us something new, as if it connected us to reality for the first time. Illuminating the world means clarifying what we, on a certain level, already know."

To explain this view of bounded freedom, Sandel offers the illuminating metaphor that we are compelled to become authors of the latest chapter in a book already written by others. "In this situation, the author is clearly not free to write whatever he desires. Insofar as he must continue the story, any addition, any new creation, is determined by the standard of [the] story itself, by the unity of meaning that the text expresses. The addition, even if we speak of it as a wonderful enhancement, is nothing other than the story *itself*."

Cognitive science teaches that each of our minds has two broad systems for thinking. System 1 carries out mental processes that are rapid, emotional, perceptual, intuitive, automatic, and largely outside our awareness. System 2 carries out mental processes that are abstract, analytic, deliberative, and seemingly within and controlled by our consciousness. This division was pithily captured in the title of Daniel Kahneman's 2011 book, *Thinking, Fast and Slow*. And it might seem to align remarkably well with the division Sandel develops from Aristotle through Heidegger, between the knowledge explicit in our thoughts and the understanding implicit in our actions — so much so that the two could even be seen as scientific-philosophical counterparts.

Today researchers are assembling an ever-longer list of what they consider cognitive biases, which are apparently the product of a jumble of cognitive mechanisms that evolution has snatched up and crammed uncomfortably together. A new philosophical effort is needed to account for the findings of this science, and to challenge its shortcomings. Efforts like the one undertaken in *The Place of Prejudice* will be vital to this task. Adam Sandel offers a picture of a mental world pervaded to its lowest levels with intelligibility; a world in which sensation and feeling and passion are not raw and brutish things, but brimming with meaning awaiting revelation and articulation. If philosophy succeeds in reckoning with this science, we will be able to see more clearly the kind of beings we are: animals rational yet always immersed in some scene and bound to act within it, unified beings in a multifarious world we did not ask to enter yet have no choice but to make our own.

Wow In Music – I'm Not In Love

There aren't many songs that get hour-long documentaries written about them 10cc's 1975 hit 'I'm Not In Love' is one of them. It became a worldwide smash, not only topping the UK charts but also reaching number two in the US, has been covered by dozens of artists, and has become an all-time classic.

Here's a fascinating insight into the making of the record, an edited interview with the song's main writer, Eric Stewart. Look out for all the Inventive Principle leaps into the unexpected. Starting with the song's (Principle 13) title:

"At that time my wife and I had been married about eight years," Stewart recalls, "and she asked me 'Why don't you say "I love you" more often?' I had this crazy idea in my mind that repeating those words would somehow degrade the meaning, so I told her 'Well, if I say every day "I love you, darling, I love you, blah, blah, blah," it's not gonna mean anything eventually.' That statement led me to try to figure out another way of saying it, and the result was that I chose to say 'I'm not in love with you,' while subtly giving all the reasons throughout the song why I could never let go of this relationship."

"I had the guitar hook first —a little arpeggio on an open 'A' chord — and the melody kept going through my head, so when I got the idea to write the words 'I'm not in love' it just sort of slotted together," he continues. "Once I'd clicked on the idea to approach it that way, it was actually very easy to write the rest. I made things fit phonetically, and it just sort of rolled out very smoothly in a bossa nova shuffle. You know, Stan Getz, Astrud Gilberto.

"So I had the first six chords or so of the verse figured and I had the melody already figured in my head, as well as the first verse lyrics 'I'm not in love, so don't forget it, it's just a silly phase I'm going through...' so I took this to the studio, played it to the other guys and asked 'Would anyone like to finish it with me?' Graham Gouldman ('GiGi') the bass guitarist, said he would.

"We started with the chords that I already had and we began bouncing ideas off each other. We were both very good at steering something away from the norm, looking for another way to make the chords move so that it didn't become a 'regular' pop song...

"There's no middle eight or chorus in 'I'm Not In Love' (Principle 2)*. GiGi came up with this lovely little fill in between verses: an open 'E' string with the chords moving from 'E' to 'A' to 'G', with this 'E' bass string ringing through it — very, very tasty. I eventually played that on the recording with a Fender Rhodes. A beautiful progression with a beautiful sound. He also came up with the opening chords of the song, an 'A' chord with a 'B' bass, moving to a full 'B' chord, all very 'expectant' of what is to follow. Then we wrote a second verse and, because we thought this was going to be something different, we also wrote what could be termed as a middle eight quite early on in the song* (Principle 10)*. We got the melody for that very, very quickly, but the words just sounded naff…*

"GiGi contributed quite a lot on some of the chord changes to take them away from what I'd originally figured," Stewart remarks. "He'd take them in a different direction (Principle 17)*. There were, as I said, these little fills in between the verses, and he also pulled that chord progression for the 'Ooh, you'll wait a long time' bridge out of the bag; a nice arpeggio run-down.*

When Stewart and Gouldman first played the other two band members their sub-four-minute bossa nova classic, Kev and Lol were a little coy: "Yeah, yeah, it sounds nice, it sounds a bit cute. But hey, let's try it!"

All four began recording the song immediately, with Eric Stewart behind the desk. While Stewart engineered, the other three recorded as a band, with Gouldman's Rickenbacker bass DI'd and Creme's Les Paul going through a Marshall 50, played at a low level and miked with a valve U67.

"We were always very blunt with each other," says Stewart. "We recorded everything we came up with, but we were very brutal at the end of it, saying things like 'Is this working?' or 'Do we like this? Is this gonna fit? Yes or no?' Out of four people we needed a majority of three votes to say 'Yeah, we carry on,' or 'Yeah, it's going on the album' or 'No, it's out.' Well, we recorded 'I'm Not In Love' as a bossa nova and Godley and Creme didn't really like it! Kevin was especially blunt. He said 'It's crap,' and I said 'Oh right, OK, have you got anything constructive to add to that? Can you suggest anything?' He said 'No. It's not working, man. It's just crap, right? Chuck it.' And we did. We threw it away and we even erased it (Principle 34…)*, so there's no tape of that bossa nova version. It pissed me off no end at the time, but it was also very democratic.*

Anyway, walking around Strawberry each day, I kept hearing people singing the melody: 'I'm not in love...' And I kept going back to the band and saying 'There's something more with this song. We've not got it yet, but I don't want to lose this song, because it's got people hooked.'

"Then the secretary Kathy said 'Why didn't you finish that song? I really love it. It's the nicest thing you've ever done.' This didn't really impress Kevin, of course, but we discussed it again, and believe me, it was Kevin who suddenly came up with the brainwave(…Principle 34 part 2)*. He said 'I tell you what, the only way that song is gonna work is if we totally fuck it up and we do it like nobody has ever recorded a thing before* (Principle 13)*. Let's not use instruments* (Principle 2)*. Let's try to do it all with voices.'*(Principle 33) *I said, 'Yeah. OK. That sounds... different.' A cappella, vocal instrumentation is what he was talking about.*

I said 'Right, there's just four of us to do the whole thing with voices. How are we going to do it?' And it was Lol who then said 'What about loops? Tape loops (Principle 14… okay, 26)*. Endless voice loops* (Principle 20)*. We can make endless loops of a chromatic scale* (Principle 17)*.' I said 'Right. OK, Jesus, this is really off the wall.'*

"it took me a couple of hours to get my head around the idea. But then I figured how we could physically make the loops and set up the studio to do that. I rigged up a rotary capstan on a mic stand, and the tape loop had to be quite long because the splice edit point on the loop would go through the heads and there'd be a little blip each time it did. So, I had to make the loop as long as

I could for it to take a long, long time to get around to the splice again. That way you wouldn't really hear the splice/blip. We're talking about a loop of about 12 feet in length going around the tape heads, around the tape-machine capstans, coming out away from the Studer stereo recorder to a little capstan on a mic stand that had to be dead in line vertically with the heads of the Studer. It was like one of those continuous belts that you see in old factories, running loads of machines, and we had to keep it rigid by putting some blocks on the mic stand legs to keep it dead, dead steady.

"It worked, but the loop itself — and this is where it gets interesting — had to be made up from multiple voices we'd done on the 16-track machine. Each note of a chromatic scale was sung 16 times, so we got 16 tracks of three people singing for each note (Principle 1). That was Kevin, Lol and GiGi standing around a valve Neumann U67 in the studio, singing 'Aahhh' for around three weeks. I'm telling you; three bloody weeks. We eventually had 48 voices for each note of the chromatic scale, and since there are 13 notes in the chromatic scale, this made a total of 624 voices. My next problem was how to get all that into the track.

"I mixed down 48 voices of each note of the chromatic scale from the 16-track to the Studer stereo machine to make a loop of each separate note (Principle 5), and then I bounced back these loops one at a time to a new piece of 16-track tape, and just kept them running for about seven minutes. Because we had people singing 'Aahhh' for a long time, there were slight tuning discrepancies (Principle 16) that added a lovely flavour, like you get with a whole string section, with a lot of people playing. Some are not quite in time, some have slightly different tuning, but musically a lovely thing happens to that. It's a gorgeous sound. A very human sound, very warm and moving all the time. Anyway, after putting the 13 chromatic scale notes back onto the 16-track, it meant there were only three open tracks left!

"On one mono track we put a bass drum and me playing the Fender Rhodes piano as well as bumbling a guide vocal very, very crudely, just to keep the song's timing. Kevin actually did the bass drum using a Moog bass note; a funky sound with a little edge on it, a little click almost. The timing had to be perfect, with no metronome! Then, all four of us manned the control desk, and each of us had three or four faders to work with. We moved the faders up and down and changed the chords of the 13 chromatic scale notes as the chords of the song changed — 13 tracks on a 16-track tape, fed through the control desk faders, back out of the master fader and onto that stereo pair of open tracks that was left free on the 16-track machine. It took a long time before we thought we'd got something really interesting.

"Luckily we got it. We got it just right. We very, very quickly got the lead vocal down and then we sat there, I tell you seriously, for about three days, just listening to this thing. I was looking at Kevin and the other two guys saying 'What the fuck have we created? This is brilliant.' We knew we had something very, very special, very different. I'd never heard anything like it in my life. I mean, the Beach Boys were seriously good at harmonies, but they hadn't, as far as I knew, done anything this way. It was a very, very unusual sound. And sound degradation caused by all the bouncing didn't matter at all because, when each of us were using control desk faders to mix the voices, there was a piece of gaffer tape across the bottom of the fader paths to stop them ever going to the bottom. That meant we had a chromatic scale sizzling underneath the track all the time (Principle 20), a hiss just like the hum you sometimes hear at a football match when nobody's shouting. If you listen to the opening of the song, where the bass drum beats us in, you will hear a sizzling hum there that continues all the way through the track. We actually created 'hiss' on the track, when we would normally have been fighting to get rid of hiss! (Principle 9)

Not surprisingly, the song would only take half a day to mix. In the meantime, however, Eric Stewart had to track his lead vocal, and this he did with his usual valve U67, recorded dry with no reverb or EQ, and certainly with no comping (Principle 2).

"There's a very different vibe to somebody singing from start to finish, (Principle 20)" he says. "You get the whole feeling of the song together. I can spot comping a mile off. So we didn't comp it. It's not a difficult song to sing. I got it down in one and then dropped in to correct a few mistakes. The

little high answers at the end of the verses where it goes 'It's because...' — Lol and Kevin could do that. They had great high voices, those two, so I multitracked them about four times on those lines (Principle 5).

"At this point there was no bass on the track whatsoever. The left-hand side of my Fender Rhodes was providing the bass notes — I played them in octaves with my left hand, which is how I normally play keyboards, and that was enough. It didn't need a bass guitar. But again, there was another unusual idea suggested: why don't we try a bass solo? A bass solo in a ballad? (Principle 17) Bloody stupid you'd think. However, it did fit beautifully. It's all about searching for something that hasn't been done before, and believe me, we sometimes spent days, sometimes weeks searching for sounds that we thought were different.

"For the bass solo, GiGi came into the control room, I DI'd his Rickenbacker through one of those lovely Dbx 160 compressors to keep its gorgeous, round, thumping sound tight and smooth, and he played the solo. We sat there and he played bits, and we said 'Like that,' 'Don't like that,' 'Do that again,' and it developed. When we got that down, the song was, to all intents and purposes, finished, but again we sat there listening to it, wondering what else we could do to 'screw' this song up. That's the way it was beginning to look to me.

…Well, when we listened to 'I'm Not In Love', Kevin kept saying 'It's not finished, it's not finished,' and I remember saying 'What do you want to try next? A fucking tambourine solo in the middle of it? What do you want?' We kept thinking and kept thinking, and Lol remembered he had said something into the grand piano mics when he was laying down the solos. He'd said 'Be quiet, big boys don't cry' — heaven knows why, but I soloed it and we all agreed that the idea sounded very interesting if we could just find the right voice to speak the words. Just at that point the door to the control room opened and our secretary Kathy looked in and whispered 'Eric, sorry to bother you. There's a telephone call for you.' Lol jumped up and said 'That's the voice, her voice is perfect!'(Principle 17)

"We got Kathy in the studio just to whisper (Principle 39) those words, and there it was, slotted in just before that bass guitar solo. And it fitted beautifully. Again, another little twist of fate, an accident that wasn't on anybody else's songs. We'd never heard that before. It just clinched it and made the song even more original.

There was one further addition. "The last thing recorded on 'I'm Not In Love' was a child's music box over the fade out (Principle 13) We sent the secretary out to buy a simple plastic one, attached it to a piece of string, and Lol sat at the drum kit and whirled it slowly over his head (Principle 14) while I recorded it on the overhead drum mics."

Given Kevin Godley's initial reaction to 'I'm Not In Love', it may seem a little surprising that he was subsequently willing to not only give it another chance, but also to give it sufficient consideration to come up with such innovative ideas. However, it wasn't the song that he hated as much as its initial sugary samba arrangement, and despite having been turned off it, he was eventually swayed by its popularity among the studio staff.

As Eric Stewart surmises, "He must have just sat there thinking 'How can we do it and make it different? How can I not make it schmaltzy?' And he figured it with the a cappella idea. It was great. A lovely piece of chemistry coming from his head."

Amazing insight I think.
Check out the full interview here:
http://www.soundonsound.com/sos/jun05/articles/classictracks.htm

Investments – No-Drill Dentistry

The best solutions fix the problem ‘by themselves’. Great for the customer; not so great for the company looking to monetize their great new self- solution. Or the investor… unless they manage to find a novel service innovation model.

Well, at least this month’s investment suggestion has the first part of the story right. Stop tooth decay by helping the teeth fix themselves. Key to the second ‘service innovation’ part of the story: the word ‘help’. Not good if you’re a dental drill manufacturer. But, if you hate the thought of a dentist ever putting a drill in your mouth again, this solution is the one for you.

It all comes from a recently published University of Sydney study. The study has revealed that tooth decay (dental caries) can be stopped, reversed, and prevented without the need for the traditional 'fill and drill' approach that has dominated dental care for decades.

The results of the seven year study, published this month in *Community Dentistry and Oral Epidemiology*, found that the need for fillings was reduced by 30 to 50 per cent through preventative oral care.

"It's unnecessary for patients to have fillings because they're not required in many cases of dental decay," said the study's lead author, Associate Professor Wendell Evans of the University of Sydney.

"This research signals the need for a major shift in the way tooth decay is managed by dentists -- dental practice in Australia needs to change. Our study shows that a preventative approach has major benefits compared to current practice.

"For a long time it was believed that tooth decay was a rapidly progressive phenomenon and the best way to manage it was to identify early decay and remove it immediately in order to prevent a tooth surface from breaking up into cavities. After removing the decay, the affected tooth is then restored with a filling material -- this process is sometimes referred to as 'drilling and filling'.

"However, 50 years of research studies have shown that decay is not always progressive and develops more slowly than was previously believed. For example, it takes an average of four to eight years for decay to progress from the tooth's outer layer (enamel) to the inner layer (dentine).

"That is plenty of time for the decay to be detected and treated before it becomes a cavity and requires a filling."

Professor Wendell Evans and his team developed the Caries Management System (CMS) -- a set of protocols which cover the assessment of decay risk, the interpretation of dental X-rays, and specific treatment of early decay (decay that is not yet a cavity).

The CMS treatment 'no-drill' involves four aspects:

1. Application of high concentration fluoride varnish by dentists to the sites of early decay

2. Attention to home tooth brushing skills

3. Restriction of between-meal snacks and beverages containing added sugar

4. Risk-specific monitoring.

"The CMS was first tested on high risk patients at Westmead Hospital with great success," said Professor Evans.

"It showed that early decay could be stopped and reversed and that the need for drilling and filling was reduced dramatically.

"A tooth should be only be drilled and filled where an actual hole-in-the-tooth (cavity) is already evident," he said.

The CMS treatment was then tested in general dental practices in New South Wales and Australian Capital Territory. The Monitor Practice Program (MPP), funded by the National Health and Medical Research Council of Australia (NHMRC), confirmed that after seven years, decay risk was substantially reduced among the CMS patients and their need for fillings was reduced by 30 to 50 per cent compared to the control group.

"The reduced decay risk and reduced need for fillings was understandably welcomed by patients," Professor Evans said. "However, patients play an important role in their treatment. This treatment will need a partnership between dentists and patients to be most successful."

Generational Cycles – Woodstocks

We are stardust
We are golden
And we've got to get ourselves
Back to the garden

The Woodstock festival of 1969 was a defining moment in the coming-of-age of the Baby Boomer generation in the US. Three days of peace and music attended by 400,000 hippies. It is widely regarded as a pivotal moment in popular music history. *Rolling Stone* listed it as one of the *50 Moments That Changed the History of Rock and Roll*. The festival is also widely considered to be the definitive nexus for the larger counterculture generation.

It was generally felt to be an unrepeatable moment in time.

But that didn't stop a group of post-hippie bread-heads deciding that a 25th year anniversary repeat would be a good way to make some well-deserved money.

And so upstate New York found itself party to Woodstock 94. Here's what one review said of the event:

One thing I know: Whoever organized this was a buckethead," said one state trooper directing traffic at Woodstock '94. The show's promoters, Woodstock Ventures, would likely disagree. They expect to make a "small profit" on this trip back to the garden. But small by whose standards? More than 190,000 tickets were sold (at $135 each), while the profits from pay per view ($5 million-$8 million) and the upcoming CD, video, and film are still to be counted. Other numbers from the much-hyped weekend:

**There were no official tallies on how much food was sold, but one vending area grossed $400,000 the first day.*

**Once vendors shut down on Sunday, everything but the 840-acre Winston Farm was for sale. Among the collectibles: Peace Patrol security T-shirts ($100- $500) and Peace & Love pizza boxes ($1).*

**Despite drug-sniffing dogs, illegal substances made the scene. Pot: $2-$5 a joint. Acid: $3-$10 a hit. Ecstasy: $20-$25.*

**Then there was cleanup. It will take 150 workers, 50,000 bags, and 20,000 pairs of rubber gloves to collect the estimated 1 million pounds of garbage. Will Saugerties — the New York town that was offered a performing-arts center by the promoters for hosting Woodstock '94 — do it again in 2019? "We need a day of rest," says town clerk Eleanor DeForest, "but I'm sure in 25 years we'll be ready."*

Woodstock 94 – aka Mudstock 94 – aka Muckrake 94

So much for peace, love and understanding. The GenX kids basically got fleeced by the Boomers.

The Boomers liked it. They decided to repeat the con again in 1999. The thirtieth anniversary.

Here's a review of that event:

"This is not the real Woodstock. They messed up. They messed up the whole name of Woodstock."

Volumes have been written about the disaster that was Woodstock '99, but if you're looking for a succinct appraisal of the infamous festival that started out as a 30th anniversary celebration of a watershed moment in American pop culture and ended in blazing riots, the above quote — taken from an Associated Press report filed as the sun rose on the final night's smoldering wreckage — is pretty solidly on target. Sadly, anyone who'd been paying attention could have seen it coming.

Part of the problem stemmed from motivation. Promoter John Scher, was determined not to repeat past mistakes. As he told reporters, "You can have a Woodstock, and it can be a safe and secure environment. We're going to try and make a profit on this one." To that end, Woodstock '99 was moved to Griffiss Air Force Base in Rome, N.Y. — a questionable decision not only because it lies hundreds of miles from the original Woodstock, but because the grounds were once toxic enough to qualify for EPA Superfund site status. Even more problematic was the fact that trees on the site had been cleared out to increase safety on the landing strips, thus removing any natural shade spots — and given that Woodstock '99 was scheduled for the weekend of July 22–25, 1999, when temperatures soared over 100 degrees Fahrenheit, concertgoers found themselves coping with sweltering heat.

As it turned out, heat was only one of the potentially dangerous environmental factors that concertgoers were forced to deal with. According to David Moodie and Maureen Callahan's damning postmortem for Spin*, the promoters cut corners just about anywhere they could, including skimping on plumbing for vendors and installing an alarmingly low number of toilets and showers (which were then situated in the worst possible height and distance from the campgrounds).*

Staffing was also a major problem. Moodie and Callahan describe an environment in which low-paid workers, denied water or regular meals, simply walked off the job partway through the festival, leaving trash bins to overflow and letting attendees get away with a long list of alleged abuses that included theft, sexual assault and rampant, inappropriate pooping.

Adding to the negative energy building over the weekend were the outrageous prices for everything, starting with the $150 it cost for a ticket and continuing through inflated charges for beer ($5), personal pizzas ($12), burritos ($10), bottled water ($4), and bags of ice ($15). As Los Lobos member Steve Berlin, who performed at the festival, later observed, "This is the first generation that's been branded their whole lives. They've been identified as a market opportunity since they took their first breath. And when you take those people and tell them this is going to be culturally and historically important and it turns out to be another commercial, I'd probably get pretty pissed off too."

Sad as the event was, it turns out to be highly symbolic of how generational arcs play out. 1969 Woodstock was the perfect showcase for Narcissistic Prophets. Woodstock's 94 and 99 were cynical, corporate money-making machines that, no surprise, Alienated Nomads responded to by burning the place down.

It's difficult to imagine anyone being brave enough to try another Woodstock.

Which would – ironically perhaps – be a great shame because now the generational tide has turned again. I suspect a Heroic Generation Y '50th anniversary Woodstock' in 2019, provided the money thing gets properly squashed, could easily become a defining moment in that generation's history.

Call it a prediction.

Based on this:

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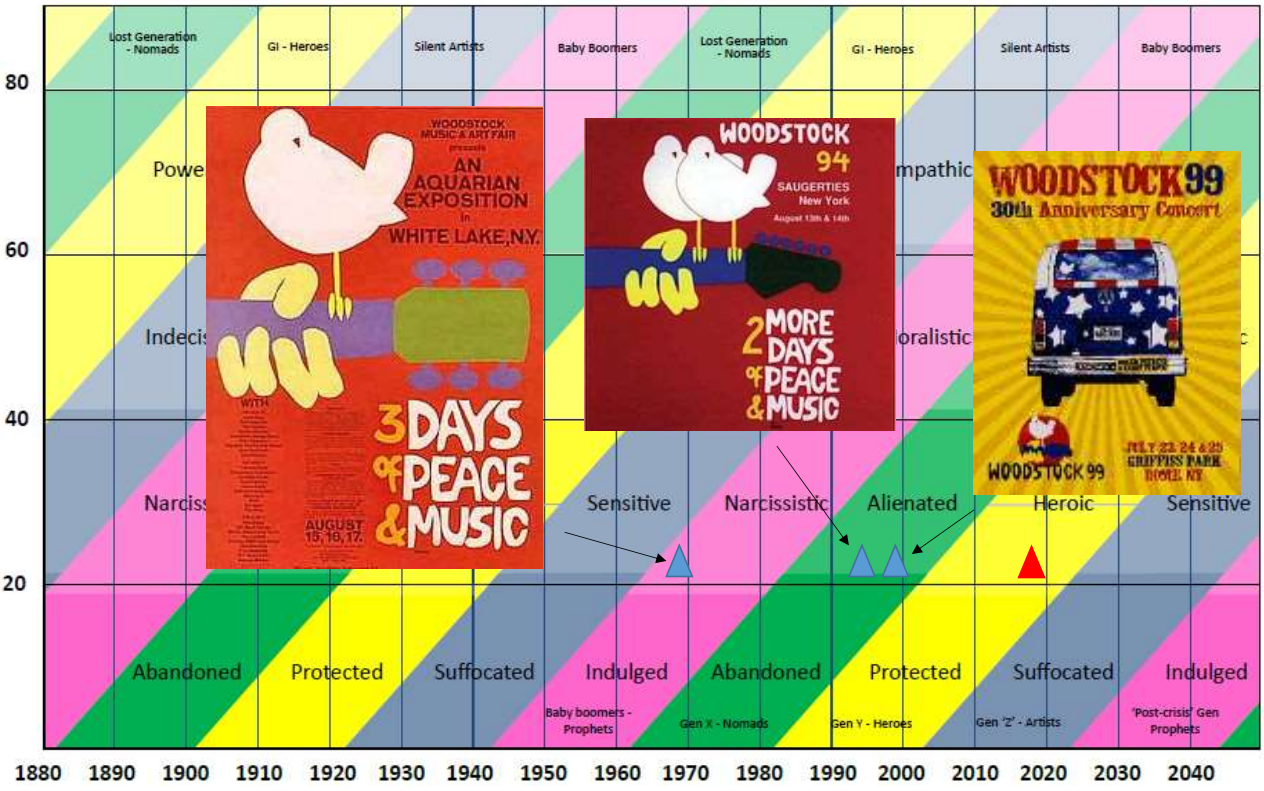

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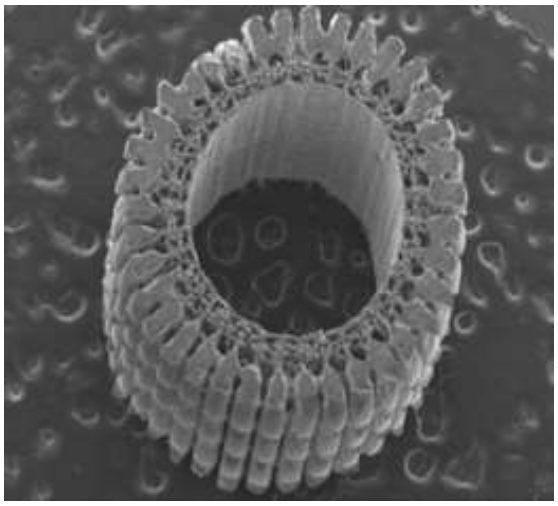
Biology – Sea Urchin Spines

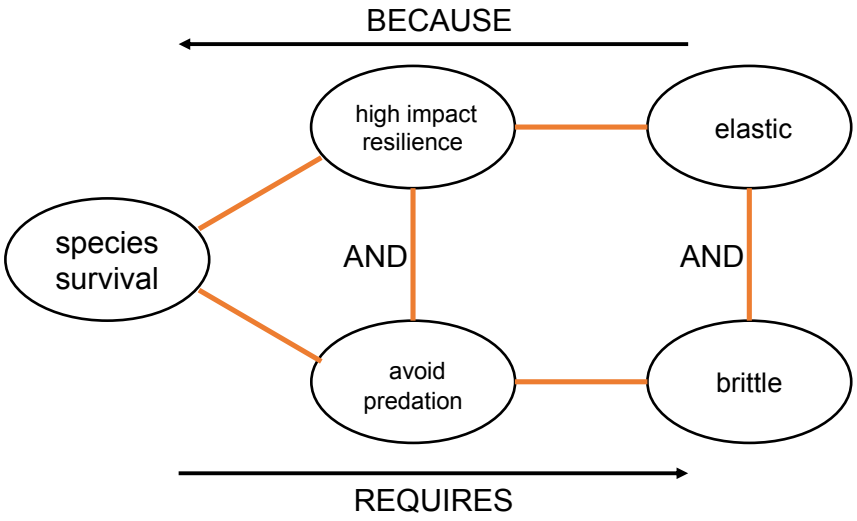


For the first time, a team of Australian engineers has modelled the microscopic mechanics of a sea urchin's spine, gaining insight into how these unusual creatures withstand impacts in their aquatic environment.

The skeleton of the purple-spined sea urchin (*Centrostephanus rodgersii*), found in tidal waters along the coast of New South Wales, has many long spines extending from its core. These spiky features are used for walking, sensing their environment, and for protection against predators and rough surf.

The long hollow (Principle 31) spines are made from a single crystal of calcite – which is essentially glass – arranged in a porous, intricate structure. Material scientists are interested in the chemical composition of these spines, but there has been no previous exploration of how they respond to mechanical stress.

In this latest study, published in the open-access journal *PLOS ONE*, researchers from UNSW and the Australian National University explain how this unique and intricate structure enables an advantageous blend of elasticity and brittleness, which allows the spine to better absorb impacts and stress under some conditions, and snap off under others. It's classic contradiction territory:



In addition to offering some new insight into this curious marine animal, researchers say the finding could offer clues for creating new bio-inspired materials and more efficient engineering designs, which often strive to improve strength-to-weight efficiency.
The sea urchins spine strength is particularly interesting given the brittleness of its constituent materials, says lead author Dr Naomi Tsafnat from the School of Mechanical and Manufacturing Engineering at UNSW.

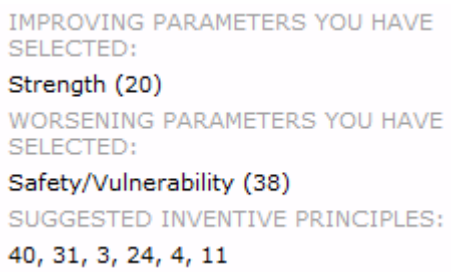
"While we're not certain that this evolutionary feature is optimised, it certainly works – the longevity of this creature, having survived hundreds of millions of years, is a testament to that," she says. "The spine is both strong and lightweight, and has mechanical characteristics that suit the sea urchins needs."

"It can withstand some types of loads, like compression, which allows the sea urchin to manoeuver and walk around, but snaps easily when the urchin needs to protect itself from predators."

Using a process known as microtomography, the researchers created a high-resolution 3D microscopic image of a segment of spine, which allowed them to identify unique features in its architecture. These included protruding wedges and barbs on their surface (Principle 3), linked together by tiny bridging structures (Principle 24) that spiral around the spine's axis.

The team used this 3D image to create a computer model of the spine segment, and then simulated various mechanical load scenarios. They observed that different types of stress concentrate at different points within the architecture (Principle 3). This contributes greatly to its strength and unusual elasticity under certain strains.

Here’s what the urchin’s problem looks like when mapped on to the Contradiction Matrix:



The Inventive Principle solution suggestions for which look to me like a pretty good facsimile of the sea urchin’s evolved solution. Principle 3, Local Quality, as ever, rules okay.

Short Thort

"The time we need in order to heal our wounds and finally manifest our deepest dreams is only as long as the gap between two thoughts. These are thoughts in polarity, such as separation and unity, conflict and peace, misery and joy, hate and love, etc. Since as human beings we are all capable of experiencing both thoughts, the only skill we need to develop involves mastering the GAP."
Franco Santoro

"It's not so much that we're afraid of change or so in love with the old ways, but it's that place in between that we fear . . . . It's like being between trapezes. It's Linus when his blanket is in the dryer. There's nothing to hold on to."
Marilyn Ferguson

News

Lean Educators Conference
Further to last month's announcement that Darrell will be giving a keynote - Counter-Intuitives: Lean, Innovation & Complex Adaptive Systems – at the big UK Lean conference of 2016, he'll be staying on to the following day to deliver a half-day TRIZ seminar. 14 and 15 September are the dates for your diary.

DTU
Darrell will be giving an evening presentation on 2 March, 'Don't Just Do Something, Stand There'. Check out the website for more details.

InnoMeto Conference
Plans for the Byron Bay conference next March (15-16) are well in motion. Book this year in order to obtain the early-bird discount. Contact Darrell to get a booking discount code.

New Projects

This month's new projects from around the Network:

Logistics – innovation strategy workshops
Automotive – Design-make project
Conglomerate – Systematic (Service) Innovation workshops
Construction – Innovation Strategy project
Financial Services – Design-make project
Materials – Evolution Potential/Invent-to-Order study
Transport – TRIZ/SI Certification workshops
Consumer Electronics – New Product Development workshop
Media – production innovation project

Happy Holidays

Finally, it remains for the SI team to wish all of our readers a happy holiday season. Many thanks for all of the feedback you sent in during 2015. From our part, the holiday allows a once-a-year opportunity to reflect on all we've seen and heard from you in order to set a better course for 2016, starting, as far as the SI UK office is concerned, from January 4. We quite simply couldn't do it without you. All the best to you and yours.