Systematic Innovation

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

Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.

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

Automating Innovation Capability Maturity Measurement

Ever since we built the first version of the Innovation Capability Maturity Model (ICMM) we've had in mind the idea of automating the assessment process as much as possible. Mainly because by automating the measurement of an enterprise it makes it much easier to benchmark the Capability of that enterprise relative to any of their competitors. So much for the intention. Realizing it has been a whole other story. Very easy to say, in other words, but not so easy to build.

At least a part of the problem is knowing how best to capture the reality of a situation rather than what people might wish their reality to be. When we were designing the questionnaire's for the ICMM Introduction book, we spent a lot of time creating and testing questions that were sufficiently 'ambiguated' that respondents couldn't obviously see what the 'right' answer to any of the questions was, and hence they were much more likely to answer honestly.

When it comes to scraping narrative data from a company's website or reports relating to their innovation activities, however, it is much more difficult to control for whether an individual in an organisation is telling the truth or merely spinning a story they might want the rest of the world to believe is their reality. Take the highly fashionable subject of Open Innovation. Lots of companies are more than happy to say they're 'doing it', but doing it and generating any tangible success through those efforts are two things that can easily be very different from one another. Open Innovation sounds simple, but in actual fact requires a very high Level of innovation capability to make work. It's a methodology and approach that in reality only makes sense for organisations that have attained Level 4 on the ICMM scale.

But how can a scraping tool successfully recognize that just because an organisation is talking about Open Innovation that they are using it successfully? That became the real heart of the sort of problem we decided we had to solve if we were to have any hope of achieving our automation goal. Doing a keyword search wasn't going to be good enough, but then neither was a semantic engine to do a context check to determine whether the word or expression was being deployed in context. Or even whether it was being deployed at all.

It's been a tough problem, but one that we now – three years after we started to think about it – believe we have finally got right. This article is about what the solution looks like. And how we think we have turned the problem into a useful resource that doesn't just help us to make an automatic ICMM assessment, but also to measure how deluded an organisation is in terms of their ability to recognize where they *really* are on the scale.

As is very often the case, half the solution comes through working out how to define the problem in the right way. For us that problem definition arrived when we took a lead from an earlier piece of work we did on the level of complexity present in a situation. The breakthrough insight there was to construct a plot that separated 'actual' and 'perceived' measurements onto two orthogonal axes. Figure 1 shows what this same split was used to re-frame the ICMM measurement story:

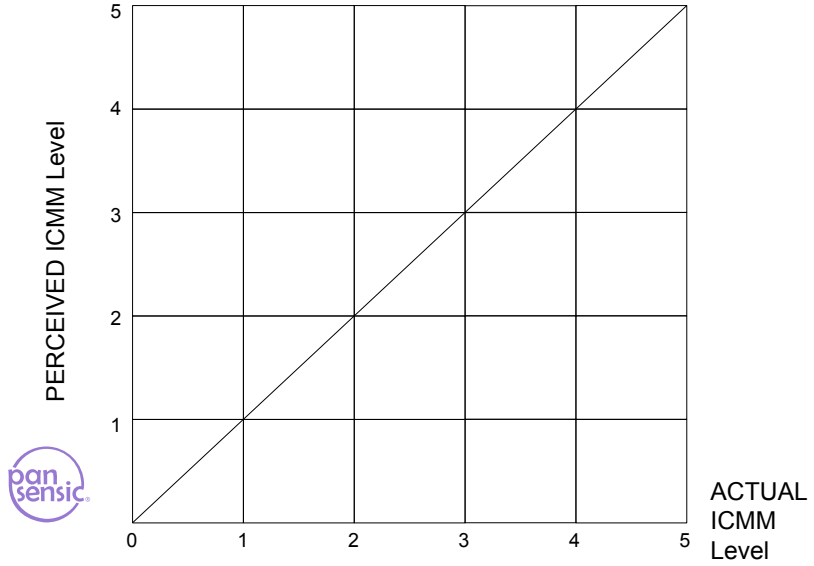


Figure 1: Two Axis ICMM Assessment Grid

The horizontal axis on the plot is used to plot the *actual* ICMM Level of an organisation – including, we decided, the possibility that the organisation might be at a 'Level 0' position. The vertical axis denotes an organisation's *perception* of their ICMM Level, on the same 0-5 scale. Which then means that a diagonal line drawn from the bottom left of the grid to the top right can be taken to denote some kind of 'coherent reality line' – the state where the perception of the ICMM Level of the organisation is an accurate reflection of their reality. A point drawn above this line thus represents a state where the organisation thinks it's better than it actually is ('the delusion zone'?); a point drawn below the line meaning that the organisation believes it is worse than it actually is ('the glass half empty' or 'Eeyore' zone?)

Having worked out how to plot the output, we then began to think about the sorts of things that could be plotted onto the axes. Figure 2 started to look like some kind of ideal:

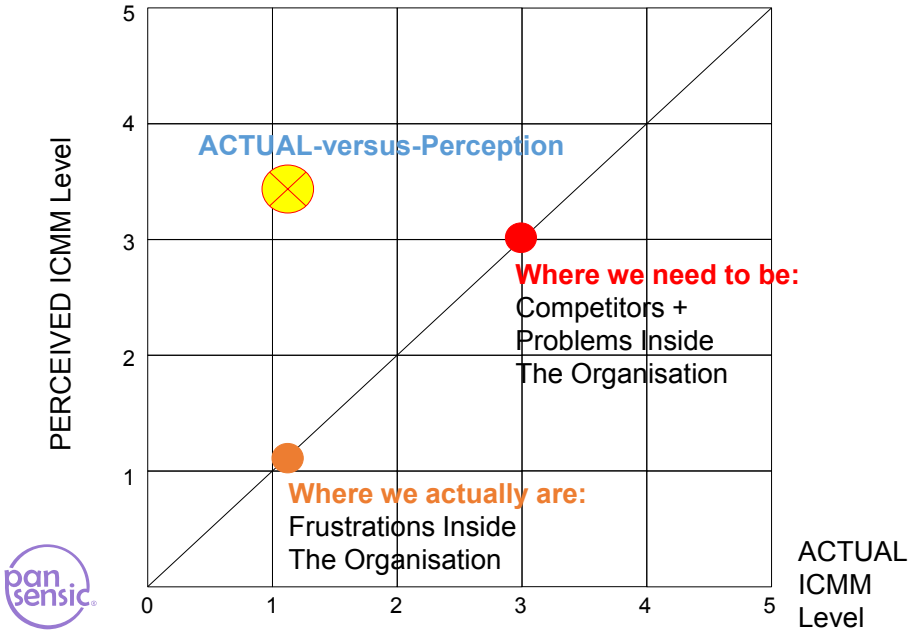


Figure 2: Key Points Plottable On The Assessment Grid

The yellow dot, first up, would be the most important point on the graph – the point that described the 'actual' ICMM Level of the organisation *and* their perception of where they are on the scale.

The orange point would always sit on the diagonal line, it being the actual ICMM Level, and in effect ignoring the perceived Level by assuming zero delusion inside the organisation.

The red point would then be some kind of measure of where the organisation needs to be on the ICMM scale. Again this point is intended to be a measure of 'actual' ICMM assuming zero delusion, and as such would also always sit on the diagonal line.

So much for what we'd like to be able to plot. How to make a meaningful measurement of each of the points was where the challenge took us next. Start with the ideal, then work out how to achieve it. It's almost as if we were using Systematic Innovation to work this whole thing out!

Actual ICMM Measurement
Having rejected the option of scraping for key words, we needed a new 'ambiguation' strategy if we were to be able to measure the actual ICMM Level of an organisation. Anyone can use the right language, but that doesn't necessarily correlate with any kind of reality. We needed something that somehow brought that – likely hidden – reality to the fore. That something turned out to be something we'd worked out how to measure in one of our other PanSensic tools: frustration. If we can establish what things are frustrating people's innovation activities, we hypothesized, maybe we get a clear insight into their ICMM reality. It's a hypothesis that turned out to work extremely well. The frustrations experienced in a Level 1 ICMM organisation – lack of money, lack of management support, etc – turn out to be very different from the frustrations experienced in a Level 2, 3, 4 or 5 organisation. 'All' we had to do was work out a comprehensive list of the frustration found at each of the Levels and we'd have a simple way to gauge where an organisation was on the ICMM scale: *what people are frustrated about reveals their capability*.

Perceived-versus-Actual
Measuring the perceived Level of innovation Capability in the organisation turned out to be almost precisely the thing that we'd rejected as our initial idea for measuring reality: all we had to do was scrape for the words that the people in an organisation might be talking about, irrespective of whether they were being used consistent with the actual ability of the organisation. Scraping for things like 'Open Innovation', 'crowd-sourcing', 'TRIZ', 'QFD', 'customer outcome' and all the myriad innovation jargon that's out there would allow us to make an assessment of where people 'thought' they might be on the scale. 'TRIZ' is one of those words we often see being used (we would, wouldn't we?) even though we know it is rarely if ever being used well. TRIZ is a collection of tools, most of which require Level 4 ICMM Capability Levels to make meaningful use of. Comparing the output of this kind of 'jargon' scrape with the frustration scrape would thus allow us to plot the yellow 'actual versus perception' point on the graph. The gap between the yellow and orange points on the graph would then provide us with a measure of the ICMM Delusion Effect in an organisation – something we decided would be very useful to know when it came to helping provide advice on any kind of capability-building Journey.

Where We Need To Be
Here was our 'holy grail' automated measurement goal. Again, at the beginning we had no idea how we might obtain a meaningful assessment of where an organisation needed to be on the ICMM scale without conducting a lot of interviews with people in the

organisation, and assessing where on the scale their current and likely future competitors were. At least the second of these factors seemed to have become possible through the frustration scraping methodology – it being just as easy to analyse text from one organisation as any other. If we know that all of the competitors of an organisation are at, say, ICMM Level 3 then that should immediately suggest that we too should be at least at that Level. But what about the first part of the problem? How might we automatically capture what people inside the organisation might have to say (truthfully!) about where the organisation needed to be on the scale? Another mystery that turned out to have already been solved by an existing PanSensic tool – the Contradiction Finder. A tool designed to scrape through narrative text to uncover the unsolved conflicts and contradictions within an enterprise. In a manner similar to what we were able to derive for the frustration finder, we quickly came to see that the unsolved contradictions in an organisation correlated very elegantly to different ICMM Levels. The contradictions present in a Level 1 organisation, in other words, are different to the ones found in other Levels. When a contradiction is being talked about in unsolved terms, by either people inside the organisation or, better still, by customers, that's indicative of where on the scale an organisation needs to be. Conversely, when contradictions aren't being talked about, that's indicative of the fact that either they've been resolved or aren't recognized yet. Being able to tell which of these two scenarios represents the reality then becomes the means by which we're able to determine where an organisation needs to be on the scale. Combine this with the competitor analysis and, hey presto (oh that it were so simple!), we have a meaningful way to calculate the point we'd like to be able to automatically draw on a Figure 2 type plot.

One of the most surprising things we found during our efforts to understand and validate the Contradiction-Type-ICMM-Level correlation was that there was a clear relationship between the location of a contradiction on the Contradiction Matrix and the ICMM Level of the people responsible for that contradiction The PanSensic Contradiction Finder tool in any event scrapes narrative (e.g. company reports, email traffic) and plots the results as heat maps using the technical and business Matrices as the basic framework – Figure 3.

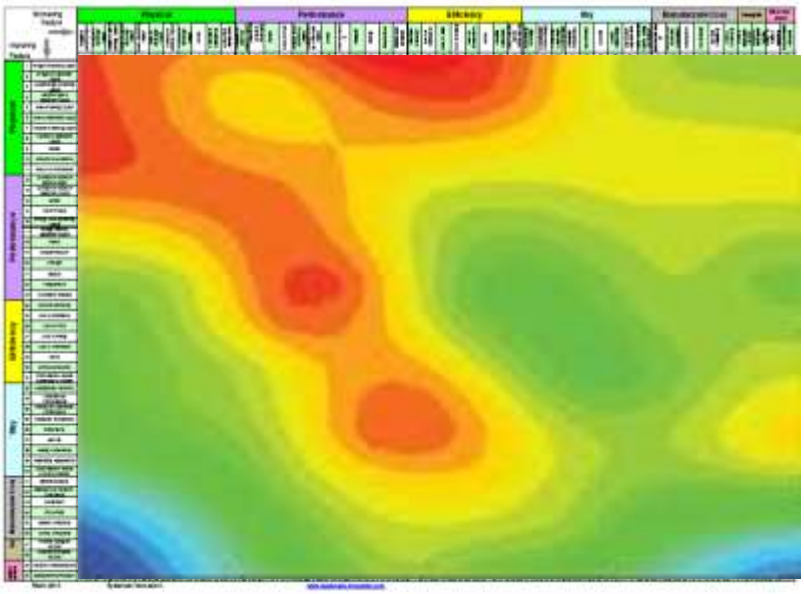


Figure 3: Contradiction Finder 'Heat Map'

By way of a simple example, a propensity of contradictions in the improving 'manufacture cost' rows of the technical matrix are indicative of ICMM Level 1-type problems; performance and efficiency improvement problems are much more indicative of Level 2

problems; and contradictions mapped on to the ‘Supply’ rows of the Business Matrix are strongly correlated to Level 3 ‘business innovation’ problems. No doubt we’ll talk more about the intricacies and capabilities of the PanSensic Contradiction Finder in future case study articles. For the moment, the thing to note is how it makes for a ready-made way of making an indirect – ‘ambiguated’ (so little possibility for a person to cheat the results) – means of helping to build a meaningful automated ICMM Level assessment capability. If anyone would like to offer up their organisation as a ‘beta test site’ for the tools, we’d love to hear from you.

Case Studies: Gravy

A few years ago, we played a small role in a project to create a ‘new, improved’ gravy product for a UK food company. For those that don’t know, ‘gravy’ is the only part of a typical British meal that tastes of anything. It’s a brown liquid that gets poured over all of the other food items that don’t taste of anything.

The manufacturer interviewed a bunch of consumers to find out what they thought about gravy, and how the company might create a better product. Here’s one of the verbatims that emerged from the interviews:

“I use packet gravy mix because it’s convenient. When I’m in the kitchen, I’m in charge. It’s my domain. I decide. Even though I don’t always have the time I’d like. Sunday’s my day though. My crescendo. Sunday dinner is the meal that brings everyone together.”

As it transpired, the company determined that this was one of the ‘nugget’ verbatims in that it contained what appeared to be an actual insight, and therefore a clear instruction to the gravy R&D team: ‘make the gravy mix more convenient’.

The next question was how to do this. One of the interviewers at this point remembered that very often when they were observing consumers making the gravy, they tended to add some chopped onion.

Aha, the R&D team concluded, we can make the gravy mix more convenient for everyone by adding onion to it.

So they did.

Then they eagerly watched a kitchen-load of trial consumers use the new ‘more convenient’ gravy product. The consumers declared themselves pleased. Yes, this new gravy mix is indeed more convenient, they said. Just before they got out an onion and chopped some into the new improved, more convenient gravy.

The R&D team was confused.

They shouldn’t have been if they’d examined the initial verbatim comments in more detail. Their problem, like most collectors of verbatims is that they don’t know what they’re supposed to be listening to. They kind of understand that there’s often a mismatch

between what consumers say and what they then go on to do – like just happened here – but they assume that the difference is beyond their control.

They could help reduce the mismatch if they first of all understood the '4Gs' of consumer interview psychology. As with any kind of experiment, the fact that the consumer knows they're being scrutinized alters their behavior. The main factor affecting the type and extent of the alteration is whether they feel empathetic or antagonistic to the experimenter. If they decide they 'like' the experimenter (or who they perceive the experimenter to be, if, for example, that person – or their company – is hidden behind a two-way mirror), they will be inclined to say stuff that they think is helpful. Conversely, if they are antagonistic to the experimenter, they will be inclined to be unhelpful.

Having fallen into one of the empathetic/antagonistic categories, the next thing that tends to vary is how actively they express these feelings. This expression can generally be seen to fall into one of two directions: they can be pro-active or reactive. Which, if drawn onto a standard 2x2 matrix gives us the 4Gs:

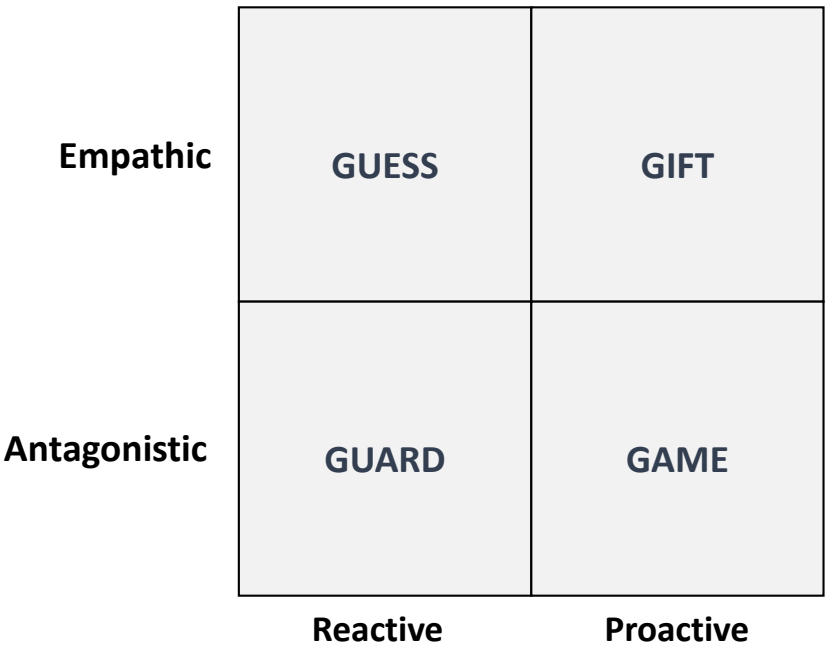


Figure 1: 4Gs Of Consumer Trial Behaviour

Gifting: if the person 'likes' the experimenter and does so proactively, they will actively think about what is likely to make the experimenter happy, and will construct a narrative that they think will best achieve that state of happiness.
Guessing: if the person likes the experimenter, but doesn't really know what will make them happy, knowing they're expected to say something (in order to ensure they receive their fee for taking part in the experiment charade usually), they will guess various different things until they hit upon something that they perceive elicits a happy looking reaction from the experimenter. Then they'll keep going in that direction until they think they're in danger of being found out that they don't know what they're actually saying.
Gaming: if the person is proactively antagonistic to the experimenter (or the enterprise they assume the experimenter is representing), then they will deliberately construct a narrative that they believe will send the experimenter off in the 'wrong direction', all the time, most likely with a smile on their face. Members of Generation X seem to be particularly good at this kind of 'gaming' activity.
Guarding: is the reactive version of being antagonistic to the experimenter. This is the passive aggressive responder, the person who intends to put the experimenter off the

scent, but without wishing to cause any direct offence. Here's the person that has discovered the best way to achieve this goal is to simply say as little as possible.

If the gravy R&D interviewers had looked at their verbatim comments through this 4G lens, I think they would have concluded that there had been an awful lot of Guessing going on: groups of 'happy to help' consumers, that had little or no idea how to give the interviewers what they wanted: it was gravy mix, it did the job it was supposed to do, and why would anybody think about changing it?

Knowing which of the 'G' situations an interviewee is in can be helpful in trying to uncover what the real insights – if indeed there are any to be had. Far better, however, is to think about trying to capture what a person is 'really' thinking about. What's happening in their limbic brain, in other words, rather than the narrative that's been constructed in the pre-frontal cortex.

Here's what would have been revealed if the 'insightful' convenience nugget verbatim from the start of the article had been analysed using some of the PanSensic lenses:

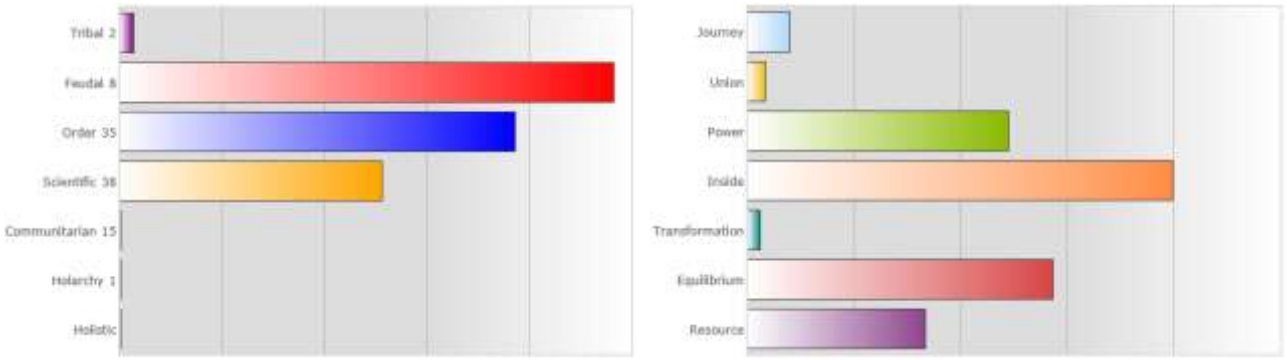
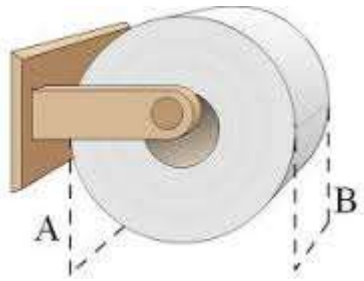


Figure 2: PanSensic Mental Gears & JupiterMu Metaphor Analysis Of Verbatim

What these two graphs reveal is a quite different message to the 'please make it more convenient' conclusion the interviewers extracted from the verbatim. 'Reading between the lines' we reveal a very 'my way' Feudal thinking person, with a strong desire to be in charge, inside the boundaries they perceive to the outside world ('it's my domain').

The real insight revealed here is that the gravy they're making has to be **their** gravy. It didn't matter how much onion (or whatever else) had been pre-added to the gravy mix, the act of chopping an onion was their way to take control over the part of the meal that was going to deliver the overall taste of the meal.

Serious – First World Contradictions #1: Toilet Roll



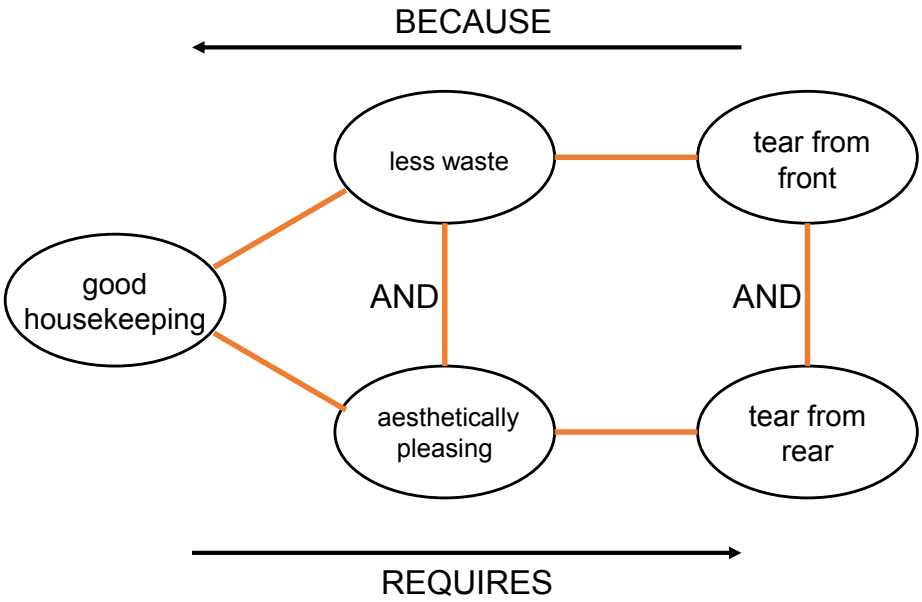
Never mind all this abstract innovation theory nonsense, people often say to me, when are you going to start solving some real problems? Something that people actually care about.

Hear the words often enough and, like piling more and more straw onto a reluctant camel, eventually something has to give. So, hopefully, we can use this section of the ezine to apply some of our high-falooting abstract theories to important issues. And where better to begin than the perennial First-World home dilemma of which way around to put the toilet roll in the bathroom?

A challenge that has confounded the greatest minds of our age since Martha Stewart was first asked the question in the 1970s. Which I guess provokes the next question, why haven't the domestic-goddess consultants been able to offer any real insight into the problem?

Answer: because none of them seems to understand the importance of running towards the dilemma and tackling it head on, rather than assuming the answer is going to involve some kind of trade-off. Fortunately, we have a tool for that…

…here's what the toilet roll problem looks like when mapped onto the Contradiction Map:



Which in turn we can map into the Matrix+ software wizard to reveal that others in a situation like this have used the following Inventive Principles to resolve the problem:

Most frequently used: Principle 14 – Curvature
2nd most frequently used: Principle 15 – Dynamics
3rd most frequently used: Principle 5 – Merging
4th most frequently used: Principle 17 – Another Dimension

As is often the case, the most frequently used Principles should fairly swiftly take us to an 'obvious' answer. Here's a solution combining Principles 14, 15 and 5. So it must be good:

As is also often the case, the less frequently used Principles have a propensity to deliver the bigger 'wow' solutions. My vote goes for the real actual answer either goes with this sly Principle 17 gem:

But the one I opted for in my own bathroom turned out to be a much simpler Principle 17 solution:

No need to thank me. Just doing my little bit to help the First World into a more ideal, more harmonized place to live. No charge.

Patent of the Month – Superwetting Surfaces

FIG. 2A

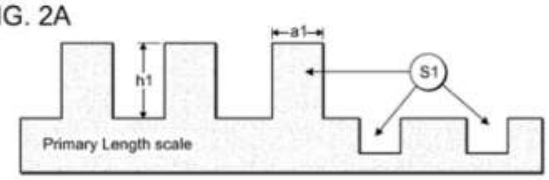


FIG. 2B

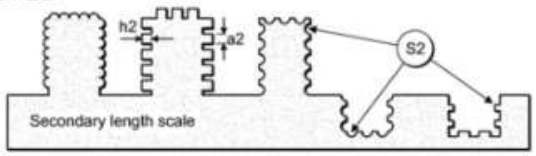


FIG. 2C

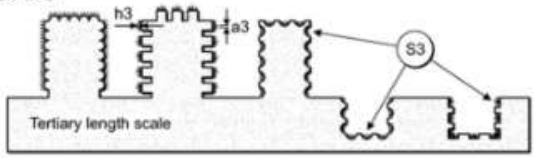


FIG. 2D

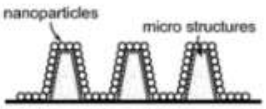
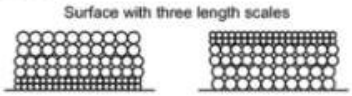


FIG. 2E



Patent of the month this month takes us to a half-dozen inventors working at MIT. US8,983,019, 'Superwetting surfaces for diminishing Leidenfrost effect, methods of making and devices incorporating the same' was granted on 17 March. We've seen a lot of patents in recent years looking at surface engineering and in particular the creation of strongly hydrophobic capabilities. This invention takes the other extreme: the desire to achieve strongly hydrophilic surfaces. Here's what the team of inventors has to say in their background description:

The heat transfer of droplets or sprays impinging on a super-heated dry surface or pool boiling can be categorized into four regimes: single-phase liquid evaporative cooling, nucleate boiling, transition boiling and film boiling. The boundary between nucleate boiling and transition boiling is the point of the highest heat transfer coefficient and is denoted as the critical heat flux (CHF) point. The boundary between transition boiling and film boiling is the point of lowest heat transfer coefficient and is denoted as the Leidenfrost point (LFP). The LFP is characterized by levitation of a droplet above a heated surface, supported by the excess pressure of the vapor generated between the droplet and the solid surface. As power densities continue to increase, the nature of the droplet-surface interaction will fundamentally limit this process. This limitation arises from the Leidenfrost effect, in which thin vapor film formation under the drops prevents surface wetting. Under such circumstances, heat transfer occurs via conduction through the vapor films leading to dry-out, catastrophically high surface temperatures, and failure of the device. This fundamental limitation leads to the classical catastrophic kink instability (for temperatures beyond the critical heat flux temperature) in the heat flux versus temperature curve. As a result, two-phase cooling solutions have to operate at significantly lower heat flux levels. Similar limitations are encountered in quenching and some coating processes.

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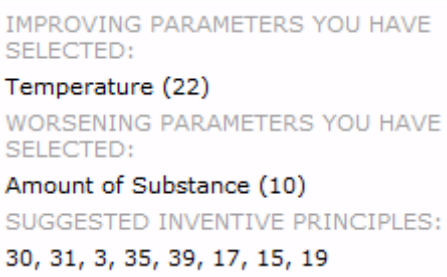
It is an object of the present invention to overcome these significant limitations by engineering multiple length scale super wetting surfaces including surfaces with micro- and nano-structures that can fundamentally alter droplet-surface interactions to continuously rewet the surface, prevent vapor film formation, and enhance the Leidenfrost temperature.

From a conflict resolution perspective, the central issue here is the desire to increase heat flux being hampered by evaporation of the vapor films (in layman's terms, pockets of air being trapped underneath evaporating droplets). Here's how that conflict pair is best mapped on to the Contradiction Matrix:



And, just in case the drawing at the start of the article hasn't given the game away, here's how the invention resolves the problem:

In a first aspect, the invention is a textured surface for increasing Leidenfrost temperature. The surface includes an array of microscale structures extending from the surface, the structures having size, height and spacing selected to increase the Leidenfrost temperature. In a preferred embodiment, the texture comprises of surface features over multiple length scales--from micro to nanoscale--wherein the features at each length scale have a size, height, and spacing selected to increase the Leidenfrost temperature. In one embodiment the surface includes microscale structures disposed with nanoscale structures on their surfaces. The size, height and spacing of the microscale and nanoscale structures are selected to maximize the Leidenfrost temperature. The term height could also mean depth of the features

In a preferred embodiment, the microscale structures are posts with a width a, height h and spacing b wherein the b/a ratio and h/a ratio are selected to increase Leidenfrost temperature. The nanoscale structures may be particles. The particles are preferably in the size range of 15 nm to 500 nm. The b/a ratio may be in the range of 0.25 to 10. The microscale features may have a width upto 100 .mu.m. In another embodiment the multiscale structure comprises of microscale structures that may be porous material with nanoscale features disposed on the material.

In another embodiment, the invention is a hierarchically textured surface for increasing the Leidenfrost temperature including an array of microscale structures extending from the surface, the structures having a selected size, height and spacing. Nanoscale structures having a selected size range are disposed on the microscale structures whereby the Leidenfrost temperature is increased.

The basic inventive step, in other words, is all about hierarchically textured surfaces. Definitely alluded to by Inventive Principle 3, Local Quality and Principle 17, Another Dimension. A stickler for the rules of TRIZ might also insist that the best way of mapping the 'hierarchical' aspect of the invention would be to have Inventive Principle 7, Nested Doll somewhere in the list of recommended solution strategies. That would certainly be the most direct means of 'seeing' the answer. By way of a fall-back, I'll go with combining the aforementioned Principles 3 and 17 with the first recommendation from the Matrix, Principle 30, 'flexible shells and thin films', which is pretty much what the drawing looks like.

Simple when you know how.

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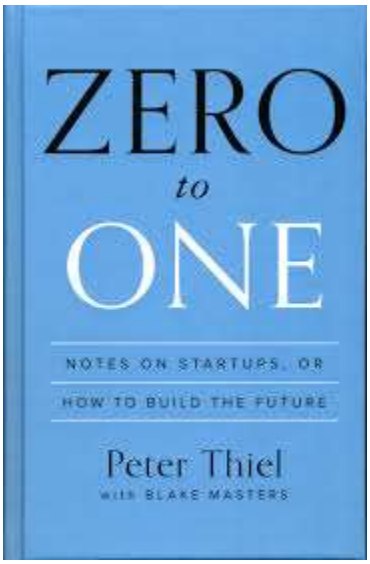
Best of the Month – Zero To One



The problem with the world today, says the Silicon Valley investor and Paypal co-founder, Peter Thiel, is that we've lost faith that there's anything truly big or exciting left to be discovered. Thiel is the sort of (American) GenX Nomad that's very easy to mock. He plans to live to 120, and wants to build floating cities far from the reach of government. Even so, in a month when the tech world is losing its mind about adding live video to Twitter (because if there's one thing we need, it's a reason to spend more time on Twitter!), it's hard not to admire the scale of his ambition.

Besides, Thiel's approach to innovation is too interesting to be left to libertarians and would-be billionaires. I'll grudgingly concede that his recent book, Zero To One, may be essential reading for anyone whose work involves coming up with new ideas.

These days, he argues, we divide major breakthroughs into two: stuff that's already been done, and stuff that probably can't ever be done. "What's left to do is either easy or impossible, and pursuing those tasks is deeply unsatisfying," he writes. There seems to be no middle ground of stuff that's tough but possible – those inventions, or solutions to problems, that Thiel calls "secrets" (as opposed to insoluble "mysteries"). It wasn't always this way: before the globe was fully mapped, for example, explorers uncovered secrets all the time. But now business and culture are suffused with the sense that everything important and doable has been done. Thiel blames this feeling for everything from religious fundamentalism to hipsters, with their love of retro tech. But they've got it all wrong, he insists. There are plenty of secrets left. You just have to know where to look.

It's freeing to think of big ideas as "out there", waiting to be discovered, rather than created in the mind. It relieves you of the pressure to become an idea-generating genius; instead, you need only find new ways to look at the world, to see what's already there. So how? Ask which topics in your field are taboo, Thiel says. Classic example: Fifty Shades Of Grey. Which was the discovery of a previously hidden business category – socially acceptable erotica. Another favourite question, and quite possibly my favourite insight from the book: what can't you do an undergraduate degree in at Harvard or Oxbridge? The answer has already pointed me towards a number of intriguing business ideas I wish I had more time to develop. Domains where knowledge isn't yet standardised, such as nutrition, a vitally important subject about which we know shockingly little.

One implication of Thiel's hypothesis is that "disruption", Silicon Valley's and most CEO's I talk to, favourite approach to everything, is unwise. Focus on shaking up some existing institution, and you'll inevitably end up thinking in its terms, stuck in old grooves. The same's true in personal life: trying to be "unconventional" still means letting conventional wisdom dictate your actions. "The basic challenge," Thiel concludes, "is to find things that are hard but doable. You want to find a frontier. But don't simply accept others' definitions of the frontier." Whether you're trying to solve interstellar travel, world poverty or a relationship problem, don't fall into the trap of assuming that, if an idea were any good, someone would already have had it. That's what everyone else is thinking, too.

Wow In Music – Happiness Is A Warm Gun

Happiness Is a Warm Gun is a song by The Beatles featured on the eponymous double-disc album *The Beatles* also known as *The White Album.* It's generally felt to be one of the band's finest hours. The song itself is primarily a John Lennon composition, credited to Lennon/McCartney.

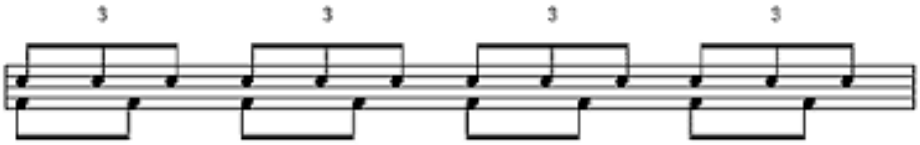
The first 'wow' associated with the song is very likely the innate contradiction carried in the song's title. According to Lennon, the title came from the cover of a gun magazine that producer George Martin showed him: "I think he showed me a cover of a magazine that said 'Happiness Is a Warm Gun.' It was a gun magazine. I just thought it was a fantastic, insane thing to say. A warm gun means you just shot something."

"Happiness Is a Warm Gun" is purportedly Paul McCartney's favorite song on *The White Album,* and he's often also stated that the album is the Beatles' finest achievement. Although tensions were high among the band during the album's recording sessions, they reportedly collaborated as a close unit to work out the song, as such it is one of the few true "Beatles" songs on the album.

Most likely the song required so much collaboration because of its high level of rhythmic complexity. One of the most salient musical features of the song is its frequent shifts in time signature. Beginning in 4/4 time, the song has one measure of 6/4 time for the line "She's well acquainted..." before changing back to 4/4 time for the next line ("The man in the crowd..."). It then uses a measure of 5/4 followed by a measure of 4/4 for the line "a soap impression of his wife which he ate and donated to the National Trust". The subsequent guitar solo features a measure of 9/8 followed by two measures of 12/8. This pattern is repeated in the "I need a fix..." section. This gives way to alternating 9/8 and 10/8 measures in the "Mother Superior..." section before returning to 4/4 for the doo-wop

style ending. The "When I hold you..." section slows down dramatically and employs one of the few examples of polyrhythm in the Beatles, where the drums play triplets while the rest of the instruments and background vocals use a duple rhythm.

From a musical ‘wow’ perspective, we might categorise the shifting rhythms as an extreme example of multiple instances of Principle 19B (‘change the periodic frequency…’) chained together. The ‘3 over 2’ polyrhythm, though, is a whole other beast:



One that is probably best viewed as an illustration of Principle 37 in its ‘Relative Change’ form, or maybe an inverse example of Principle 12, ‘Equi-potentiality’, given the noticeable rise in the song’s tension during the ‘when I hold you…’ lyric.

Either way, even today, close to 50 years after its release, the song still has a tremendously hypnotic power.

Perhaps the answer to how and why the song exists at all comes from recognising it as a typical Lennon accident. He said, when quizzed about the song that he’d "put together three sections of different songs ... it seemed to run through all the different kinds of rock music." The song begins with a brief lilting section ("She's not a girl who misses much..."). Drums, bass and distorted guitar are introduced as this portion of the song proceeds. The surreal imagery from this section is allegedly taken from an acid trip that Lennon and Derek Taylor experienced, with Taylor contributing the opening lines. After this, the song transitions into a Lennon song fragment called "I Need a Fix," built around an ominous-sounding guitar riff. This section drifts into the next section, a chorus of "Mother Superior jumped the gun." The final section is a doo-wop send up, with the back-up of vocals of "bang, bang, shoot shoot." The song's multiple sections were, reading between the lines, mangled together because none of them alone were considered good enough to be expanded into a song in their own right. (See also, classic songs like Joe Walsh’s ‘Life’s Been Good’, or Radiohead’s ‘Paranoid Android’, and Inventive Principle 5.)

Finally, as if the ‘wow’ story didn’t already have enough dimensions, when critics have tried to interpret the song’s lyrics, it has been said that, in addition to the obvious reference mentioned, the "Warm Gun" could also allude to Lennon's sexual desire for Yoko Ono and also to his well documented problems with heroin at the time of the recording of The White Album, in this case, the gun being a loaded syringe…

"I need a fix, 'cuz I'm going down/Down to the bits that I left uptown."

Investments – Ghost Machine

I first read about this solution last November in my dentist's waiting room, flicking through a copy of Scientific American. What I loved about it then was that it offered a suddenly very rational explanation for a lot of the gobbledygook talked about in the world of para-psychology. Or more specifically the deluded individuals that believe in ghosts. Especially those declaring they have some kind of 'sixth sense' that allows them to 'feel' the presence of ghostly beings. Behind every piece of psychobabble nonsense, I've always believed, is a highly logical and coherent scientific explanation waiting to be discovered.

Which is precisely what a piece of research at the Ecole Polytechnique Federale de Lausanne in Switzerland was able to report in the Scientific American article. Ghosts aren't ghosts, they're a neurologic imbalance between what the mind perceives and what the body feels.

Not a story that I imagine the para-psychology brigade will be too enamoured to hear about. It might ruin them. Much as I might wish to contribute to such a downfall, I couldn't work out a way to get the de-bunking story into the ezine. But then, I figured, why think about the story in terms designed to upset a community of no doubt nice people? Why not turn the story the other way around and make it into a product?

Lots of people love the idea of ghosts (I live near a 'haunted hotel' that always seems to be full of people desperate to be staying on a night when the ghost might put in an appearance). So why not allow them to create ghosts on demand? Provide them with a ghost machine: a device that sets up the required neurologic imbalance between what the mind perceives and what the body feels. Ideally in a manner that allows the user some kind of control over what kind of ghost they experience. Some kind of a dial on the machine, for example, that allows a user to change the ghost setting so that they conjure up Casper on the one hand through to Paranormal Activity V on the other. With perhaps a Patrick Swayze version somewhere in the middle? Or Nicole Kidman and 'The Others'?

I think I'd buy that machine for my next party. It's a winner I think.

Go work out how it's done here:
http://www.scientificamerican.com/article/this-robot-messes-with-your-brain-until-you-feel-a-ghostly-presence/
Perfect for a crowd-funding investment.
You heard it here first.

Generational Cycles – Demi Moore, 1991

In August 1991, Demi Moore caused a massive amount of controversy in and beyond the US when she appeared, seven months pregnant, on the cover of Vanity Fair. The image still has considerable power to shock even today, almost 24 years later.

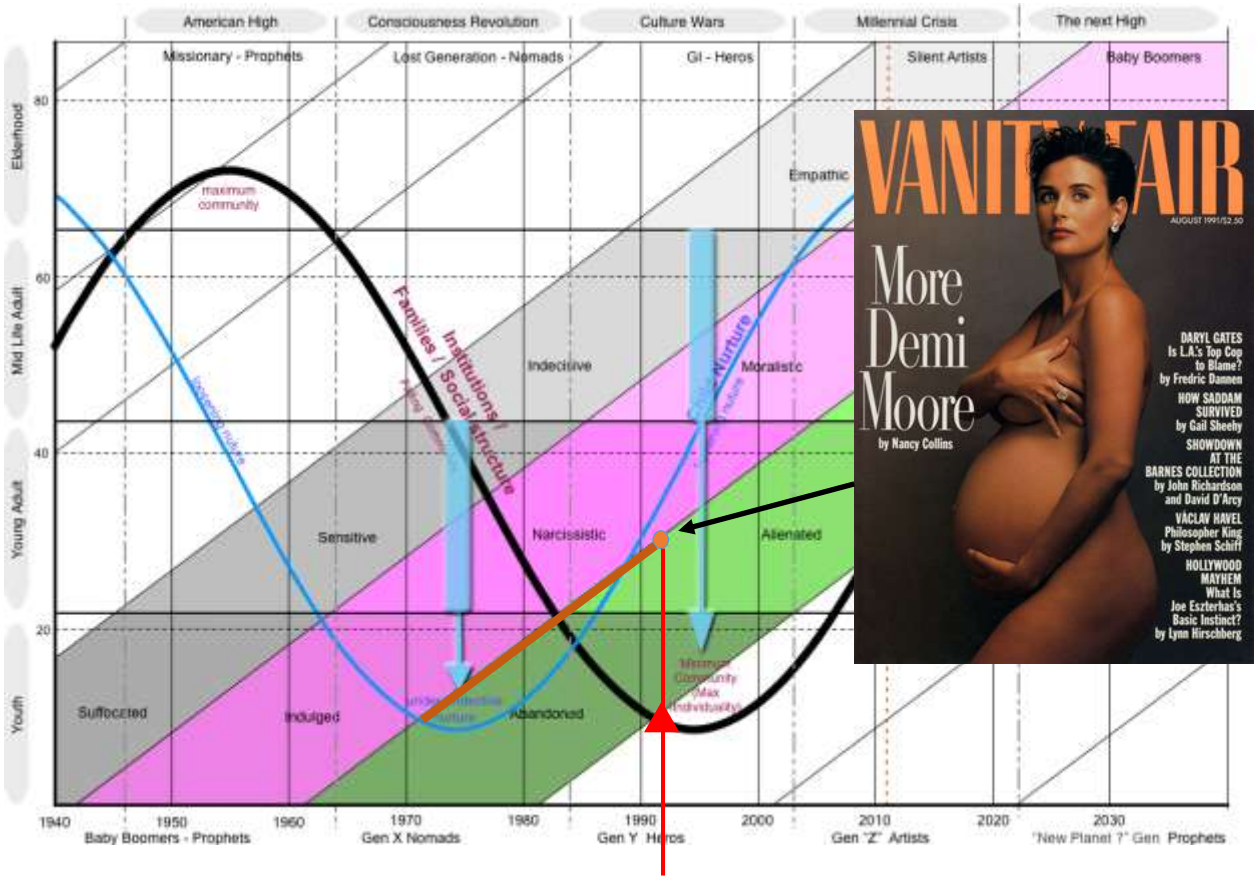
On one level, it's a typical media constructed 'scandal'. On the other, it's something that instead of disappearing from view by the time the next issue of the magazine came out, it set in place a conversation about parenthood that echoed, and to some extent still echoes across the whole of society. To the extent that a similarly pregnant Christina Aguilera reprised the idea in a magazine photo shoot last year. So why the 'earthquake'?

Born at the end of 1962 (putting her right on the boundary between Boomer and GenX – although, one would likely conclude that she very definitely fell on the X side of the generational fence), Moore was 28 when Annie Leibovitz famously snapped the picture. The act itself could be seen as the sort of alienated rebellion typical of Generation Xers in their twenties and thirties. Shocking the readers of Vanity Fair was fair grist to the Alienated Nomad mill.

But I also propose it happened at pretty much the exact right time in generational history to serve as the sort of trivial, 'random' event that triggered a societal pendulum to stop swinging one way and to begin swinging the other.

In terms of the pendulum swing between 'we' (community-dominated) and 'me' (individual dominated), the August 1991 issue of Vanity Fair arrived when the pendulum was at society's 'me' peak (see the red triangle on the graph at the intersection between the line denoting 1991 and the black sine-curve showing the me-we pendulum oscillation):

SYSTEM·ATIC INNOVAT·ION



Coming as it did at this moment in history, it came to serve as a potent reminder to selfish Yuppies everywhere that it was time to stop being selfish and start thinking about some of their societal responsibilities.

In this regard, it serves as an iconic reminder of how the 'trivial' ends up being a profound turning point.

But it also does something else too. And that's to explain why the 'me-we' pendulum swing is out of synch with the nurture curve (blue sine curve on the figure). The clue here is the brown line running parallel to the generational boundary between Baby Boomers and Generation X. It's also Demi Moore's life trajectory. And it tells us that she went through her puberty at the moment in history when the nurture cycle is at its minimum. She was part of the most extreme portion of the 'abandoned' Nomad archetype. And her childhood shows her to have been at the most extreme end of that extreme: Her father, Charles Foster Harmon, Sr., left her mother, Virginia Beverly (King), before Demi was born. Her stepfather, Danny Guynes, did not add much stability to her life, either. He frequently changed jobs and made the family move a total of 40 times. The parents kept on drinking, arguing and beating, until Guynes finally committed suicide. Demi quit school at age 16 to work as a pin-up-girl. At 18, she left the family home for good, marrying rock musician Freddy Moore; the marriage lasted four years. The Vanity Fair photoshoot seems in this context like a pretty good exorcism of earlier childhood memories from puberty.

As we often hear ourselves saying, the Generation Cycle is not about 'everyone', but every time we try and look for the exceptions to the rule, we seem to find ourselves proving the rule. And hopefully learning something interesting too along the way.

Now all I need to do is work out why I still have a crush on Ms Moore. A bit trickier I'm guessing. Or maybe I actually don't want to (or shouldn't) know?

SYSTEM·ATIC INNOVAT·ION

Biology – Sea Squirt Microbes

In 2005, scientists studying tiny sac-like creatures called sea squirts found bacteria containing two types of chlorophyll (*a* and *b*) in cavities inside the squirts' tissues. These two pigments were soaking up most of the sunlight -- the violets, indigos, blues, green, yellows and oranges.

All that filtered through the squirts was deep red light. So the scientists were surprised to discover a film of photosynthesizing microbes on the underside of the squirts as well. They turned out to be full of chlorophyll *d*, a rare variant of the chlorophyll molecule that absorbs near-infrared light.

By tinkering with the chlorophyll molecule, evolution had managed to contrive a version that soaks up the last bit of sunlight, adapting the bacteria to life in perpetual shade. It is an astonishing feat, albeit one achieved by nature's traditional method of trial and error.

From a contradiction-resolution perspective, what the 'lucky' microbe had hit upon was a solution to a problem – living in the shade of the sea-squirt was good because it provided shelter and safety, but it wasn't good because there was no 'food':

IMPROVING PARAMETERS YOU HAVE SELECTED:

Security (37) and Safety/Vulnerability (38)

WORSENING PARAMETERS YOU HAVE SELECTED:

Energy used by Moving Object (16) and Productivity (44)

SUGGESTED INVENTIVE PRINCIPLES:

12, 13, 10, 1, 4, 19, 32, 28, 35, 17, 25, 15, 2, 39, 8, 9, 24, 3, 5

Whether developing the ability to make use of the 'un-used' near infra-red leftover light represents an example of Principle 32, or a combination of Principle 1 and 25B ('make use of waste resources') is probably immaterial: the problem is solved and the microbe is happy.

But then so is the team of chemists who studied pigments like chlorophyll in the hope of gaining a better understanding how the pigments work from first principles and well enough to manipulate their light absorption at will. Three specific such chemists are Jonathan Lindsey, PhD, the Glaxo Professor of Chemistry at North Carolina State University; David Bocian, PhD, distinguished professor of chemistry at the University of

California-Riverside; and Dewey Holten, PhD, professor of chemistry in Arts & Sciences at Washington University in St. Louis.

They began with a bang: in a set of publications in *Photochemistry* and *Photobiology*, they described the counter-intuitive ways the chlorophyll molecule's chemical structure sometimes alters the color of light it absorbs.

Then, in two recent articles in the *Journal of Physical Chemistry B*, they describe how they used that knowledge to push the absorption of pigments into the less-explored territory of the far reds and near infrareds. By making the molecules from scratch and studying their properties, "we have been able to understand at the most fundamental level why chlorophyll-like molecules have the colors they do, how nature tuned those colors, and how we can tune them for our own research purposes," Holten said.

Solving the mystery of chlorophylls a and b

The pigments that make grass green and some bacteria purple all have rings of carbon (and nitrogen) atoms alternately linked by single or double bonds. The alternating bonds create what is called a conjugated system, where the outermost electrons on the atoms are delocalized and inhabit orbitals (regions of electron density) that are associated with the molecule as a whole rather than with individual atoms.

A photon with just the right amount of energy (color) will promote one or more electrons to higher energy molecular orbitals. The energy difference between the molecular states, which is related to the energy spacing between the orbitals involved, determines the color of light absorbed. Which color this is depends on the structure of the ring, but also on the chemical groups attached to it. These groups, called substituents, change the symmetry, electron-density shapes and energies of the molecular orbitals. In the case of the chlorophylls, one of the most important substituents for tuning color is a formyl group (HC=O).

But then there was still a bit of a mystery here. The addition of the formyl group to the seventh carbon in chlorophyll *b* creates absorption bands that lie inside the main absorption bands of chlorophyll *a*. But the formyl group linked to the third carbon in chlorophyll *d* and at the second carbon in chlorophyll *f* shifts absorption to the red, outside the chlorophyll *a* bands: Why does formyl substitution at the seventh carbon have such different consequences than its substitution at the third or second carbon?

To find out, Lindsey synthesized many different versions of chlorophylls from simple to more complex. This menagerie of molecules included ones that had a formyl group at the key third and seventh carbons together with a parent bearing no substituents at all. He then shipped these synthetic molecules to Bocian's and Holten's labs for analysis using spectroscopic and theoretical methods.

"One of the first things we did was molecular-orbital calculations in which we walked the formyl group around the ring, attaching it to each of the carbons in succession to see what would happen to the molecular orbitals," Bocian said.

When light absorption promotes electrons among these orbitals, it causes a net change in electron density along either the x or y molecular axes, or both. "Four possible electron promotions should give four absorption bands, although the extent of mixing between them also influences the spectra," Holten said. The two absorption bands in the violet/blue region of the spectrum are called By and Bx, a weak band in the green-yellow region is called Qx and the last band, in the red or near infrared, is called Qy.

Bocian's calculations showed that the formyl on the seventh carbon of chlorophyll b draws electrons away from the core of the molecule along the molecular x axis. "It's off-axis," Bocian said. "It pulls on the orbitals in a way that weakens the Qy absorbance and shifts it to shorter wavelengths."

One of the recurring themes of the chemists' work is that as Qy moves to longer wavelengths and gets stronger, its partner By moves to shorter wavelengths and gets weaker. This coupling between partner states explains why chlorophyll *b*'s absorption bands lie within those of chlorophyll *a*.

Playing with colour

Having learned as much as they could about the native pigments, the group set out to design new pigments that would absorb parts of the spectrum less utilized or untouched by the native chlorophylls of plants or the bacteriochlorophylls used by photosynthetic bacteria.

Their first goal was to fill the gap between the longest-wavelength absorption they had achieved with chlorins and the shortest-wavelength they had achieved with bacteriochlorins. By positioning several conjugated groups along the y axis of a chlorin, they got the biggest red shifts for chlorins they have achieved to date.

Next they tried to push the absorption wavelengths of the bacteriochlorins as far into the near infrared as they could. "To do so we put as much conjugation as we could along the y axis," Lindsey said. Some of the resulting molecules, called bacteriochlorin-bismides, had peak absorption at about 900 nanometers, far deeper in the near-infrared part of the spectrum than the native bacteriochlorins.

To test their theory, they also put conjugated groups on the x axis. To their delight, the absorption of these molecules shifted to shorter wavelengths. "That's the same thing chlorophyll *b* does," Lindsey said. "It puts the conjugated group on the x axis. So there's a scientific commonality that is very gratifying."

"It's been a long time coming," the chemists said. But they are satisfied they have the problem in hand. "If you give us a chemical structure of a chlorophyll-like or bacteriochlorophyll-like molecule," Holten said, "we can pop it into Gouterman's four-orbital model and tell you which colors of light it will absorb.
"Or, flip it the other way," he said. "If you come to us and say we'd like to have a molecule of this type that is going to absorb a narrow band of light centered on some particular red or near-infrared wavelength, say 750 nanometers, we could tell you how to synthesize one that will give the spectrum you want."

Keep your eyes on this one. I suspect it might have some rather broader implications and benefits. And all thanks to a bacteria. Nature, sometimes, just makes your jaw drop.

Read more here:

1. Kaitlyn M. Faries, James R. Diers, Joseph W. Springer, Eunkyung Yang, Marcin Ptaszek, Dorothée Lahaye, Michael Krayer, Masahiko Taniguchi, Christine Kirmaier, Jonathan S. Lindsey, David F. Bocian, Dewey Holten. Photophysical Properties and Electronic Structure of Chlorin-Imides: Bridging the Gap between Chlorins and Bacteriochlorins. *The Journal of Physical Chemistry B*, 2015; 150114100627003 DOI: 10.1021/jp511257w
2. Pothiappan Vairaprakash, Eunkyung Yang, Tuba Sahin, Masahiko Taniguchi, Michael Krayer, James R. Diers, Alfred Wang, Dariusz M. Niedzwiedzki, Christine Kirmaier, Jonathan S. Lindsey, David F. Bocian, Dewey Holten. Extending the Short and Long Wavelength Limits of Bacteriochlorin Near-Infrared Absorption via Dioxo- and Bisimide-Functionalization. *The Journal of Physical Chemistry B*, 2015; 119 (12): 4382 DOI: 10.1021/jp512818g

Short Thort

"You do not need to leave your room.
Remain sitting at your table and listen.
Do not even listen, simply wait, be quiet still and solitary.
The world will freely offer itself to you to be unmasked,
it has no choice, it will roll in ecstasy at your feet."
Franz Kafka

"Solitude is very different from a 'time-out' from our busy lives.
Solitude is the very ground from which community grows.
Whenever we pray alone, study, read, write, or simply spend quiet time
away from the places where we interact with each other directly,
we are opened for a deeper intimacy with each other."
Henri Nouwen

News

PanSensic & Happen
We are very happy to announce that our PanSensic spin-out company signed a cooperation agreement with our long-time friends at Happen during March. Happen, for those that don't know them, are an agency that specializes in communicating difficult things in easy ways. Oh, and inspiring some of the best innovations you'll see whenever you walk around your local supermarket. Expect there to be a step change in the beauty and elegance of the PanSensic story in the coming weeks. Plus hopefully, a raft of new clients and client case studies not long after.

SI Shop
Eagle-eyed followers of the SI world will know that we just gave our online shop a facelift. Which hopefully means it's easier to navigate around the site and find anything you might wish to purchase…

ICMM eBook
…including a brand-spanking new ebook version of the ICMM Introduction book. The first of what we expect to be ebook versions of all of the SI library in the coming weeks and months…

GenerationDNA
…including, with a following wind, the long-overdue GenerationDNA book. Apologies to all those that have put in advance orders for the book. Darrell decided there was a section he just 'had' to include before the book was released. Hence it came back from the printers and had a few thousand new words added. Hopefully the enhancement outweighs the frustration caused by the delay. Gulp.

HongKong CIO Conference
We were worried we might be booed off stage when we used our keynote address to hint that the Big Data Analytics industry was currently delivering zero value to client organisations. The fact that every CIO head in the room seemed to nod their heads in agreement suggests we might be on to something. Download the slides either from the Systematic-Innovation home page, or the conference website…
http://cioleadershongkong.com/

India
Darrell's (too short) trip to Mumbai and Pune in April is now full of either workshops or meetings. Sorry to anyone that was trying to get a meeting. The good news is it looks like we'll be back in India either at the end of June or early July. More details as the itinerary unfolds, but if anyone thinks they might want to collar some of Darrell's time, now is the time to start prodding him…

USA
…ditto the US, where it looks like there will be a short tour for one of the week's in July.

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

- O&G – TRIZ workshops
- Education – 'Beyond Operational Excellence' Strategic Study
- Conglomerate – PanSensic consumer insight study
- Electrical – Problem-Solving project
- FMCG – Eyes on the World study
- FMCG – Next-Big-Thing Disruption Eyes on the World study
- FMCG – TrenDNA consumer insight workshop
- Automotive – Innovation Strategy workshop series
- Automotive – 'TRIZ For Managers' workshop series
- Agriculture – TRIZ workshop
- Medical Devices – Invent/Design/Make Project
- Government – Process SWEAT project
- Utility – Eyes on the World study