Systematic Innovation

e-zine

Issue 158, May 2015

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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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 Studies: Plan B and No Plan B

Following a statement during a client session that I thought 'Getting To Plan B' (Reference 1) was one of the best business books of the last decade, I was approached during one of the coffee breaks by one of the team members. He didn't look happy. The gist of his unhappiness was that my suggestion was likely to adversely affect the morale of his team. 'If we're not all bought in to the project,' he said, 'it will all collapse around us. We need to know everyone is aligned and heading in the right direction, not looking around for excuses or diversions.'

It sounded like we'd found an interesting contradiction. I could see his point, but I could also see that Mullins and Komisar, the authors of 'Getting To Plan B' had built their hypothesis on some pretty solid foundations. Namely, that in a complex world, there's an awful lot that can't be known at the start of the project, and thus it is highly advisable to allow for course corrections as and when new information emerges during the course of filling in the unknowns.

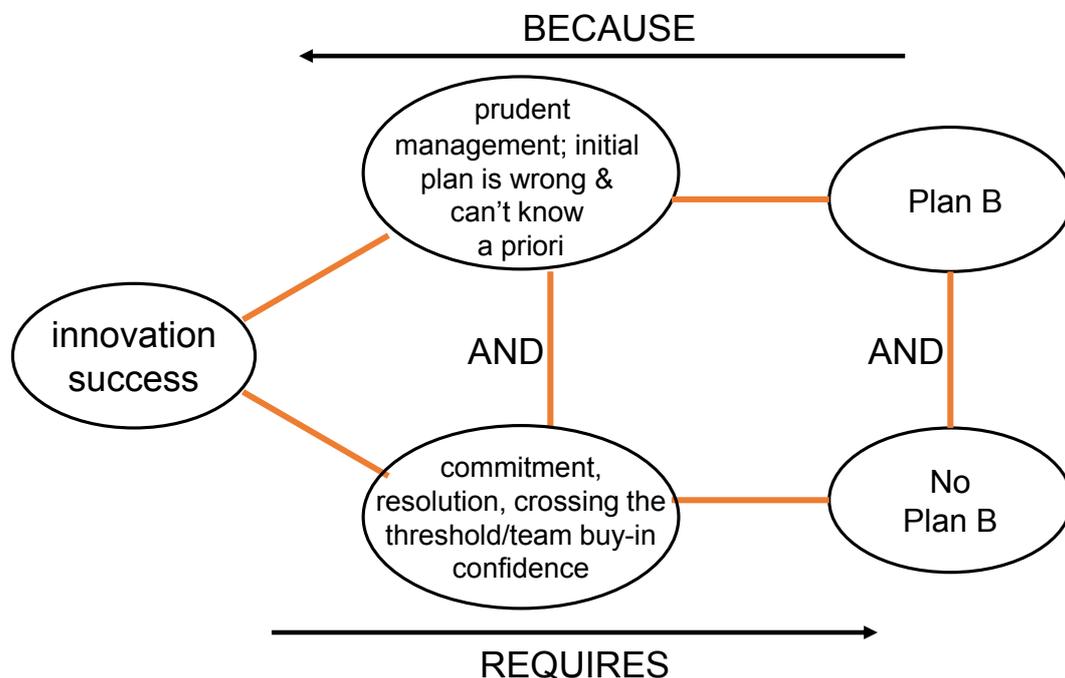The contradiction seemed to look something like the picture reproduced in Figure 1:

Figure 1: We Want A Plan B and We Don't Want A Plan B Contradiction Map

Having constructed the picture, I reminded myself – with no little irony as it turns out – that another favourite management text book of mine, 'Scuttle Your Ships Before Advancing' (Reference 2) was in complete alignment with the words of my irate client team member. The titular section of the book is built around the story of famed explorer Hernando Cortez. He landed on the shores of Vera Cruz, Mexico in 1519 and wanted his army to conquer the land for Spain. Immediately upon landing it looked like Cortez faced an uphill battle; an aggressive enemy, brutal disease and scarce resources. As they marched inland to do battle, Cortez ordered one of his lieutenant's back to the beach with a single instruction: "burn our boats."

It was a brave way to make sure the army kept their eye on the goal. Burning boats was a really excellent means of eliminating a Plan B retreat.

So which is the right strategy?

The Contradiction Map, of course, makes it clear that the answer is 'it depends'. Or rather that, ideally, we want the best of both worlds. Be totally aligned with Plan A, *and* have a Plan B. Figure 2 illustrates the results of mapping the Figure 1 problem onto the Matrix+ contradiction wizard:

Figure 2: Ranked Inventive Principle Suggestions For Solving The Plan-B/No-Plan-B Contradiction

Several of the Principles reminded me of an experiment we ran a couple of times during my time working in the aerospace industry. A typical 'project' in that world will usually require around a hundred engineers during the initial exploration and design phases of the programme schedule. We decided to place 96 of these hundred engineers into a 'Blue' team and the other 4 into a 'Red' team. Then gave both the exact same project brief. By rights, the Red team had absolutely zero chance of delivering a sensible design outcome. They were, in effect, our Plan B. Since they had no chance of successfully completing their brief using the established practices and protocols, they would have to break a few rules and try to find better ways of doing things. Their lack of numbers meant that this search for better ways had to fundamentally look for radical step-change solutions.

Both times we ran the experiment, Red Team won. Not that the competition with Blue Team was quite taken that far. The whole idea was to combine the best of both teams: Red found the step changes; Blue delivered the detail. Plan B was effectively built in to the asymmetric team segmentation structure.

I can imagine it's a strategy that would work in some contexts and not others. I haven't, for example, found a client willing to live through an equivalent Red/Blue experiment in the last five years. Most likely because the members of Red team need some relatively rare properties in terms of things like resilience and adaptability. Today we might think of them as 'anti-fragile'. People, in other words, who know the difference between burning boats and burning bridges.

So what about some of the other perhaps less radical strategies prompted by the Inventive Principles suggested by the Matrix?

Principle 19, 'Periodic Action', perhaps suggests the slightly less radical idea of periodically switching between Plans at different periods during a project. Maybe having a Plan B Day once a month, for example.

Principle 13, The Other Way Around, could be interpreted as, instead of having one Plan, have lots of Plans with a team responsible for running each. Every team has their 'Plan A' and every other team has their version of Plan B. Or, another way or interpreting the Principle 13 provocation would be to initially at least, encourage teams to find as many Plans as they can during an exploration phase aimed at cataloguing and answering the unknowns, and only after that catalogue has been whittled down to a meaningful level of convergence should there be any kind of definition of a boat-burning Plan A. Or, yet another interpretation, organisations like W L Gore don't rely on a single person to

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determine what Plan A is, instead they rely on everyone making their own judgement about whether a project is heading in the right direction or not by voting with their feet whether to stay with a project or not.

Principle 28 probably works best in its 'Another Sense' context, suggesting in that context something like using another means of getting people into the burned boats level of motivation that doesn't blind them to the need for exploration of alternatives. Not so fashionable in the last few years, but I know many companies have had success in this direction when they offered project team members a stake in the benefits.

Principle 2, Taking Out, or 'Separation' is probably easiest to connect to the idea of taking out any idea of a definitive, boats-burned Plan A until such times as all of the necessary exploration has been completed and the unknowns turned into knowns. This still leaves projects open to the uncertainties of the unknown-unknowns of course, in which case the best thing to 'Take Out' is probably time. Fail fast, fail forward being an often relevant strategy when the industry pulse rate is high. Far better to make a Plan A relating to creating a general ability to be able to make rapid iterations than to try and home in on a single all-eggs-in-one-basket project plan. This in effect takes the whole No-Plan-B to a meta level: creating a Plan A to become the world's best detergent manufacturer is probably going to be out-survived by a Plan A to become the world's best 'clean clothes' business.

Principle 1, Segmentation, offers up a whole series of different segmentation strategies. Segmenting Plan design according to ICMM Level for example, in a special 'Learning & Innovation' function or as part of the Efficiency Engine of the enterprise. It could also be segmented according to the psychometric make-up of the project team, the level of risk of the project, or whether the project is intended to deliver a sustaining, radical or disruptive outcome.

We could continue, but hopefully the intended point is already well made. Successful innovation attempts derive from formulating good questions and 'to have a Plan B or not have a Plan B' appears to us to be one of them. If only because it forces people to re-train their usually inappropriate innovation instincts. No-one likes burning boats, but sometimes it's the right thing to do. The key is knowing when. And knowing what the difference between a boat and a bridge is.

References

1) Mullins, J., Komisar, R., 'Getting To Plan B: Breaking Through To A Better Business Model', Harvard Business Review Press, 2009.
2) Luecke, R.A., 'Scuttle Your Ships Before Advancing: And Other Lessons from History on Leadership and Change for Today's Managers', Oxford University Press, 1993.

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Never Make Predictions…
Especially About The Future

Following our success at predicting the outcome of the Scottish independence referendum last year (see the www.darrellmann.com blog), we thought it would be a good idea to demonstrate that it wasn't a one-off PanSensic freak by doing something relating to the UK national election that took place this month. So we did a bunch of social media scraping across the country, but with a particular focus on marginal seats and, then, if we started to see something interesting, did a deeper dive in certain regions. Very early on in the analysis, Scotland came out as one such region where big changes in the political landscape seemed to be afoot.

Convention dictates that when making predictions, it's preferable to make them in advance of the actual events taking place. So that's what we did. We presented our findings at a meeting in Hong Kong in April. Scotland will experience an unprecedented shift to the SNP, we boldly stated, and the Conservatives will win an overall majority.

Everyone in the room (full of British expats, by the way), appeared to give a collective shrug of the shoulders, and in effect told me that this was an obvious conclusion to make. As a consequence of which, we never formally published the analysis results.

The unspoken question when challenging someone to predict the future is 'predict something that was unpredictable'. If the eventual outcome matches what everyone thought was an obvious and inevitable prediction, then it doesn't appear to offer any kind of 'proof' that the method was in any way useful. Given that an awful lot of future predictions end up falling in to this 'obvious' category, the futurologist's job takes a rather frightening turn for the worse. We all love David-beats-Goliath stories, and the reason we love them is because they're surprising. Never mind that 99 David's out of a 100 get beaten to a pulp.

It's only when I returned to the UK a couple of days before the election that we began to realise that our Scotland and Conservative predictions were indeed 'surprising'. Surprising, that is, to the collective media, who predominantly seemed to be describing the forthcoming 7 May Election Day, 'the most unpredictable election for over a hundred years' and/or, were stating that some extraordinary proportion of the electorate (40% was the highest number we saw) 'still hadn't made their mind up'. Sadly for us, by the time I realized I'd been duped by my Hong Kong audience it was too late for me to get anything written up and published before the Day arrived. More fool me. And not much of a consolation to know that the only 'proof' that the prediction was made at all resides with a couple of dozen Hong Kong meeting attendees.

All of which leaves me looking back to the post-Election media analysis rather wistfully. Fun to watch bad pundits eating their metaphorical (and in one case, actual) hats, but not so helpful to the PanSensic cause. Except for the fact that, despite all of the hand-wringing scrutiny by the winning and losing politicians, it still seems that none of them still has the first clue *why* what happened happened.

So maybe there's a small space for me to redeem myself by revealing a little about the PanSensic analyses we conducted and maybe make a few predictions based on the

results we derived. Maybe even one or two predictions about things that haven't happened yet. Who knows.

Let's start the process with the result in Scotland. For those e-zine readers living outside the UK, you might not know the extent of the apparent sea-change in the political landscape of the country. There was an average 27% swing in the votes of the Scottish electorate, which, given the British 'first past the post' voting system meant that the Scottish National Party went from winning 6 of the 59 seats to winning all of them bar three:
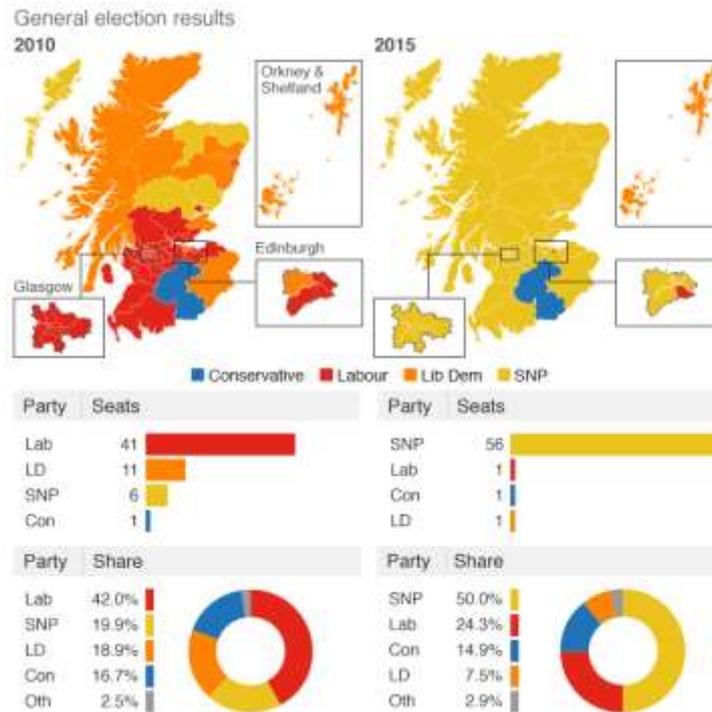

This was an apparently massive vote for 'Scottishness'. That it came as such a 'surprise' was because only a few months earlier, in the independence referendum, a significant majority of the population had voted to stay part of the United Kingdom.

So what changed?

Here's what the PanSensic analysis revealed regarding the Scottish social media in the weeks prior to the election. First up the JupiterMu metaphor analysis tool:
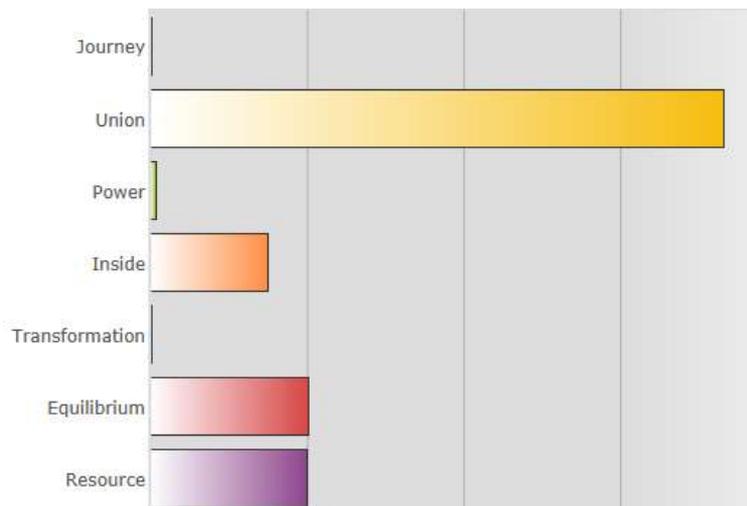
And then the Archetypes and Mental Gears analyses:
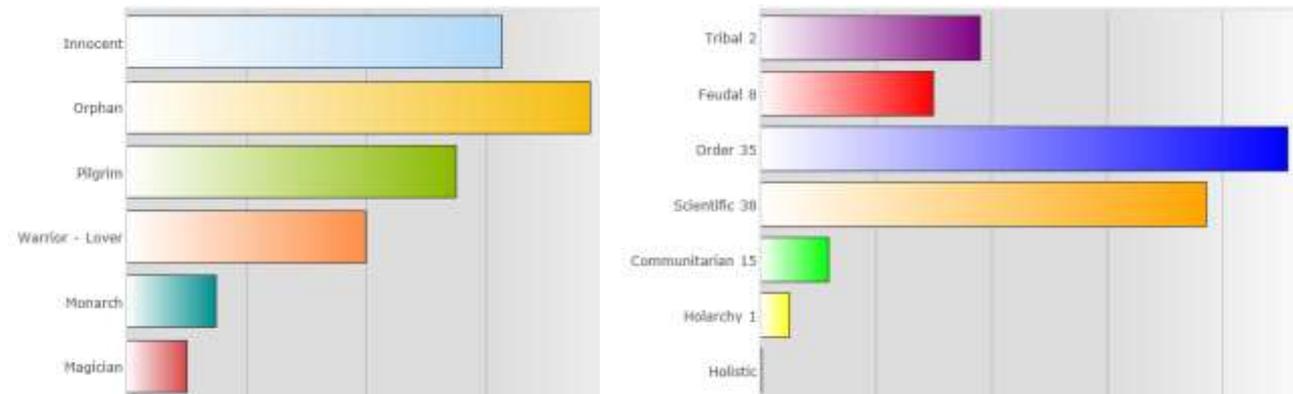
All of which leads to a new blinding flash of the obvious: the May 7 election was a completely different game to the independence referendum. Voting 'Yes' to Independence last year would have had very definite consequences in terms of the responsibilities that independence would have demanded. Voting for the SNP in May, on the other hand was a terrific way to demonstrate how Scottish the majority was feeling, only this time there could be no consequences: 56 SNP members of the UK parliament is a minority that gives zero power to actually change anything. For the Scottish electorate there was only up-side in voting SNP this time around – show the world you're Scottish, but no responsibility if anything subsequently goes wrong.

How do we know this is happening?
Several reasons:
- The majority of the metaphors being used were about Union and Inside (nationalism) and Equilibrium and a conspicuous absence of anything relating to Journey or Transformation – a classic case of rallying the 'tribe' but not actually wanting to go anywhere.
- The majority of the voters fall in to the Innocent and Orphan categories – basically saying, 'we don't really know what the point of this election is'
- Very high Tribal and Feudal scores on the Mental Gears analysis again emphasizing the Scottish nationalism, but in a no-responsibilities manner.

So, can we make any predictions for Scotland on the basis of this admittedly relatively sparse snapshot in pre-election time? How about three:
1) There will be little enthusiasm from the Scottish population for another independence referendum, at least for the duration of this next five year parliament.
2) If one is forced upon them, the answer will still unequivocally be to stay in the Union.
3) If the UK holds the promised 2017 referendum on staying in the EU, the Scots will vote to stay in with a bigger majority than the other parts of the UK.

So much for Scotland. What about the Conservative majority prediction in the supposedly 'unpredictable' election?

Two things give us all the clues we need. Firstly, the figure over the page shows how people were comparing David Cameron and Ed Milliband as seen through the MercuryPhi lens. The leadership battle was in effect a battle between a 'Rock' and a 'Yes, And'er'. In tough economic times, people tend to want Rocks. Milliband was basically un-electable because he didn't look like a Rock and never managed to sound like one either.
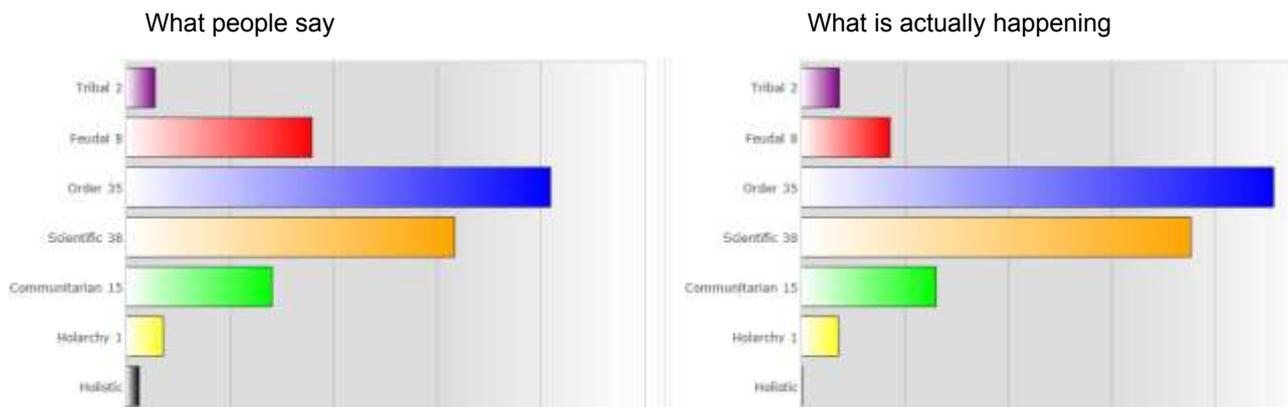
Milliband   Cameron

Second up, we did some scrapes to compare what people were saying on social media about the Conservative Party, versus what was actually being reported in the media. Here's what the Mental Gears lens revealed:

What people say   What is actually happening

At first sight, the two pictures don't look too dissimilar, but what is different about them is the higher level of Feudal narrative in the 'what people say' analysis. What this points to – we think – is a repeat of what has happened at previous elections in the recent past: there's an element of embarrassment about saying that you support the Conservative Party, even though in reality you actually do. People, put less subtly, had a tendency to lie about their support for the Conservatives. They lied to the pollsters and they lied to their social media friends.

Which means?
Remember my opening paragraph about future predictions having to contain a 'surprise'? That's what we have here I think. Five years of Conservative rule with no real surprises. At least not ones caused by them. Sorry to end on such a dull note. Reassuring though. Maybe.

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Art – Erwin Wurm

Erwin Wurm is an Austrian artist born in Bruck an der Mur in one of my favourite parts of the word, Styria, in 1954. Most artists seem to base their career on what effectively boils down to one or two Inventive Principles. Professor Wurm seems to know quite a few more. Here are some of our favourite Wurm pieces.

What better place to start than Inventive Principle 1, Segmentation. Or, In Wurm's World, 'Self Portrait as Pickles.' Where the total mass of pickles matches his own mass. Obviously.

Principle 2, ('This Is Tomorrow'):

3:

4:

5.

…You get the picture.
Here are some of my favourites:

Principle 17 seems to be a fairly regularly deployed Inventive step:

Principle 38 is more difficult, but definitely worthwhile:

You can work this one out (I call it, 'working with the French'):

Patent of the Month – Lignin-Based Nanostructures

One of the more obvious Principle 35 illustrative step-change solutions involves a change in material. There's no hiding the fact that this month's Patent Of The Month makes use of such a strategy: it's there for all to see in the title found on the invention disclosure. The patent itself – US9,023,471, was granted to a trio of inventors at the University of Florida on May 5. Here's what the background description to the invention tells us about the motivation for the step-change from the 'usual' carbon to lignin as the nanostructure foundation:

Limitations of cylindrical carbon nanotubes based on the buckminsterfullerene structure as delivery vehicles for therapeutic agents include their chemical inertness, sharp edges, and toxicological concerns. Nanotubes can also be formed from polymeric materials such as polyelectrolytes, collagen and poly(3,4-ethylenedioxythiophene) via template synthesis using nanoporous membranes containing arrays of aligned cylindrical pores. This approach produces either polymer-functionalized nanoporous membranes or polymer-based nanotubes from a sacrificial template. The development of polymer nanotubes holds many promises for biomedical and biotechnological applications because of their greater biocompatibility. However, the inability of synthesized polymer-based nanotubes to maintain their shape limits commercial applications.

Lignin is a complex phenolic plant cell wall polymer formed by the oxidative coupling of hydroxycinnamyl alcohols and related compounds. It can be synthesized in vitro. Lignin is a waste product from paper mills and biorefineries that convert renewable resources, such as lignocellulosic biomass, into fuels and chemicals. The desire to reduce both the dependency on imported fossil fuels and the net emission of greenhouse gasses attracts attention to the potential for bio-based fuels and chemicals. Since the presence of lignin in the biomass lowers the processing efficiency, lignin is typically removed during a thermo-chemical pretreatment and burned to generate heat for the distillation of alcoholic fuels from the fermentation broth. Lignin's rich diversity in chemical bonds and functional groups may, however, be attractive for applications that require biodegradability, biocompatibility, and low cost.

Which looks something like this when mapped on to the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Compatibility/Connectivity (33)

WORSENING PARAMETERS YOU HAVE SELECTED:

Amount of Substance (10) and Stability (21)

SUGGESTED INVENTIVE PRINCIPLES:

35, 28, 31, 24, 2, 33, 13, 3, 26, 27, 10, 5, 17

Good to see our inventor's strategy, Principle 35, at the head of the list. Not specifically mentioned, but certainly implied in the invention discosure is that the solution comes about as a result of making use of what is otherwise often percieved as a troublesome waste product coming out of other processes. Principle 27 perhaps?

Here's what the inventors have to say about their potentially very exciting deployment of the otherwise troublesome waste resource in its new role:

The embodiments of the present disclosure encompass nanostructures, particularly lignin nanotubes and nanowires. The lignin nanostructures of the present disclosure are made

substantially of lignin, meaning, as described above, that the composition of the nanostructures is about 50% or more lignin. However, the nanostructures may have a higher percentage of lignin, and in some embodiments may be made entirely of lignin (e.g., natural and/or synthetic lignin). The lignin nanotubes and nanowires provide significant advantages over carbon nanotubes or other conventional nanotubes.

First, lignin is an abundant organic polymer and can be isolated from many natural plant sources as well as repurposed from the waste streams of industrial processes such as paper mills, biorefineries, and the like. A complex phenolic plant cell wall polymer, lignin is formed by the oxidative coupling of hydroxycinnamyl alcohols and related compounds, including hydroxycinnamaldehydes and hydroxycinnamic acids. The composition of lignin varies naturally among species, tissues within a given plant, and as a function of plant development. This variability in composition provides the most suitable biological and physical properties, which include providing structural support, a hydrophobic surface that facilitates water transport through vascular tissues, and a mechanical barrier against invading microbes and insects.

Lignin is also an abundantly available, low-cost waste product from biorefineries that hydrolyze cell wall polysaccharides from renewable resources, such as woody biomass, corn stover and wheat straw, and convert the monosaccharides into fuels and chemicals. The number of biorefineries is expected to increase in number as a result of the desire to reduce both the dependency on imported fossil fuels and the net emission of greenhouse gasses. Since the presence of lignin in the biomass lowers the processing efficiency, lignin is typically removed during a thermo-chemical pretreatment and burned to generate heat for the distillation of alcoholic fuels from the fermentation broth. This waste stream represents, however, a rich diversity in chemical bonds and functional groups that are highly attractive for applications that require biodegradability and biocompatibility.

Furthermore, lignin can be synthesized from lignin monomers, allowing customization of the composition and features of the nanotubes. For instance, a synthetic lignin polymer referred to as a dehydrogenation polymer (DHP) can be synthesized in vitro by combining hydroxycinnamyl alcohols and oxidative enzymes. Since most, if not all, of the enzymes involved in the biosynthesis of lignin monomers and the genes encoding them have been identified, it is feasible to tailor the physico-chemical and biological properties of lignin-based materials through chemical and genetic approaches, which offers the potential of custom templates for nanomaterials. In embodiments, lignin from natural sources as well as synthesized lignin can be used together.

The methods and compositions of the present disclosure combine the principles of combinatorial chemistry of lignin polymer synthesis together with the practice of template synthesis of nanostructures to synthesize nanotubes and nanowires whose structural and chemical features can be easily tailored by varying the monomer supply and synthesis conditions. As described in the examples below, controlling the rate of synthesis made it possible to effectively control the thickness of the polymeric layer deposited within the pores of the substrate, resulting in the synthesis of either nanotubes with an approximate wall thickness of 15 nm or nanowires with a 200-nm nominal diameter. This ability to tailor the wall thickness provides a degree of control over the strength of the nanotube network structure. Examples shown here also describe how the source of natural lignin as well as the method used for lignin extraction can also be used to vary the properties of the lignin nanostructures produced. Varying the composition of the monomers made it possible to modify the optical properties of the resulting nanotubes. The examples also demonstrate how, as a result of the many functional and reactive groups in the lignin, lignin-based nanotubes are highly amenable to bio-functionalization with a variety of biologically active molecules, which enables specific recognition of biological targets and expands the opportunities for the targeted delivery of therapeutic agents in humans and animals.

And here's their rather wonderful first independent claim:

The invention claimed is:

1. A nanostructure comprising: a nanotube or a nanowire comprised substantially of lignin.

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Design around that one if you can!
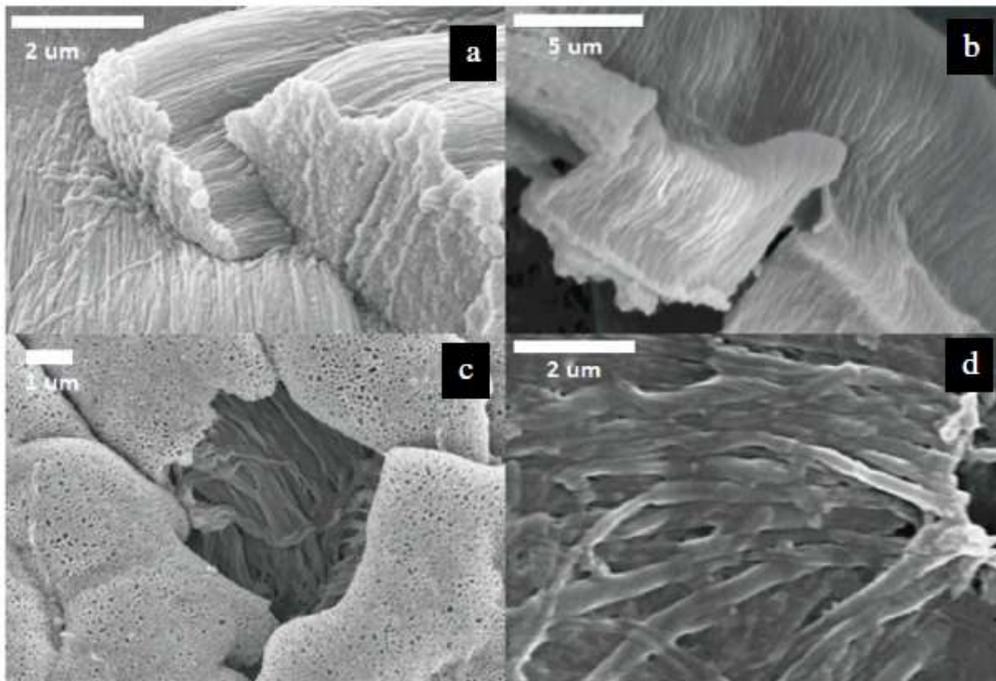
Figure 2. SEM images of lignin nanotubes illustrating (a) polymer growth both in the pores and on the top and bottom surfaces of the template (bar = 2 μm), (b) pliable bundles of lignin nanotubes reflect the material's flexibility (bar = 5 μm), (c) Au/Pd sputter-coating of the top and bottom of the membrane suppresses surface synthesis, as shown by the clean membrane surface observed in a partially dissolved membrane fragment that enables visualization of the lignin nanotubes (bar = 1 μm) and (d) free stabilized lignin nanotubes after the membrane has been dissolved (bar = 2 μm).

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Best of the Month – No Ordinary Disruption
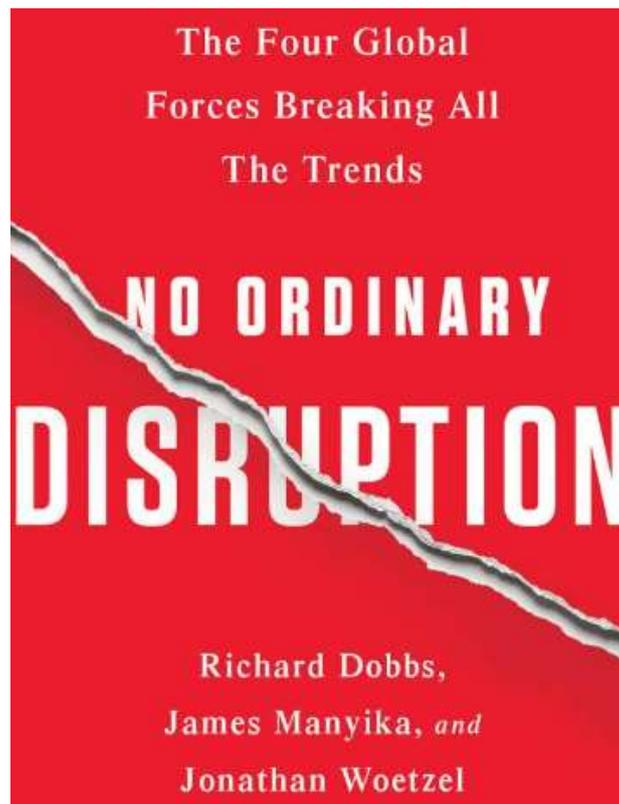
One of our clients recently took it upon themselves to tell us where we were going wrong in the Systematic Innovation Network organisation. 'You don't follow your own advice,' they said, 'you tell the story of how the employee that goes back to their boss with a simple solution is more likely to be chastised than rewarded than if they'd turned up with something really complicated, so how come you think it's you're right to hand over a simple solution to me?' One has to say, they had a point. I could feel a blinding flash of the obvious coming on. A flash made vivid by a bid we lost a couple of years ago when we went up against a team from McKinsey in Australia. The client fortunately stayed in touch and after the job had been completed, revealed that the McKinsey team had left behind a report containing over 130 recommendations and the obligatory obscene bill. Surprise, surprise very few of the catalogue of recommendations was executed (executable?), but prior to realising that, the management team had handed over hearty congratulations to the McKinsey crew for their diligence and dedication. We finally got the job we'd promised to deliver at the initial bidding competition and created a sequence of simple solutions designed to deliver first and foremost the 'sense of progress' that we knew would be needed inside the organisation before any meaningful change was ever going to take place.

The point of this rant? Well, somehow we find ourselves in the slightly awkward position of recommending a just-published book by a trio of authors from McKinsey. Not the same team that we lost to in Australia, fortunately, but very definitely another group with the same mentality of 'keeping it complicated' when it came to assembling their 200+ page tome on the subject of disruption. No doubt as a means of advertising consulting projects to help translate the content into the next set of non-actionable recommendations to their future clients.

Although there's no doubt the authors have never stinted on writing four pages when a paragraph would have sufficed perfectly well, one has to say that there is nevertheless a pretty high insight quotient.

They get some stuff wrong, they don't understand when it's okay to extrapolate along a trend or when to say that it's going to 'saw-tooth' (their words for 'make a discontinuous shift between one s-curve and the next'), but for anyone that does understand that it's not so much the trends that are important as the relationships between them, there is a lot of reading between the lines gold-dust to be found here. i.e. trend conflict finding opportunity.

The four 'global forces breaking all the trends' of the book's subtitle are Urbanization, Accelerating Technological Change, Ageing World and 'Global Connections'. None of which sounds particularly insightful in its own right. And, of course, that's not where the real insights lie… they're hidden in the cracks between. We think, when you know what you're looking for, this might just be the best 'trend' book of 2015.

Wow In Music – On The Crest Of A Wave

"Sailing away on the crest of a wave is like magic. You and your sweet desire took me higher and higher. It's a livin' thing: what a terrible thing to lose!"

These are the words from Livin' Thing, the prestigious song written by Jeff Lynne for best selling album and chief 'guilty pleasure' of many an aging Nomad. A New World Record. Charted among the top 10 in many countries (#4 UK Singles, #13 Billboard Hot 100) in 1976/77, and when Livin' Thing was released as a single, it helped to consolidate the Electric Light Orchestra as one of the biggest selling rock bands in the world.

The arrangement is memorable in many ways, starting with the introduction, where a mysterious/gypsy atmosphere given by the string orchestration leads (unexpectedly) to the first verse. According to the composer, however, that is not the main thing. To him, what makes the song outshine is the way the chords are arranged: "there is one chord change that makes the whole song, that makes it work" (the "catchy thing"), and that is going from F minor to E minor, and down to D minor and the "way it develops back to C" (In TRIZ terms, here's an interesting example of a Principle 17, Another Dimension, step-change). Another "unusual bit", according to Jeff is the sequence F, Am, G5+, C ("a new chord change that I had never heard before").

Here is what RealME - a special music player for iOS devices that does music recommendations based on emotions - has to say about the emotions Livin' Thing produces:


From what is on the graph, the overall machine interpretation is that valance, the 'good feeling' represented in the 'x' axis decreases at the same time that arousal, the intensity of emotion represented in the 'y' axis, increases. That would make you feel, starting from a relatively neutral state, an increasing sense of sadness as the music progresses (did you

lose a "livin' thing"? was that love?). At some point towards the end of the song, however, there is a sudden change in the direction of the "emotional curve" as if you were taken by surprise and put back on track towards a more relaxed and positive feeling.

Whether you agree or not with this automated emotion analysis (after all, people react differently to the same music), it is undeniable that contradiction and resolution, the main ingredients of wow, are all there.

Investments – Wood-Pulp Battery

Staying with the theme of natural materials started in this month's patent of the month feature, our investment suggestion this month is a method for making elastic high-capacity batteries from wood pulp, which was was unveiled by researchers in Sweden and the US. Using nanocellulose broken down from tree fibres, a team from KTH Royal Institute of Technology and Stanford University produced an elastic, foam-like battery material that can withstand shock and stress.
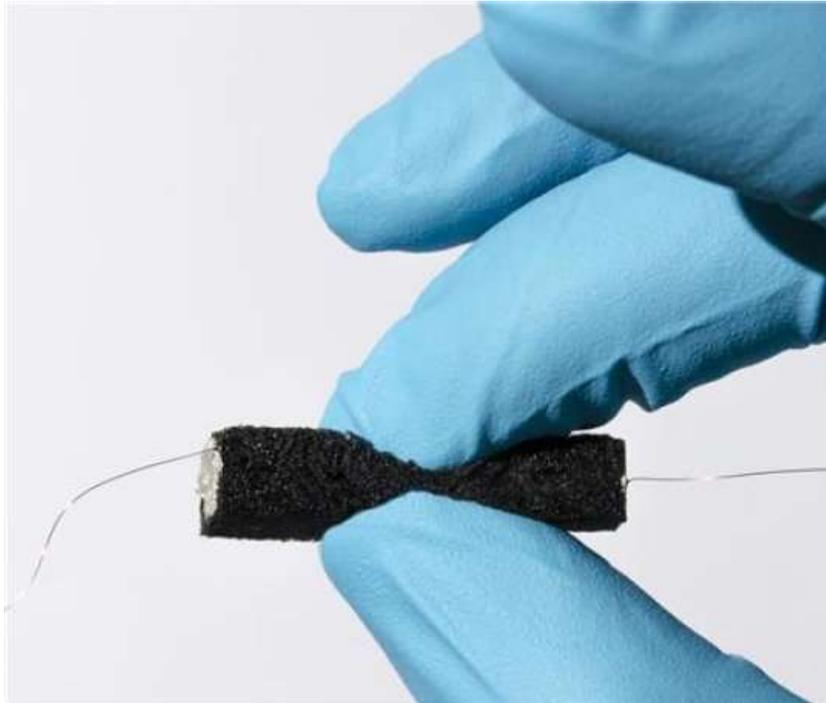
"It is possible to make incredible materials from trees and cellulose," says Max Hamedi, who is a researcher at KTH and Harvard University. One benefit of the new wood-based aerogel material is that it can be used for three-dimensional structures.

"There are limits to how thin a battery can be, but that becomes less relevant in 3D, " Hamedi says. "We are no longer restricted to two dimensions. We can build in three dimensions, enabling us to fit more electronics in a smaller space."

A 3D structure enables storage of significantly more power in less space than is possible with conventional batteries, he says. "Three-dimensional, porous materials have been regarded as an obstacle to building electrodes. But we have proven that this is not a problem. In fact, this type of structure and material architecture allows flexibility and freedom in the design of batteries."

The process for creating the material begins with breaking down tree fibres, making them roughly one million times thinner. The nanocellulose is dissolved, frozen and then freeze-dried so that the moisture evaporates without passing through a liquid state.

Then the material goes through a process in which the molecules are stabilised so that the material does not collapse.

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"The result is a material that is both strong, light and soft," Hamedi says. "The material resembles foam in a mattress, though it is a little harder, lighter and more porous. You can touch it without it breaking."

The finished aerogel can then be treated with electronic properties. "We use a very precise technique, verging on the atomic level, which adds ink that conducts electricity within the aerogel. You can coat the entire surface within."

In terms of surface area, Hamedi compares the material to a pair of human lungs, which if unfurled could be spread over a football field. Similarly, a single cubic decimeter of the battery material would cover most of a football pitch, he says.

"You can press it as much as you want. While flexible and stretchable electronics already exist, the insensitivity to shock and impact are somewhat new."

Hamedi says the aerogel batteries could be used in electric car bodies, as well as in clothing, providing the garment has a lining.

Worth noting, too, that as yet there have not been any published patent applications. Professor Hamedi has a previous track record (US20090053471) so one imagines it won't be too long before we see something appearing in what appears to be a highly attractive technology white space – we know energy storage is a major contradiction, and we know that batteries 'want' to become flexible… what better way than making use of nature's billions of years of experience?

Read more here:

Gustav Nyström, Andrew Marais, Erdem Karabulut, Lars Wågberg, Yi Cui & Mahiar M. Hamedi. **Self-Assembled Three-Dimensional And Compressible Interdigitated Thin Film Supercapacitors And Batteries**. *Nature Communications*, May 29, 2015 DOI: 10.1038/ncomms8259
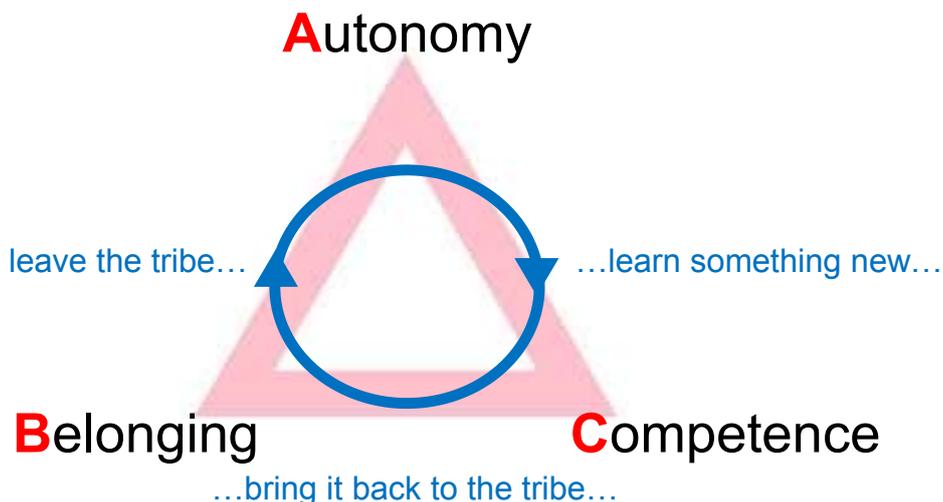
Generational Cycles – XYZ ABC

Anyone attending one of our workshops in the last two years will very likely have seen us introducing the 'ABC' model at various stages of proceedings, but especially when thinking about customers and what drives them. According to the model, when any of us is making a choice, we're looking for Autonomy, Belonging and Competence to all feel better than where we are at right now.

Autonomy

Belonging   **Competence**
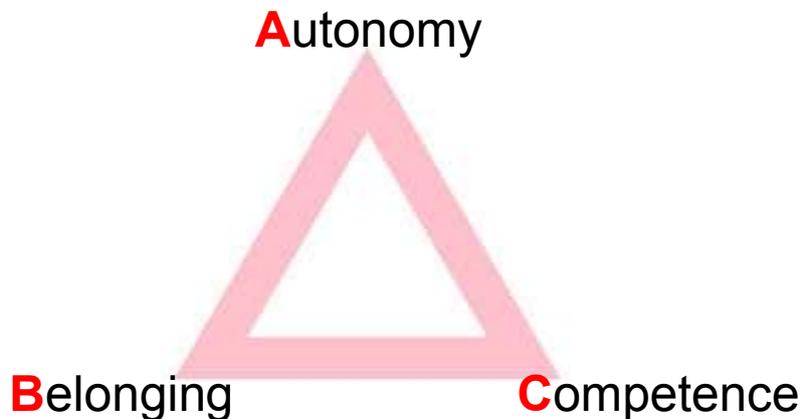
The innovation rule 'A, B, C all get better' is both a simple, but also easy to fail test when it comes to any kind of innovation project. In theory, companies like Apple understand it best. In practice, the new AppleWatch seems to fail on at least one, and probably two of the three criteria so, who knows, maybe they're losing their touch?

We also have a second way of using the ABC model. One we talk about less often because it's more about an individual is rather than where a whole population of customers might be: Any of us individually may have a bias towards one or two of the A, B, C vertices of the triangle. Knowing where that bias might be seems first and foremost to be where we are in our (Clare Graves) Thinking Style and view of the world. Not so much in the sense that 'all Scientific (Orange) people focus on C', although there is no doubt that the even-number Levels in the Gravesian world show a bias towards B, but that as we build more life experience, we pass through repeating cycles of transition between the A, B and C. That transition model typically looks something like this:

Autonomy

leave the tribe…   …learn something new…

Belonging   **Competence**

…bring it back to the tribe…

SYSTEM·ATIC·INNOVAT·ION

What this model reminds us is that at any moment in time, if we think of the area of the triangle formed by the A, B and C vertices as a continuum and asked people to position themselves as a point somewhere in the triangle, we will get different answers depending on who they are and what their current life situation is.

If we do exactly that job of asking people, 'where are you in this triangle?' however, we find some quite interesting Generational biases. Members of different cohorts are more or less likely to position themselves at different places on the triangle than others. We've come to think of this not so much as 'where a person is' in the triangle as 'where do they tend to get stuck'. In other words, we all move around the triangle as our life evolves, but during that evolution we spend more time in one place than others.

The very clear Generational pattern we can observe when looked at through this, 'where are you most often?' lens looks like this:
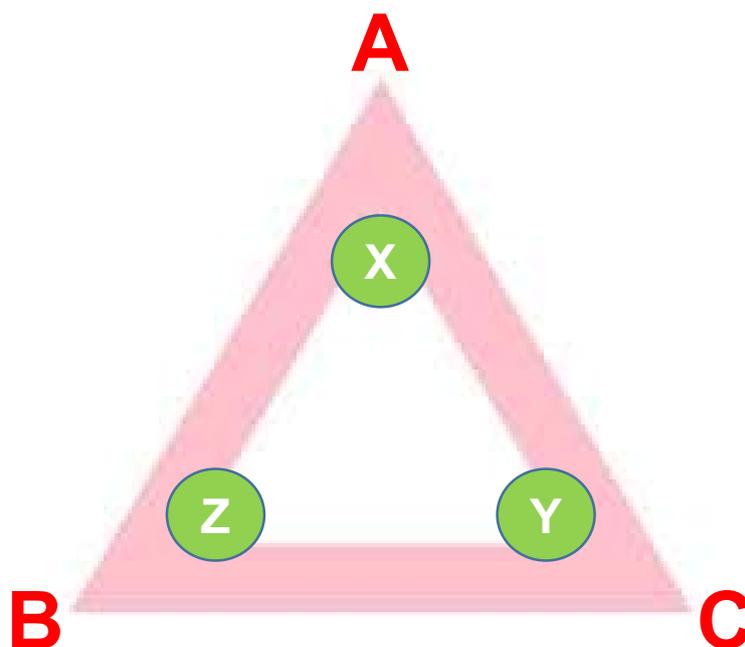
Generation X (Nomads) favour (or get stuck at their desire for) Autonomy.
Generation Y (Heroes) favour (or get stuck at their desire for) Competence.
Emerging Generation Z, like all good Artists already seem to favour (or are getting stuck at their desire for) Belonging.

We'll leave you to think about how well the ABC/XZY model applies to you and the people around you.

We'll also leave you to perhaps have a think about where members of the Prophet generation (Baby Boomers) might get stuck.

Biology – Plant Immune Receptors

Receptors carrying built-in decoys are the latest discovery in the evolutionary battle between plants and pathogens. The decoy domains within the receptor detect pathogens and raise the cell's alarm when there is an infection.

Plants display component parts of their immune system on receptors to trick pathogens into binding with them, which then triggers defence mechanisms. The discovery comes from Professor Jonathan Jones' group at The Sainsbury Laboratory, published in the high-impact journal *Cell*.

Pathogens target key parts of the plant's defence machinery in their attempt to suppress an immune response. Plants have evolved to display these targets on receptors that are primed to set off their alarm system. When the pathogen binds, the receptor starts the process of shutting down the cell to contain the pathogen and stop it from spreading. The research from Professor Jones' group shows one way in which plants perceive pathogens. Perception of pathogens is essential for immunity. Plants have very efficient defence mechanisms to stop a pathogen, if they can detect it soon enough. In turn, pathogens are constantly evolving to become stealthier to evade perception by the host. This arms race means both plant and pathogen are constantly under pressure to evolve new ways to outwit each other. Scientists now know these ways include the integration of decoy domains within receptors.

The hypothesis that plants use decoys in this way was put forward last year. Professor Jones' study -- which appears with a companion study led by Laurent Deslandes at CNRS Toulouse -- is the first substantial evidence to support this theory.

By Dr P.F. Sarris
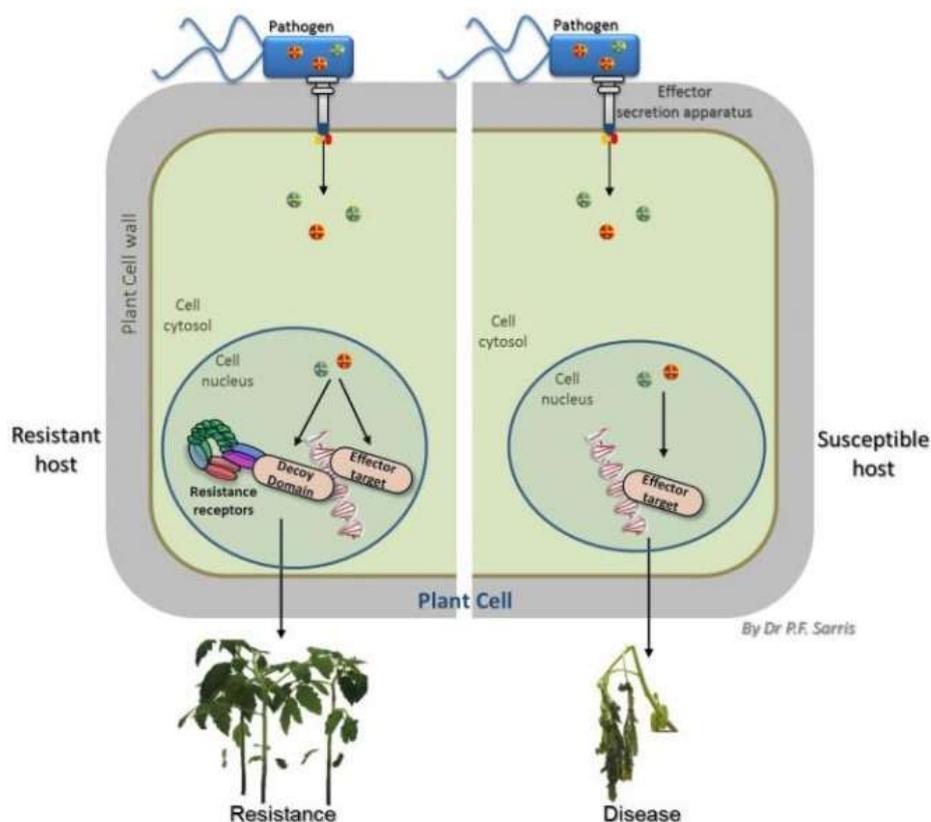
From a contradiction-resolution perspective the decoy makes for a very nice illustration of either a Cheap-Disposable (Principle 27), or, more generally, Intermediary ('introduce a temporary intermediary which disappears after it has completed its function', Principle 24B) strategy. The basic underlying contradiction is the need to ensure survival of the plant when attacked by a pathogen versus the need to minimise the use of precious resources. Here's how we might best map that conflict pair on to the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:
Safety/Vulnerability (38)
WORSENING PARAMETERS YOU HAVE SELECTED:
Loss of Substance (25)
SUGGESTED INVENTIVE PRINCIPLES:
34, 12, 13, 3, 31, 24

No sign of Principle 27, but 24 is present. And so, intriguingly, is Principle 34, Discarding & Recovering.. 'restore consumable or degradable parts of a system during operation' (34B). Which, if the biologists dig a bit deeper, might just be what's also going on in this plant-pathogen arms race.

Professor Jones, meanwhile, hopes the group's discovery could lead to bioengineering new receptors carrying decoys to perceive and trigger a defence to virtually any pathogen. Before the group can make new receptors, they first have to understand their molecular architecture. The next step will be to recreate receptors with new decoys to act as targets for a disease against which a plant has no resistance.

The discovery means scientists can start developing the next generation of tools to equip plants with new defences to pathogens. Professor Jones said: 'This is a very exciting discovery. It turns out as we survey the genomes of other plants we can see many more such "integrated decoy" domains associated with immune receptors, so we believe this observation will turn out to be of widespread significance. It's a great thrill to be involved in such important and interesting work. I am very grateful for the team of creative and dynamic students and postdocs in my lab whose dedication enabled these new insights.'

Read more here:
Panagiotis F. Sarris, Zane Duxbury, Sung Un Huh, Yan Ma, Cécile Segonzac, Jan Sklenar, Paul Derbyshire, Volkan Cevik, Ghanasyam Rallapalli, Simon B. Saucet, Lennart Wirthmueller, Frank L.H. Menke, Kee Hoon Sohn, Jonathan D.G. Jones. **A Plant Immune Receptor Detects Pathogen Effectors that Target WRKY Transcription Factors**. *Cell*, 2015; 161 (5): 1089 DOI: 10.1016/j.cell.2015.04.024

SYSTEM ·ATIC INNOVAT· ION

Short Thort

Life forms illogical patterns. It is haphazard and full of beauties which I try to catch as they fly by, for who knows whether any of them will ever return?
Margot Fonteyn
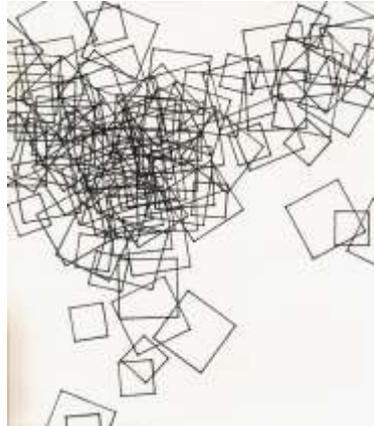
The dynamic element in my philosophy, taken as a whole, can be seen as an obstinate and untiring battle against the spirit of abstraction.
Gabriel Marcel

News

InnovChem Mumbai
We are happy to announce a two-day public workshop specifically focusing on the hands-on deployment of TRIZ/Systematic Innovation for the chemical and process industries. The workshop will be convened in Mumbai on 23-24 July. More details at www.ybsglobal.com.

TrenDNA DE
We are happy to announce that a second (updated) edition of the German TrenDNA B2C book is underway, and is expected to be published in September. In the meantime, work on the web version of a global TrenDNA software tool has found its way back onto the software team job catalogue…

Trevor Smith
…mainly thanks to the arrival of Trevor to the team at the end of this month. Trevor will be based at our Devon base and will be working on a variety of projects from getting all of our books available as electronic editions, to helping commercialise the first outputs of the Plymouth music project, to getting that long awaited TrenDNA software up and running.

RealME
Speaking of Plymouth, we have a beta version of the RealME app available to any Apple/iTunes fans out there. The initial idea of the app is to allow users to create playlists based on desired emotions and emotion shifts rather than the more usual choice of artist or album or random shuffle. Keen experimenters can find RealME in the App Store. Everyone else might like to start with Trevor.

ETRIA Berlin

It seems like all four of the abstracts we submitted to the conference have been accepted. Not sure that was part of the plan, but, never mind, we will do our best to buck the TRIZ trend and meet submission deadlines. Fortunately, two of the papers have a co-author, including one with long-term co-conspirator Simon Dewulf, where we've been making a number of exciting bridges between PanSensic and PatentInspiration. Hope to see some of you in Germany at the end of October.

New Projects

This month's new projects from around the Network:

      FMCG – Eyes on the World study
      FMCG – IP 'Invent Beyond' Project
      FMCG – Breakthrough technology strategy study
      Automotive – Problem solving workshops
      Military – IP generation project
      Semiconductor – SI workshops
      Conglomerate – mini-MBA programme
      Government – ICMM Study tour
      Telecom – 'TRIZ for HR' strategy sessions
      Manufacture – Turnkey step-change design/make project