Systematic Innovation

e-zine

Issue 163, October 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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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**

The Role Of Measurement
In Innovation Attempt Failures

The main problem trying to establish the root cause of why an innovation attempt ends in failure, is that there's no such thing as a root cause when we're dealing with a complex system. And, of course, trying to insert a new product or service into any market is inevitably complex. The best we can hope to do in trying to unravel the reasons behind a failure in a complex system is somehow uncover a 'conspiracy of causes' and hope it allows us to categorise the failure in some way.

In the past, we've been able to identify five such failure categories – one each for the five main elements of the TRIZ Law of System Completeness. Figure 1 shows what the breakdown looks like relative to each of these five categories when plotted for innovation attempt failures in corporations and multi-national organisations:

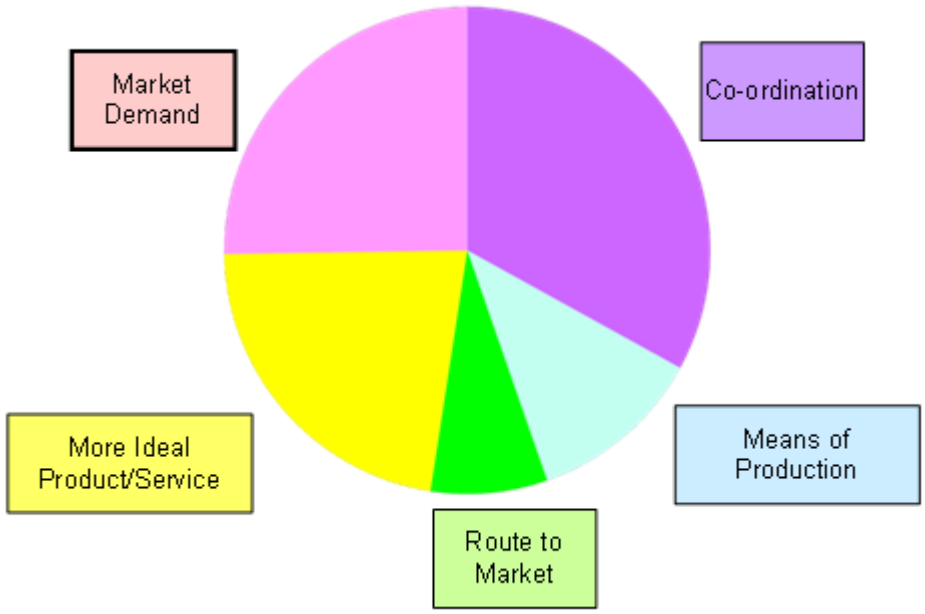


Figure 1: Innovation Attempt Failure Breakdown For Large Organisations
(first published 3nd IFIP Working Conference on CAI, Hebei University of Technology, August 20, 2009, Harbin, China)

One of the shortfalls of this original analysis was that we already knew that the Law Of System Completeness was missing an important sixth element, a 'Sensor'. Any viable system, as well as having the requisite Engine, Tool, Transmission, Interface and Coordination, also needed a way of measuring what's happening within and between each of the other five elements. The problem back in 2009 was we had no real way to uncover whether an innovation attempt failure was due to a Sensor problem. Now we have the suite of PanSensic tools, the job becomes somewhat easier.

So here are the results of a two-year long study conducted by examining innovation failures inside large organisations, now making use of the PanSensic 'reading between the lines' lenses to try and establish the role of measurement failure in the overall failure breakdown across the five previous categories we used:

Element	Overall Failure %	Measurement Related	Non-Measurement Related
Coordination	34	22	12
More Ideal Solution	22	9	13
Market Demand	26	25	1
Route To Market	6	2	4
Means Of Production	12	4	8
TOTAL	100	62	38

Table 1: 'Sensor' Related Innovation Attempt Failure Breakdown

And in a little more detail:

Coordination – almost two-thirds of all 'Coordination' failures were found to be attributed to a measurement problem of some description. Coordination includes all of the management activities that are needed to ensure the innovation project makes it all the way through the ('99% perspiration') execution phase. Coordination measurement failures were seen to fall into five basic categories:

a) A failure to establish either of both of the Innovation Capability Level of the organisation and/or the capability needs of the project such that actual Capability was lower than that required to successfully deliver the project.
b) A failure to understand 'a critical mass of resources at the critical point', failing to be able to meaningfully measure either or both of 'critical mass' or 'critical point'.
c) A failure to understand the relative need for business versus technical innovation, or to be able to integrate a solution combining the appropriate ratio of both.
d) A failure to established true ROI of the new solution and the likely need for a re-calibration of performance metrics (at least during a transition period) between incumbent and new product or service offering… culminating in teams chasing the wrong targets.
e) A failure to align short-term (operational excellence) KPIs and innovation KPIs and/or KPIs across silos such that the different factions ended up covertly fighting with one another.

More Ideal Solution – the majority of 'wrong solution' failures can be attributed to teams selecting solutions that were within their current realm of capability, rather than choosing a technology that better delivered the outcomes demanded by the customer. Measurement related 'solution' failures were in the minority within the category overall, and can be seen to fall into one of three categories:

a) A failure to take into account the intangible aspects of 'more ideal' in the eyes of the customer
b) A failure to understand or take due account of the relative importance of different attributes and the frustration they were causing customers such that even though overall Value may in retrospect be seen to have improved, the ratio of Benefits, Cost and Harm changes was inconsistent with a critical mass of customer needs.
c) A failure to break-out of a trade-off and optimization mentality so that no contradictions were challenged.

Market Demand – nearly all failures attributed to this category in our study turn out to be measurement related. The small minority that were not directly related to a measurement were ones we categorized as 'Marketing Hubris' – i.e. Marketing personnel that assumed they knew better than the customer so either didn't go ask the customer, or ignored what the customer told them. Strictly speaking, this kind of 'hubris' issue could also be said to be measurement related, but for the moment, we decided to separate it from the measurement failure category. As The PanSensic tools mature, we imagine that 'failure to

measure hubris will also become a measurement problem rather than a hubris problem per se. Over the period in which our evaluations took place, however, almost no organisation was making use of (or probably even aware of) tools to measure the hubris or level of delusion of their Marketers. Whether we should or shouldn't bundle this failure mode into the 'measurement-related' category in the future, what we know was measurement related in the analyses we've conducted to date falls into one or a combination of five basic types:

a) A failure to measure what tangible and (especially) intangible outcomes the customer wanted
b) A failure to measure the step-change pulse rate of the market and thus failed to be able to align innovation specification and launch timing.
c) A failure to observe a step-change in market dynamic (e.g. generational shift, cultural shift, arrival or departure of an adjacent product or service onto the market, or a change in micro- or macro-economic conditions)
d) A failure to measure how well served (under or over) customer needs were against the spectrum of different attributes and thus a failure to appropriately specify the solution requirement
e) A failure to identify a trend contradiction that needed to be solved.

Route To Market – for large organisations, route to market is rarely a big problem, simply because the size of the organisation is sufficient to control the appropriate flow of products and services. Where Route To Market failures do occur for large organisations it largely comes down to one of two effects; firstly a failure to identify or sufficiently engage an emerging complementer, and second, failure to identify or do anything to mitigate against the risks associated with a disruptive innovation attempt by either a new player or an intruder into the market. Both of these challenges can have a measurement aspect. Our analyses tell us that about a third of Route To Market failures can be attributed to a measurement failure in one or both of these two failure modes.

Means Of Production – again another relatively small contributor to the large organisation failure statistics, our analyses have revealed two statistically significant failure modes, each with a potential for a measurement-related contributing factor. The two modes are:

a) failure to satisfactorily calculate relative costs of incumbent and new solutions during the initial launch phase prior to full economy-of-scale effects coming in to play, such that the new solution appears to be a 'loser'.
b) As more and more product offerings take on a service element, the 'cost of production' metrics need to transition away from traditional scarcity-based supply-and-demand economics towards 'the-more-it-is-shared-the-more-valuable-it-becomes' knowledge economics. The second 'Cost of Production' failure mode relates to the inability of organisations to successfully measure and manage these kinds of product-to-service transition.

Bringing the five categories together, the headline finding is that close to two-thirds of all innovation attempt failures can be attributed to a failure of measurement – Figure 2:

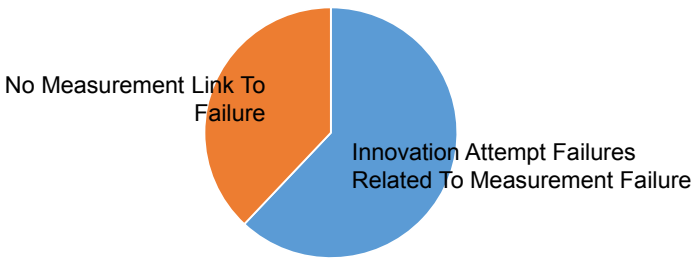


Figure 2: Measurement Versus Non-Measurement Innovation Attempt Failure Ratio

Which we can then break down back into our initial five failure categories, such that Figure 3 shows how ‘measurement failures’ are distributed:

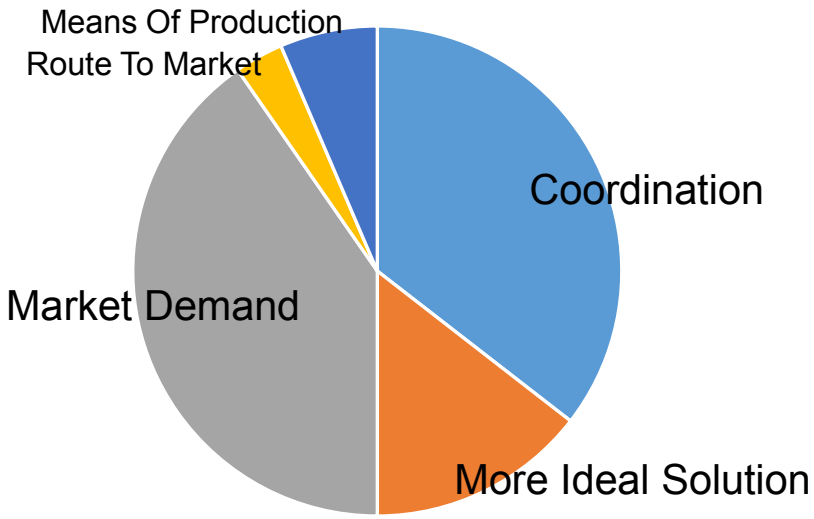


Figure 3: Measurement-Related Innovation Attempt Failure Breakdown For Large Organisations

If nothing else, I think this picture makes it clear where the two main focus areas for the PanSensic tools are right now. More on both fronts no doubt in future articles.

‘ABC-M Gets Better’?

One of the fall-out problems when you successfully distill innovation success down to its ‘DNA’ level is that, as in biology, you then need to reproduce that DNA many times over in order to get to a viable solution. Doing the same thing many times over can often sound like hard work. And therein, very often, lies the real challenge of ‘Systematic Innovation’. Systematic is not and never was intended to be the same as ‘easy’. It means finding the absolute smallest number of things that ‘need’ to be done, and building them in to a repeatable structure and sequence of activities.

We first talked about the ABC-M strand of innovation DNA back in November 2013 (Reference 1) and then refined it a year later (Reference 2). The basic idea is that, when we’re designing the intangible elements of a new solution, all four of the ABC-M elements (Autonomy-Belonging-Competence-Meaning – Figure 1) need to be perceived as better than the incumbent solution. Really easy to say the words, but when we extend the basic ‘DNA’ to recognize that *each stakeholder* needs to perceive that ABC-M gets better for them, the story becomes an order of magnitude more complicated.

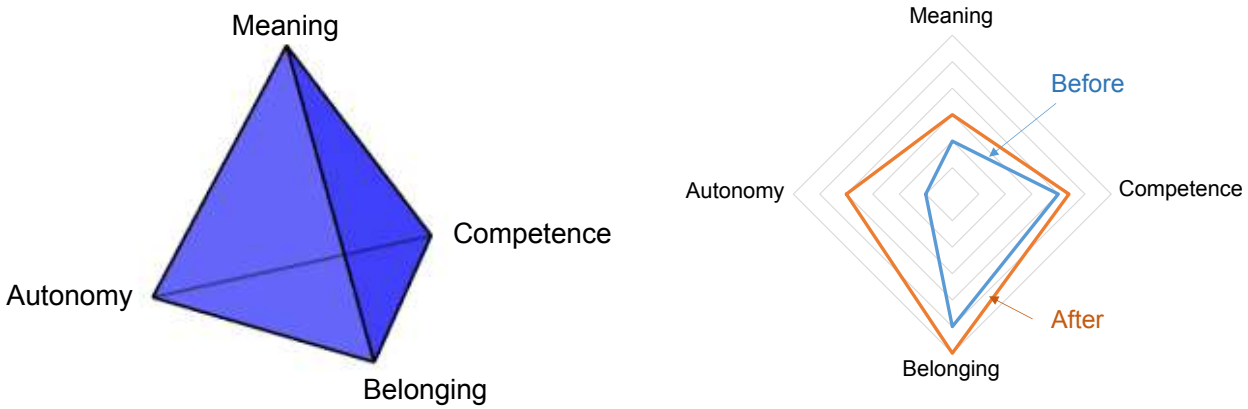


Figure 1: ABC-M Model & ‘ABC-M Gets Better’ Measurement

ABC-M is all about the core human intangible drivers. Another innovation success DNA-strand comes from the J.P.Morgan aphorism, ‘people make decisions for two reasons: a good reason and a real reason’. Put into the ABC-M context, this means that not only does each stakeholder need to perceive an improvement in each of the core intangible drivers, they also need to receive a clear tangible improvement as well. A Benefits/(Cost + Harm) calculation thus needs to be made again for each stakeholder and the answer for all of them needs to show that the new solution is tangibly better for all of them. And so we add another layer of complication to the success calculation story. Figure 2 combines this tangible ‘Value’ with the intangible ABC-M world, and adds a ‘Δ’ symbol in front of each of the constituent parts to signify that in each case what’s required is a calculation of how each attribute has changed between the incumbent solution and any proposed new solution. ‘Innovation’ in the context of this picture means that the delta (Δ) in each case is in the right direction – i.e. each attribute is the same or better for the new solution than it was for the incumbent.

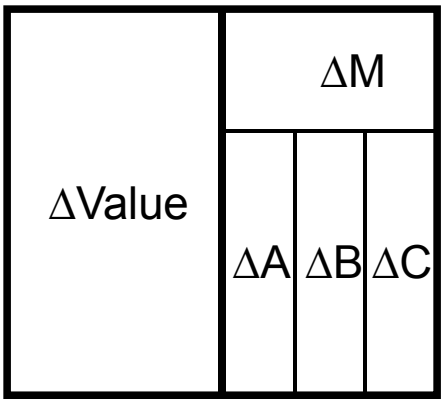


Figure 2: Combined Tangible & Intangible 'Delta' Assessment Structure

But we're then still missing at least another layer. Another strand of DNA. This time relating to another previous e-zine topic of discussion relating to ways of using the 9-Windows, System Operator tool (Reference 3). This story has again seen a degree of evolution since first discussed in 2006. Specifically to bring about a convergence with the concept of 'Moments of Truth' (MoT) as used in many parts of the Fast-Moving Consumer Goods (FMCG) industry (Reference 4). The concept revolves around key moments in the lifecycle of a product or service. In the FMCG world, the prevailing logic says there are two MoTs: one at the point in the store where a consumer either selects your product or doesn't, and a second at the point of use and did the product deliver the promised outcome. Other industries typically possess multiple other MoTs – what happens when the product breaks down; what happens when we have it serviced; what happens at the end of its life when we want to trade it in for a replacement, etc. Figure 3, taken from Reference 4, illustrates how we often extend the 9-Windows tool such that every Moment of Truth has its own column of Windows:

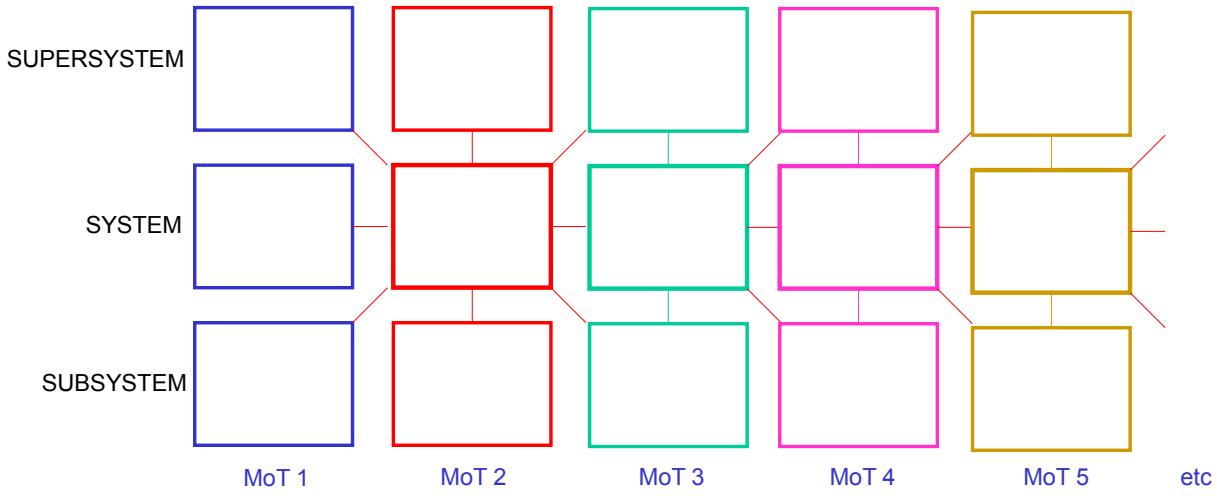


Figure 3: 'Moments Of Truth' As Utilised In The System Operator Tool

Perhaps this Figure starts to offer up some kind of an indication of the potential amount of work 'systematic' implies. If a project team is supposed to examine and complete an investigation looking through all of the windows, this can easily feel like a lot of work. The reason the 9-Windows has nine windows and not 15 or 18 or 45 is that nine seems somehow manageable whereas a higher number does not.

So much for that idea. Things are about to get worse. You probably guessed that already.

Figure 4 now merges the Figure 2 template into the MoT model to show for the first time ‘all’ of the things that a prospective innovator ought to be examining through the course of their project:

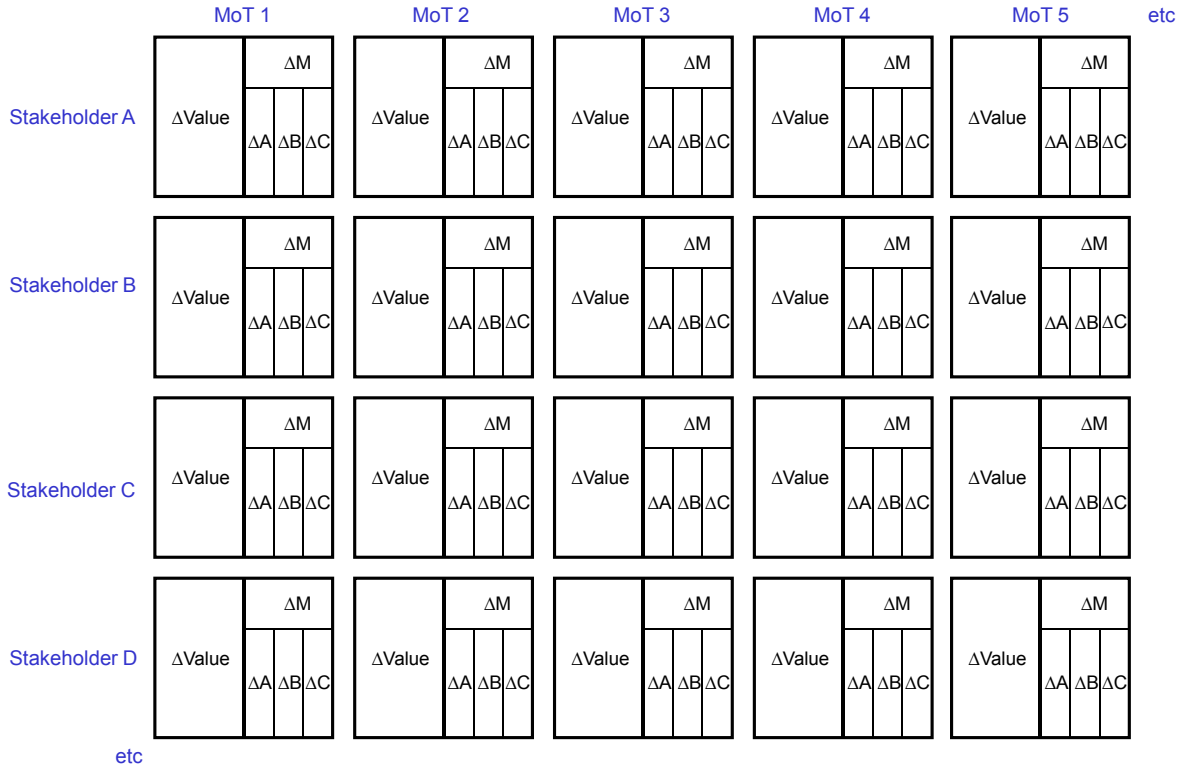


Figure 4: Combined Delta-Template Covering Each MoT and Each Stakeholder

What this somewhat daunting image is trying to tell us is that for every stakeholder, at every Moment of Truth they’re involved in, we ought to be assessing whether they see a change in the right direction for the tangible value delivered by a prospective new solution, and for each of the ABC-M intangible attributes.

If any of the boxes shows us a negative delta, the simple DNA-level heuristic tells us that our prospective solution isn’t the right solution yet. If we can imagine drawing the picture as a series of traffic lights, a real solution would show up as a green light in every box. Put another way, any ‘red lights’ tell us where we need to re-think. Most likely to challenge a contradiction: a red-light in one box exists because there is a green light in another – Figure 5.

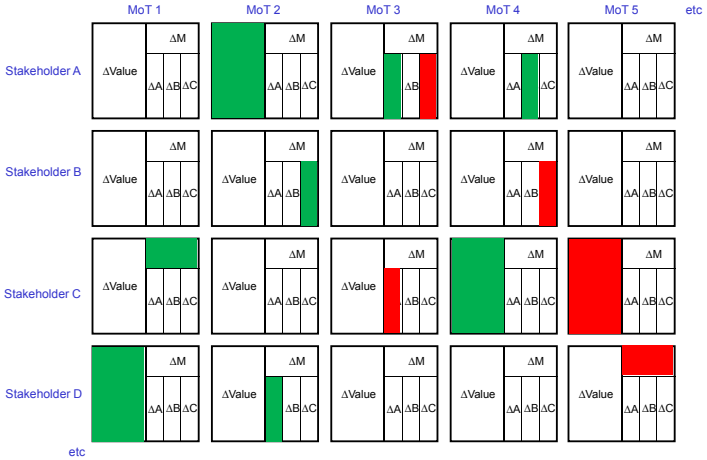


Figure 5: ‘Traffic Light’ Version Of Combined Delta Template

If there's any good news in this story, I think it comes in two parts. Firstly, the whole idea of traffic lights and 'everything better' implies that we're looking for a qualitative answer rather than a quantitative one. We don't need to know, in other words, *how much* ΔC for Stakeholder D at MoT 3 actually is, just that it's positive.

The second part of the good news is that after all's said and done, we can use the PanSensic tools to go do the majority of the hard work for us. But that's a story for another day. As my old boss once said to me at the start of what turned out to be a pulling-our-hair-out, tortuous four-month FMEA analysis project, it's good to go through the process manually at least once. Over to you.

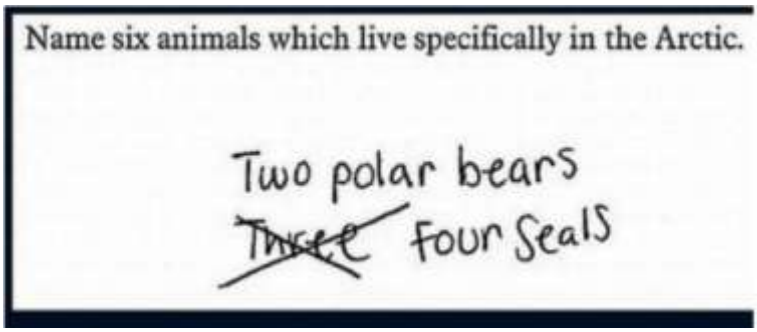
References

1) Systematic Innovation E-Zine, 'Universal Intangibles', Issue 140, November 2013.
2) Systematic Innovation E-Zine, 'Universal Hierarchy Of Contradictions', Issue 152, November 2014.
3) Systematic Innovation E-Zine,. '9-Windows – Sometimes Sufficient; Sometimes Not', Issue 54, September 2006.
4) Systematic Innovation Certification Course Notes, Level 3.

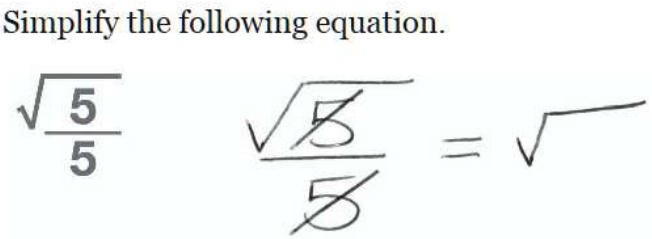
Not So Funny – 40 Inventive (Exam Question) Principles

If ever anyone needed proof that the 40 Inventive Principles are innate, you just need to take a look at some of the responses kids are able to generate when the creative pressure is on. Like in an exam…

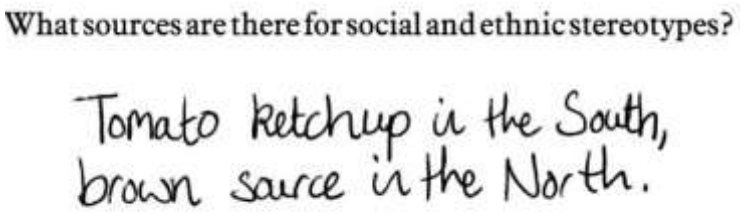
Principle 1, Segmentation



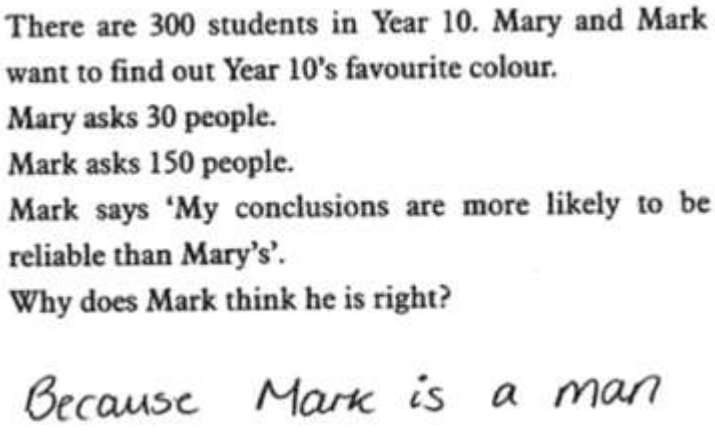
Principle 2, Taking Out



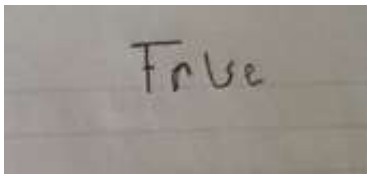
Principle 3, Local Quality



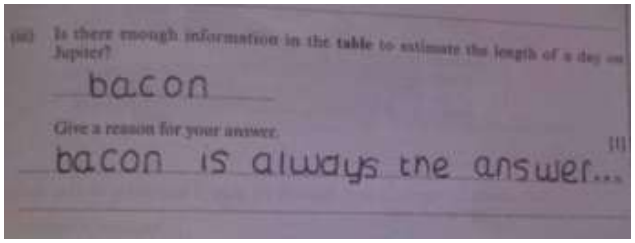
Principle 4, Asymmetry



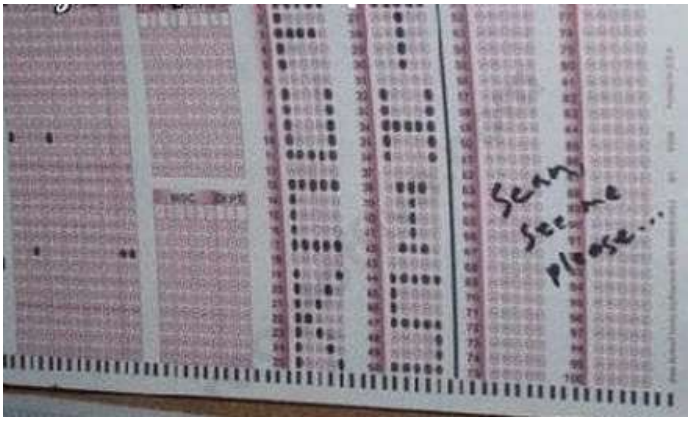
Principle 5, Merging



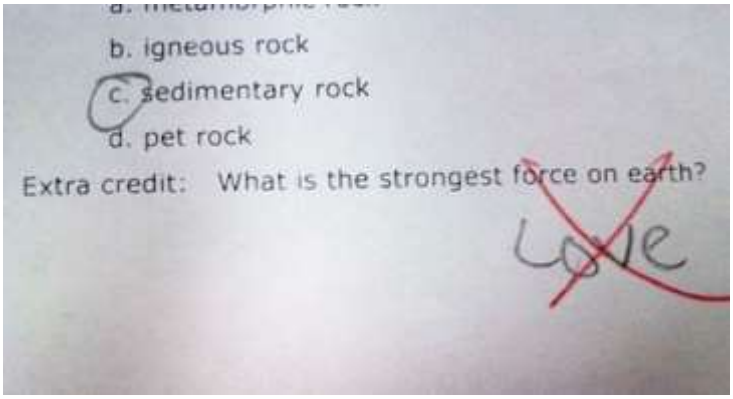
Principle 6, Universality



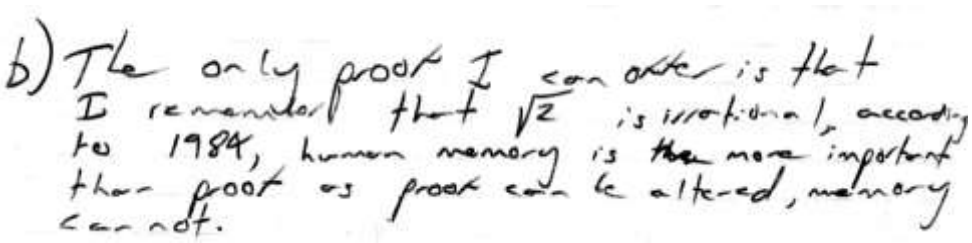
Principle 7, Nested Doll



Principle 8, Anti-Weight

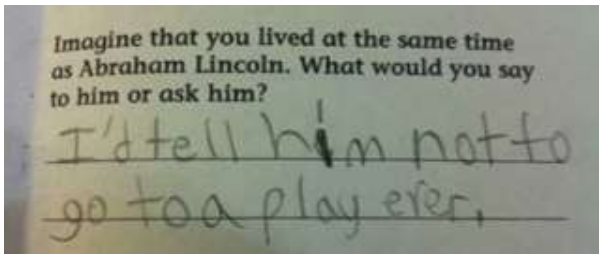


Principle 9, Prior Counteraction

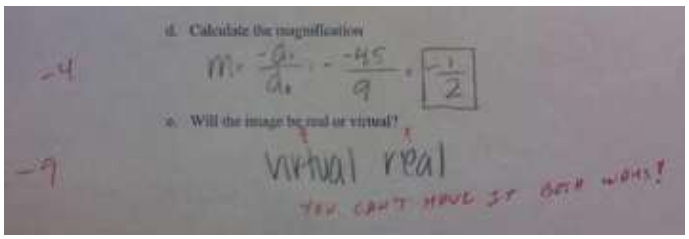


SYSTEM ATIC INNOVATION

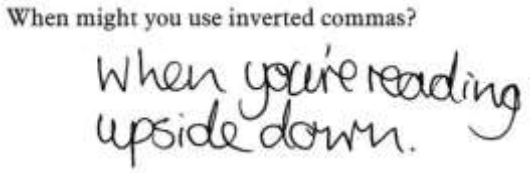
Principle 10, Prior Action



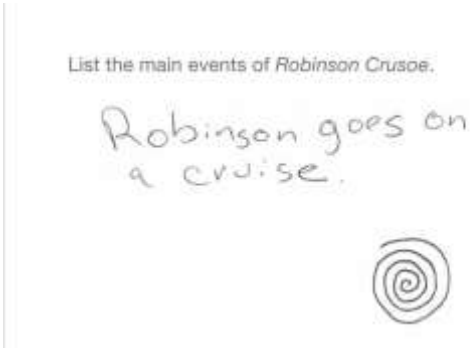
Principle 11, Beforehand Cushioning



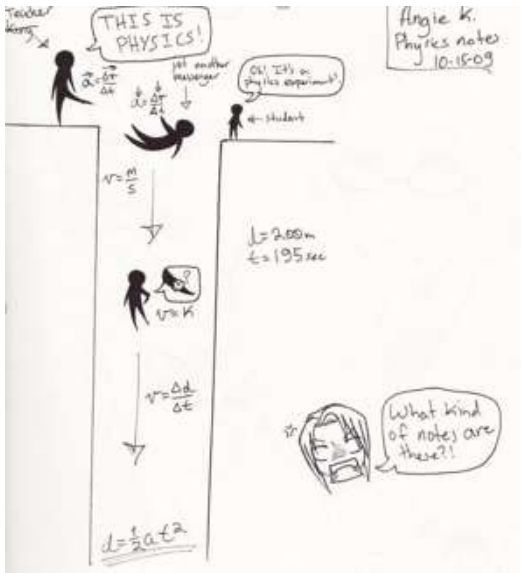
Principle 13, The Other Way Around



Principle 14, Curvature



Principle 15, Dynamics



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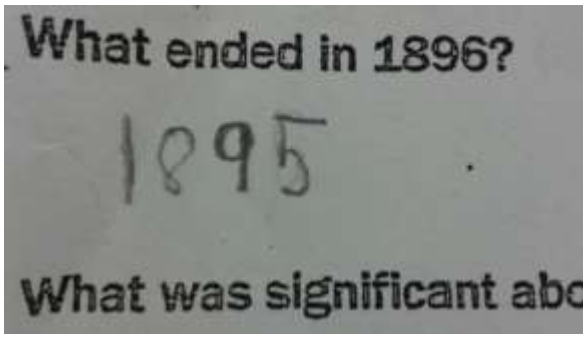
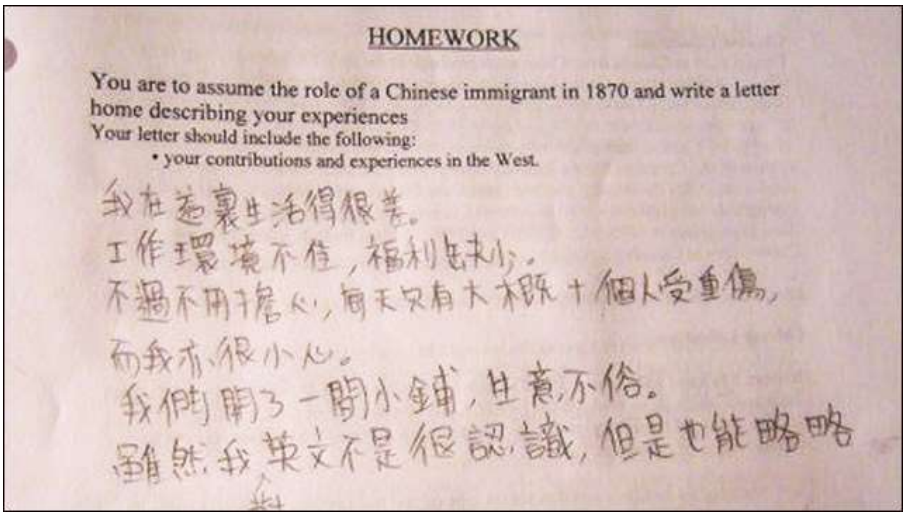
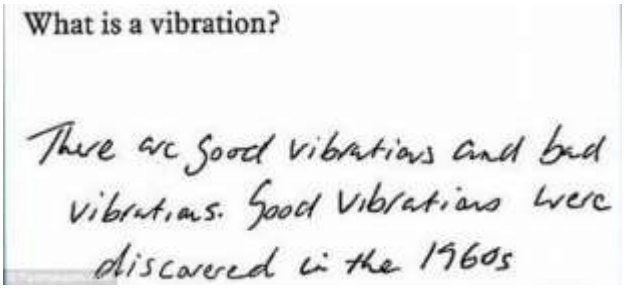
Principle 16, Slightly Less, Slightly More



Principle 17, Another Dimension

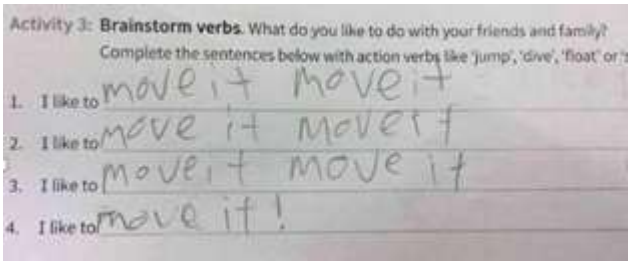


Principle 18, Vibration

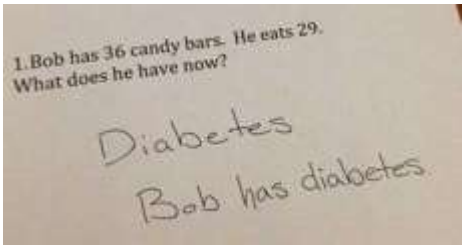


Principle 19, Periodic Action

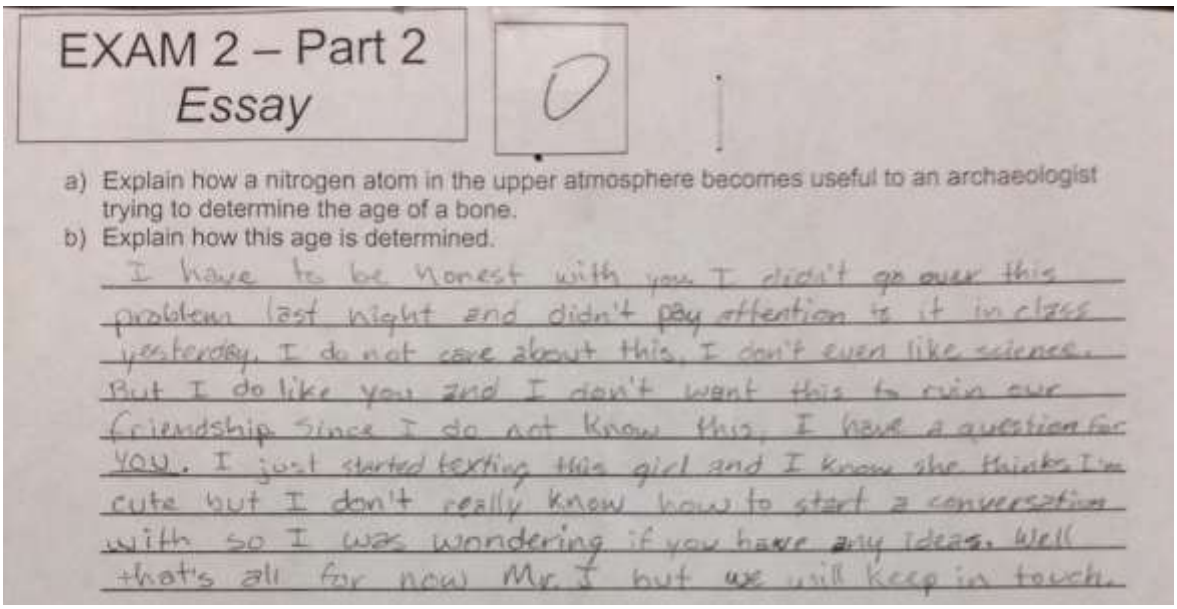
Principle 20, Continuity Of Useful Action



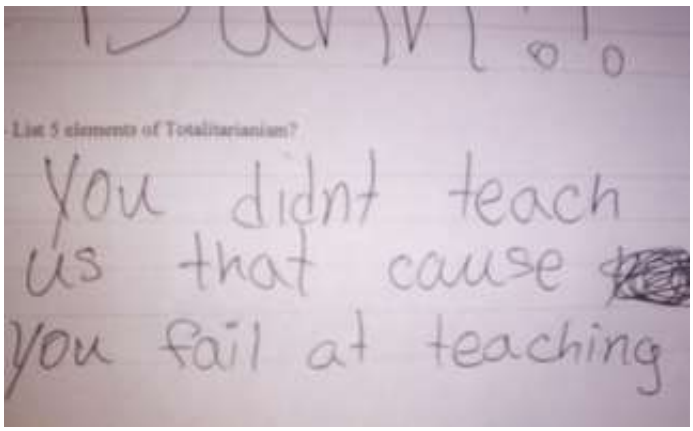
Principle 21, Skipping



Principle 22, Blessing In Disguise



Principle 23, Feedback



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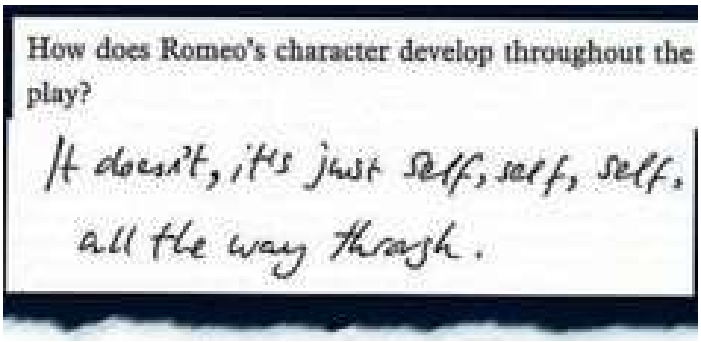
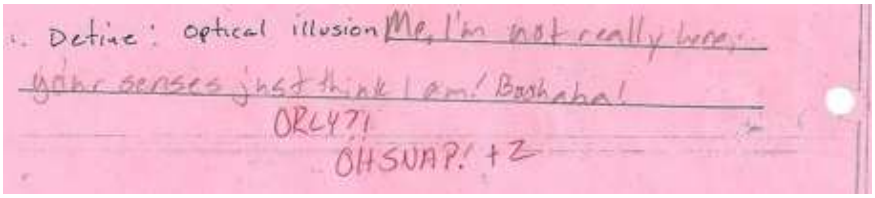
Principle 24, Intermediary

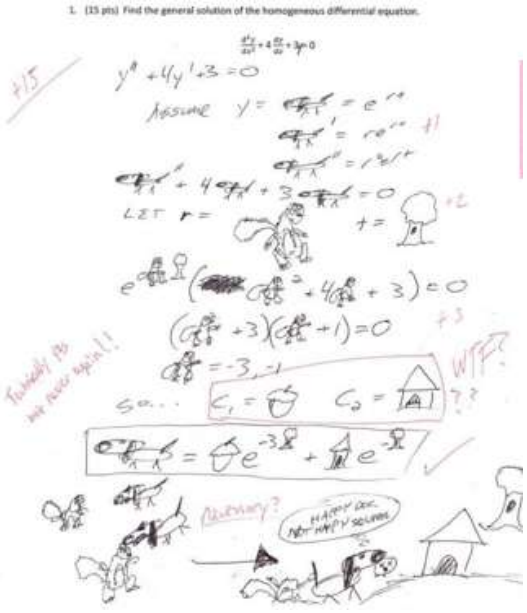
Principle 25, Self-Service



Principle 26, Copying



Principle 27, Cheap Disposable ("let C1 be a cupcake" – genius!)



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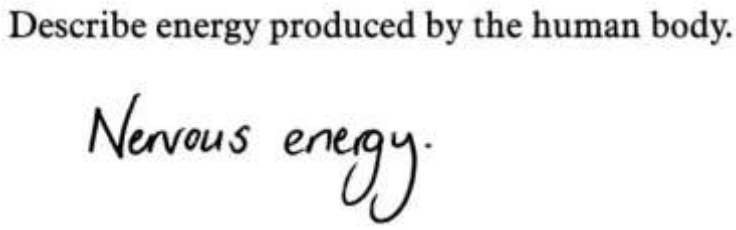
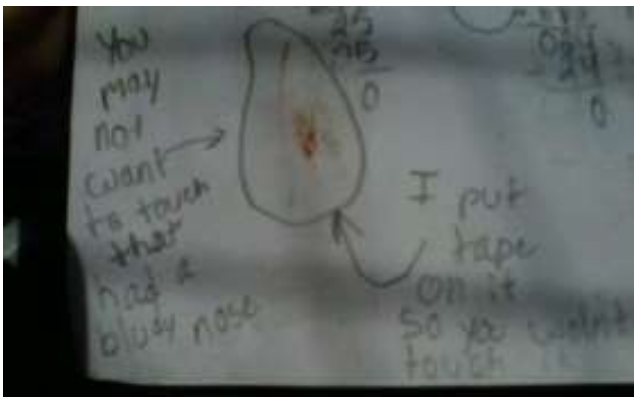
Principle 28, Mechanics Substitution



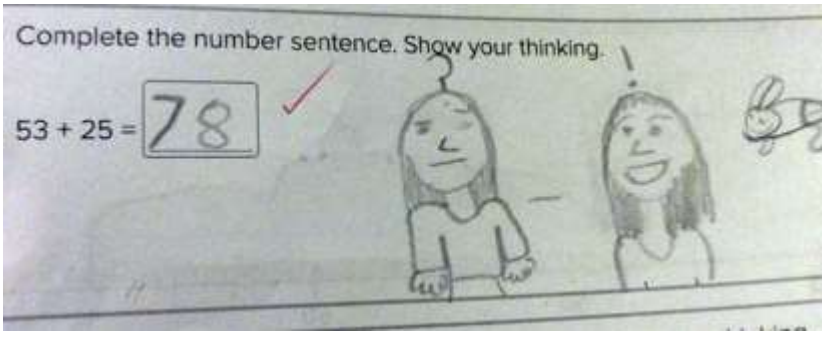
Principle 29, Pneumatics & Hydraulics

Principle 30, Flexible Shells & Thin Films

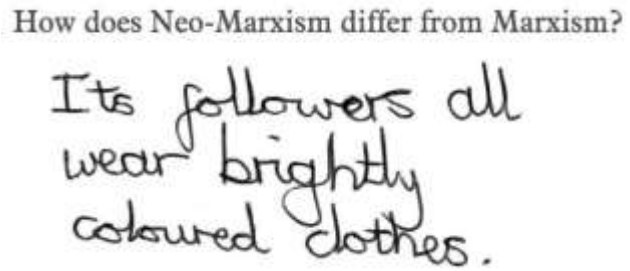


(double marks for this one as it's also Principle 29)

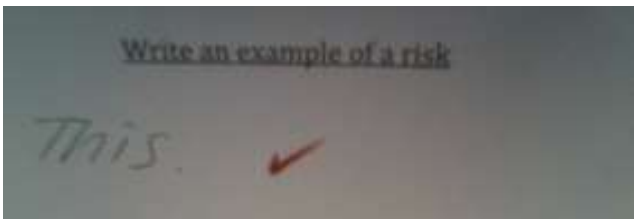
Principle 31, Holes



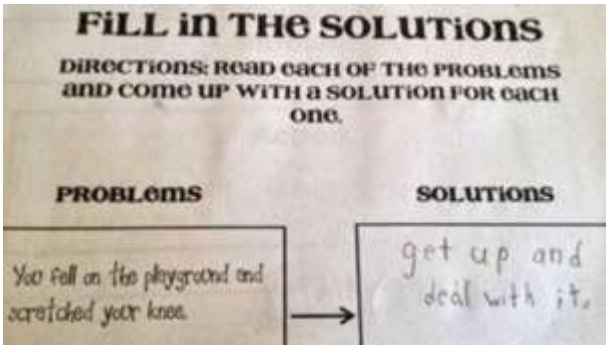
Principle 32, Colour Changes



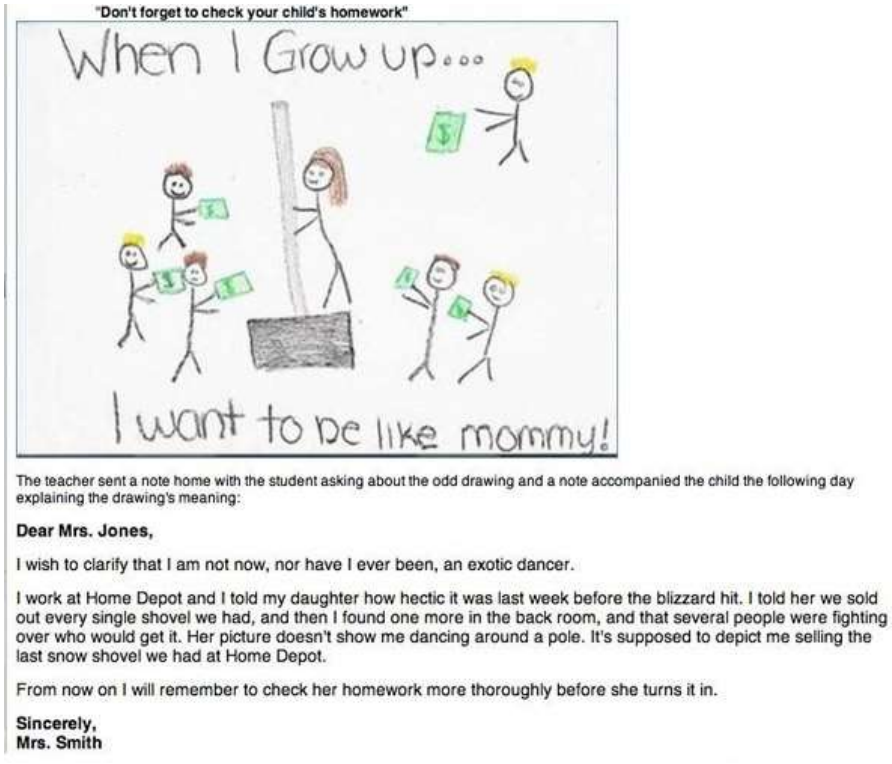
Principle 33, Homogeneity



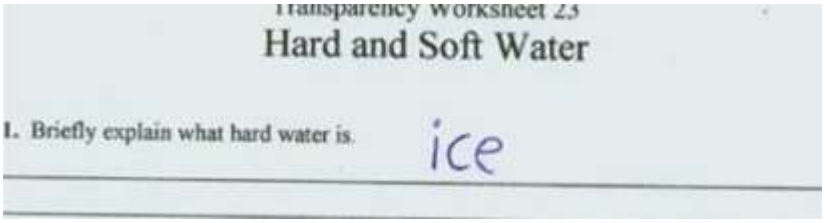
Principle 34, Discarding & Recovering



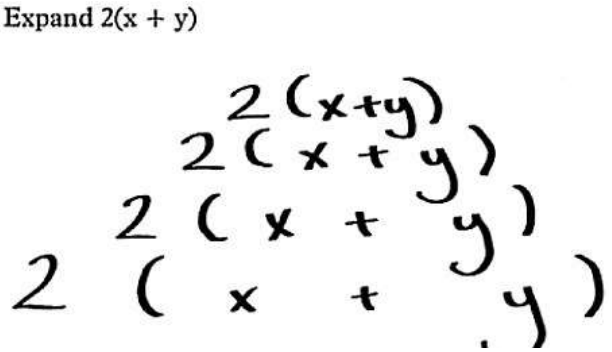
Principle 35, Parameter Changes



Principle 36, Phase Transitions

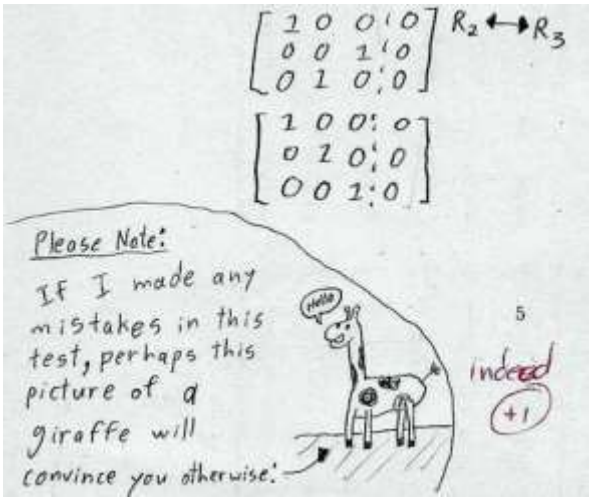


Principle 37, Thermal Expansion/Relative Change



Principle 38, Enriched Atmosphere

Principle 39, Calmed Atmosphere



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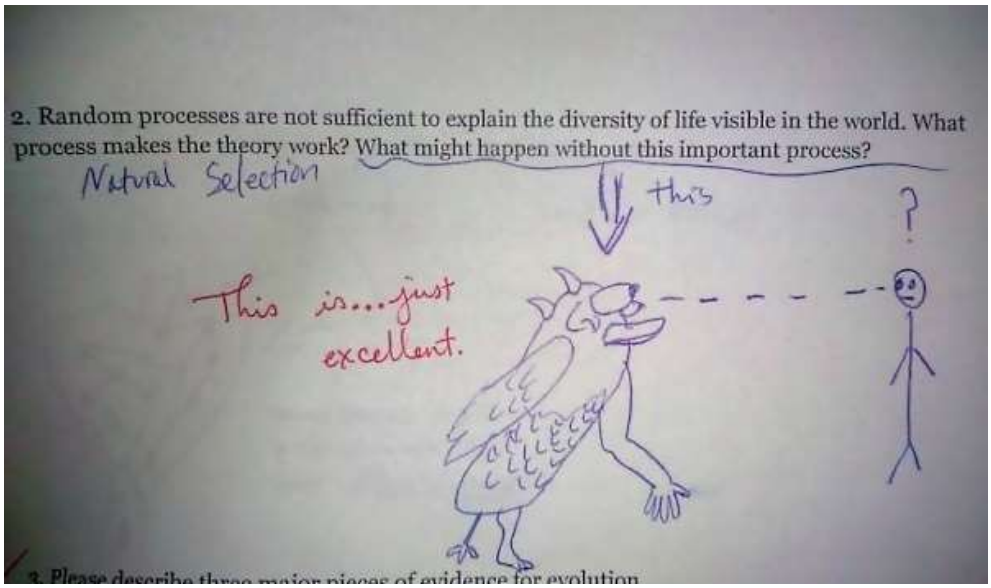
Principle 40, Composite Structures



And, err…
Principle 41, Quantimize??

I couldn't agree more.

Patent of the Month – Aerostatic Bearing

We make a trip to South Korea and a team of inventors at the Institute of Machinery and Materials in Daejeon. Their invention was granted US patent number 9,151,369 on October 6. Here's what the background description section of the invention disclosure has to say about the problem addressed by the team:

Miniaturization technologies have placed new challenges on the world of manufacturing. Micro-scale machine tools (mMTs) have recently emerged as a viable and economic option to address these challenges.

However, evolving applications for mMTs have begun to include materials that are difficult to machine. For example, hard turning and micro-machining of titanium, stainless steels, and bulk metallic glass are just some challenges faced by mMTs.

These applications require increased static/dynamic stiffness and high damping in the actuators used in mMTs. A prior solution for linear positioning, ball screws, does not generally achieve the positioning accuracy required for mMTs.

Hydrostatic lead screw actuators and aerostatic lead screw actuators have been developed for use in mMTs. Hydrostatic screws are messy and require significant support equipment.

Aerostatic lead screw actuators (ALSAs) have the potential to provide the necessary stiffness as well as extremely high positioning accuracy. ALSAs use an air film in place of balls to transmit the load from the nut (aerostatic lead screw actuators (ALSAs)) to the screw. ALSAs also eliminate backlash and stick-slip friction and therefore appear to be particularly suitable for high performance mMTs.

(does this sound like the perfect illustration of evolution along the Object Segmentation trend? Solid-goes-to-liquid-goes-to-gas… of course there's always a problem with any such jump….)

The major challenge posed in the manufacture of an ALSA, however, is maintaining the precise air gap between the screw and the nut over the entire helical threaded surface.

In the art, both orifice-restricted and porous-restricted air bearings have been incorporated in aerostatic lead screw designs. For example, Tachikawa et al., "Ultra Precision Positioning Using Air Bearing Lead Screw," discloses a porous-restricted aerostatic lead screw actuator that achieves 10 nm positioning accuracy. However, this lead screw actuator design provides relatively low stiffness (e.g., 30 N/micron), and requires thread engagement with eight thread revolutions, which significantly increases manufacturing costs.

A design and manufacturing method for a groove-fed orifice-restricted ALSA is disclosed in U.S. Pat. No. 4,836,042 by Slocum et al. Due to the special nature of the thread design in the '042 patent, however, any inaccuracy in the thread profile doubles the error seen in the air gap.

Here's how we might best map these air-gap-versus-stiffness and air-gap versus-manufacturability conflicts onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Moving Object (3)

WORSENING PARAMETERS YOU HAVE SELECTED:

Force/Torque (15) and Manufacturability (41)

SUGGESTED INVENTIVE PRINCIPLES:

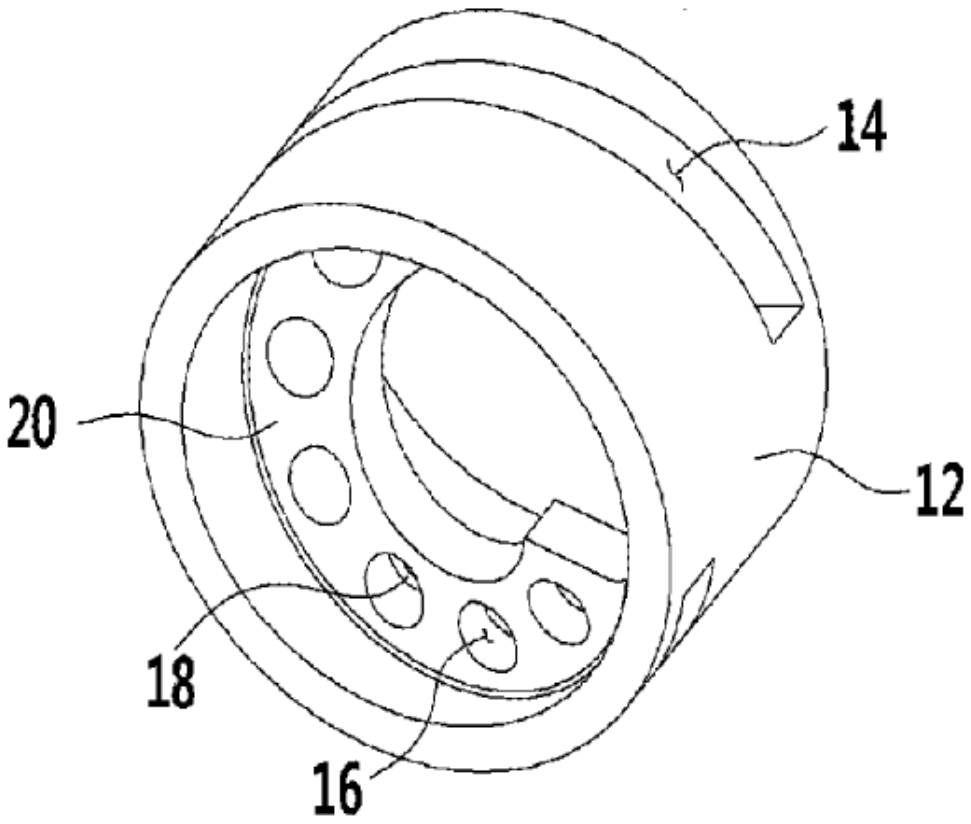
4, 10, 17, 1, 24, 14, 12, 29, 7, 37, 2, 25

And here's how the inventors have solved the problems:

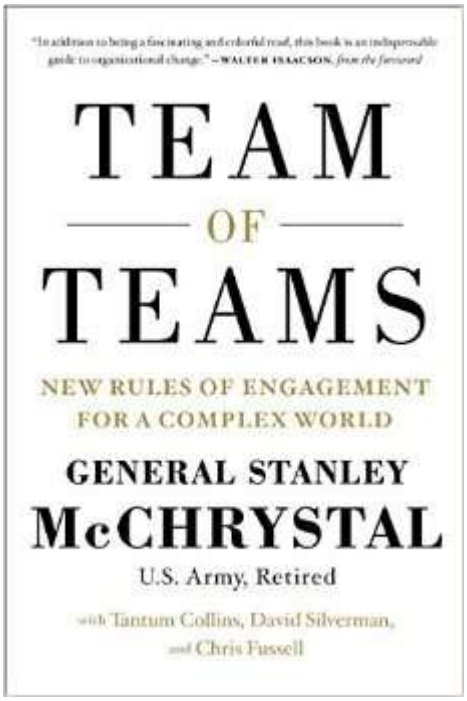
An aerostatic air bearing, comprising: an aerostatic nut; and a lead screw coupled to said aerostatic nut, wherein said aerostatic nut comprises: a housing having an air inlet disposed therein; a helical plenum chamber (Principles 4 and 14) *disposed in said housing, said helical plenum chamber being fluidly connected to the air inlet and fluidly interconnecting a plurality of openings*(Principle 1)*, said openings being disposed in a helical pattern* (Principle 14)*; and a plurality of porous media* (Principle 31)*, each of said porous media being disposed in one of the plurality of openings respectively* (Principle 7)*, and wherein said lead screw comprises a threaded surface separated from each of the plurality of porous media.*

Four out of five ain't bad!
The amazing thing is that of all the 'good' (as defined by our ApolloSigma sweep) patents granted in the US on 6 October, this was the only one that caught out the Contradiction Matrix.

Plus, it's a very simple and elegant solution to the problem. Conical surfaces rule! Conical surfaces with nested porous media rule more!



Best of the Month – Team Of Teams



After an initial struggle to find anything coherent, this month's 'best-of' winner was ultimately an easy choice. Combine someone with a lifetime of (literal) battles-scars, a compulsion to say what needs to be said no matter how unpopular it might be, and a rare understanding of complex systems, and you're already somewhere close to a compelling read. Team Of Teams is precisely that book.

It's written for anyone working in an industry struggling to adapting to the new realities of an interconnected world, and it's for anyone working in an organization blocked by silos and bureaucratic dysfunction, and still leveraging ad hoc solutions to mute the symptoms of a much larger problem. Hmm. That should cover about 90% of enterprises on the planet?

McChrystal's story begins when he was first confronted with the potential for failure in Iraq. Here's how he describes the situation:

"our instinctive reaction was to pull every traditional lever—more resources, more people, more technology. This was driven by organizational hubris and the assumption that *doing more of what has always worked* will eventually win the day. It was also tied to a dependency on technology as the solution, instead of seeing technology as an enabler, with people being the true solution. The external environment has shifted from *complicated but structured* to *complex and networked*, and we learned through our early struggles that the levers afforded by a traditional bureaucratic system couldn't solve for this new reality. On the brink of defeat, we drove a fundamental culture change in how our organization communicated, shared, and led itself, transforming from a command of teams into a *team of teams*.

That change is grounded in the relentless pursuit of scaling the effective drivers of small teams to the enterprise level. The high levels of trust and common purpose found in small teams were the critical cornerstones that ultimately allowed for the creation of Shared Consciousness and Empowered Execution at the organizational level. Once we realized that this model would allow us to match, and ultimately exceed, the speed and interconnectedness of the external environment,

our leaders became hyper focused on *driving the culture change*, knowing that effective execution would take care of itself. If the cultural core was optimized, those closest to the fight could adapt in real time. The networks that are today's reality are never static. They are unpredictable by their very nature. Organizations that leave behind static operating models, and allow for and encourage constant adaptation will excel in this new reality.

Team of Teams may be both the best military book of the year and the best business one. The killer-aphorism-per-page count is off the scale of nearly all other business books:

"Your structure is your strategy."

"Whatever efficiency is gained through silos is outweighed by the costs of interface failures."

"Unpredictability is fundamentally incompatible with reductionist managerial models based around planning and prediction."

How we organize our institutions, how we think about questions of command and control, determines how we operate. We can talk about being agile and flexible all we like, but if we retain a traditional hierarchy, there are limits to how much we can achieve those goals. In order to really adapt, you must work not harder but differently."

The prevailing belief in most large enterprises is that 'culture change' is one of the most difficult challenges of the era. Some would go so far as to say the job is 'impossible'. I tend to think that culture change is actually quite easy. Provided there's a willingness to replace the CEO and majority of the senior leadership team. I know that message rarely goes down well when I mention it. Fortunately, I now have a much better answer, courtesy of General McChrystal. Everything described in Team Of Teams is not only eminently do-able for companies at any ICMM Level, it's also very difficult for anyone to argue over the logic. When 'command and control' finally dies as a management philosophy, one suspects McChrystal's words will be the ones signaling the death knell.

Essential reading for anyone involved in innovation-anything, complexity-anything, agility-anything or strategy-anything.

Wow In Music – The Rite Of Spring

Since the inception of this series on wow music, we have looked at musical samples which in different ways can overwhelm us. We could probably say that emotions are the most central element that defines our relationship with these pieces as they correspond to our psychological and physiological reactions to sounds, an ephemeral phenomenon that has the power to imprint indelible memories on us. We have also seen that surprise is in many ways the element that triggers these emotions and (paradoxically) there are pieces of music that have the ability to renew the same effect no matter how many times we listen to. Igor Stravinsky's The Rite of Spring is of them.

Initially a piece of music for ballet, this artistic gem became one of the most influential works of the 20th Century. This is how one contemporary described the audience's atmosphere of expectation of the premiere night: "never ... has the hall been so full, or so resplendent; the stairways and the corridors were crowded with spectators eager to see and to hear"

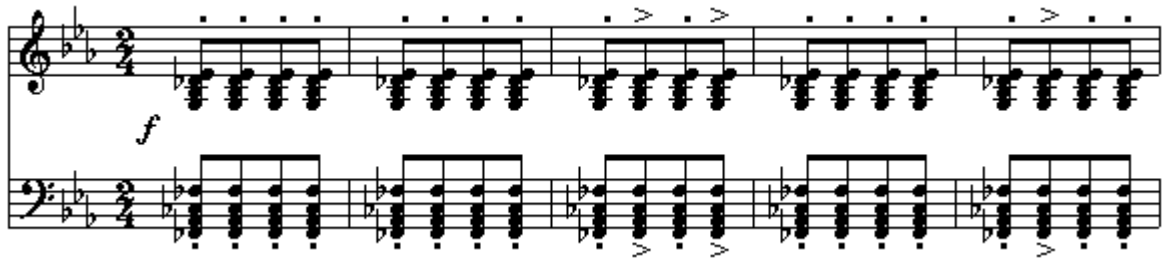
We could perhaps say that in very few moments in music history, listener's reactions were tested to their limits. It is said that the audience at the Theatre des Champs Elysées in Paris, where the premiere happened, turned the night into a riot. Rawness, earthiness, and savagery are some of the (Principle 38) words that could describe that moment. Very soon at the beginning of the performance it is said that the roars of the crowd made it difficult to hear the music. After many offenders being expelled and the order re-established, the audience was left to astonishment.

The main plot helped to build the atmosphere: a girl is chosen to dance herself to death in order to appease the Russian pagan gods of the spring. Nijinsky's original choreography undoubtedly helped to tease the senses of the audience which, of course, was not even slightly prepared for that shocking, primitive, almost violent experience. Instead of portraying the image of the classical romantic ballerinas, at that moment dancers redefined the very essence of dance.

In Rite of Spring, Stravinsky introduced (in some cases and expanded in others) the use of unfamiliar (not to say, Principle 13, awkward) musical features, experimenting with

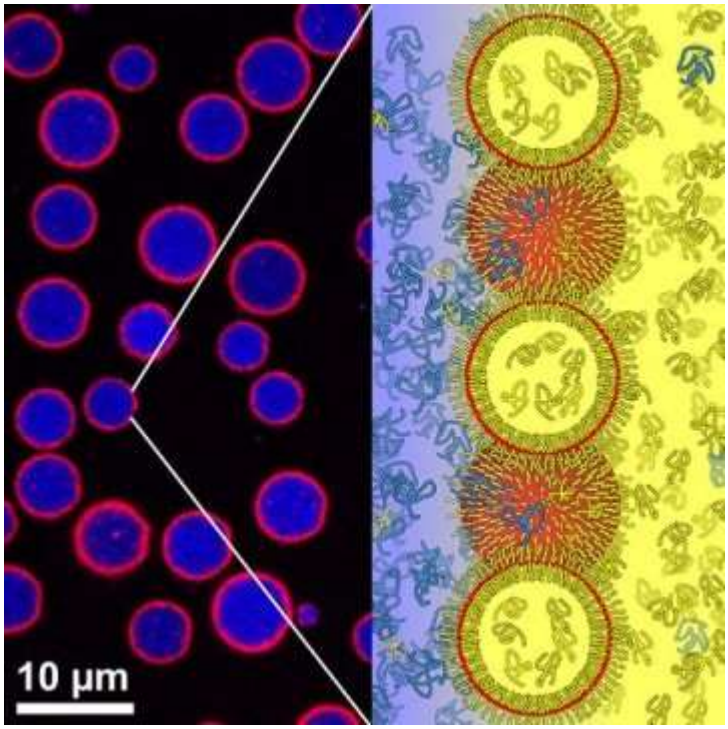
tonality, dissonance, meter, and rhythm. However, in many instances, the reaction was not positive. English composer Julius Harrison, for instance, reported Stravinsky's “abhorrence of everything for which music has stood these many centuries … all human endeavour and progress are being swept aside to make room for hideous sounds …”. It is no surprise that the press reviews described the piece with expressions such as "a laborious and puerile barbarity" and a “disconcerting adventure”. Famous Italian composer Giacomo Puccini allegedly described it as “the work of a madman”.

In today’s eclectic world, in so many ways different from that unique moment, after so many political, technological, artistic and cultural revolutions, I would be surprised if the Rite of Spring produced the same overwhelming effect on people’s lives. However, if you really want to get pushed and transformed in your own musical convictions, dear reader, it is about time to experiment it (if you haven’t yet).



Dances of the Youths and Maidens - Strings enter suddenly with repeated dissonant polychord punctuated by French horns. (note the irregular accents).

Investments – Artificial Bioreactors



Artificial cells that mimic their natural counterparts help scientists learn the secrets of complex processes, such as how plant cells turn sunlight, water, and carbon dioxide into fuel. Today's artificial cells often become unstable when materials transit the membrane. Scientists have developed a new artificial cell where lipid vesicles (small pools of fatty molecules) self-assemble around treated water droplets. The result is an artificial cell or microscopic bioreactor.

This new type of cell-like bioreactor could offer substantial advantages for carrying out complex synthesis processes that mimic natural processes. It could also offer benefits in conducting massively parallel chemical reactions.

The story started when scientists discovered a new process for spontaneously forming "artificial cells" that can function as bioreactors through the self-assembly of polymer-rich water droplets within lipid-rich water droplets. In essence, the artificial bioreactor is composed of a shell membrane through which reactants and products can selectively pass through, and an interior environment where the reactions occur. Lipid-, polymer-, and gel-based processes for preparing bioreactors modelled after biological cells have been previously developed; maintaining stable reaction-relevant internal environments while simultaneously allowing reactants and products to easily pass through have remained a key challenge.

Now, researchers at the Pennsylvania State University have developed a new type of water-in-water composite emulsion, based on self-assembly of microscale aqueous droplets surrounded by nanoscale lipid capsules in a continuous aqueous phase. These lipid-stabilized water-in-water assemblies provide an exciting alternative to traditional giant lipid vesicles, or liposomes, as artificial cell mimics. In comparison to traditional giant liposomes, which encapsulate a similar aqueous volume within a single continuous lipid membrane, the structures introduced here offer

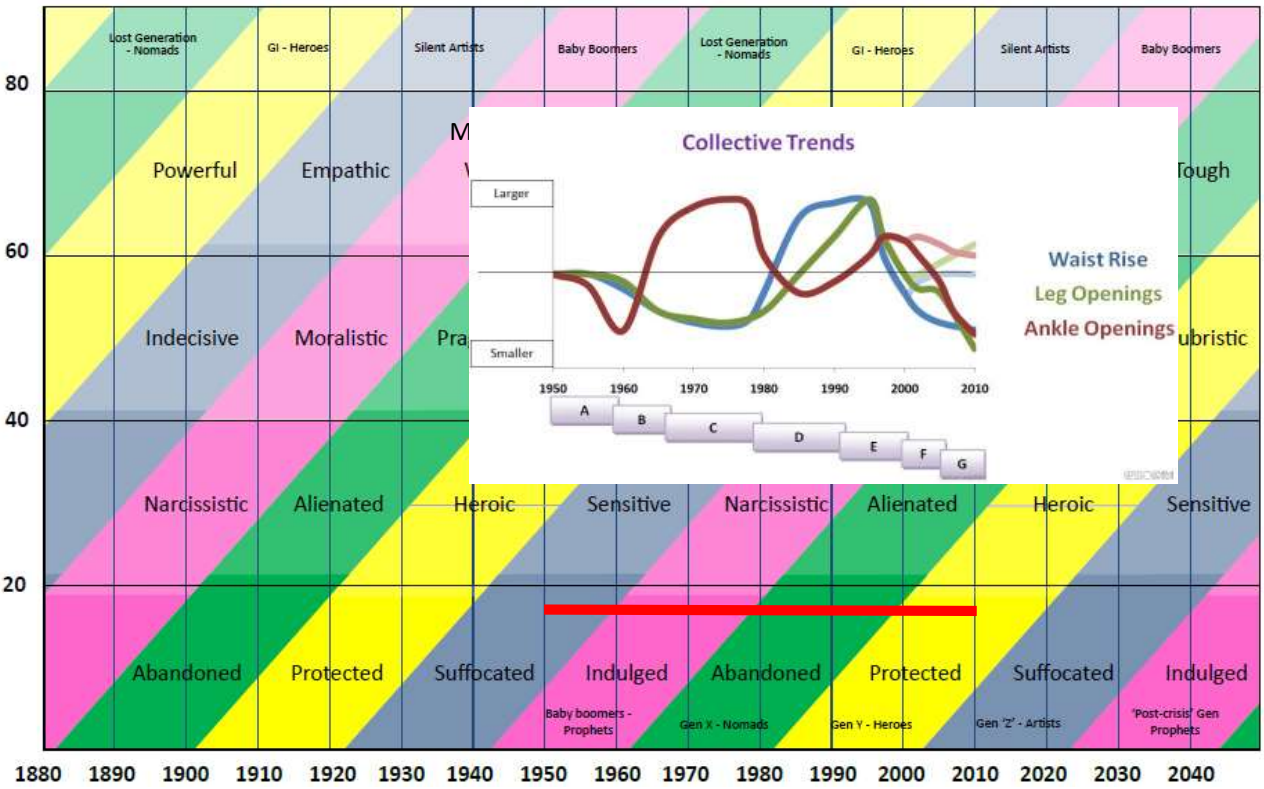
(1) facile encapsulation of proteins in the interior phase as well as polymer agents for controlling the progress of the desired reaction,
(2) excellent uniformity in droplet size and contents, and
(3) much greater access into and out of the interior volume.

The researchers found that negatively charged lipid capsules, each on the order of 100 nanometers in diameter, self-assemble at the aqueous interface of polymer-rich droplets that are tens of microns in diameter. The repulsion between the lipid capsules due their negative charges forced them to maintain their assembled structure, essentially gluing them together and stabilizing the overall bioreactor composite. A particularly exciting capability of these composite assemblies is the preferential partitioning of DNA within the interior compartment based on the length of the DNA, which bodes well for designing and preparing micro-reactors in which combinations of reactants can be selectively introduced and maintained at desired levels. In addition, ribozyme-induced cleavage of RNA encapsulated within the interior is as another example of the bioreactor's unique capability.

Read the full story at:
Daniel C. Dewey, Christopher A. Strulson, David N. Cacace, Philip C. Bevilacqua, Christine D. Keating. **Bioreactor droplets from liposome-stabilized all-aqueous emulsions**. *Nature Communications*, 2014; 5: 4670 DOI: 10.1038/ncomms5670

Generational Cycles – Flares

It's great to know that somebody has the job of studying these things. Jeans. Specifically waist height, leg openings and ankle openings thereof. Flares. Here's the summary picture of all three measures plotted on to the generational cycles map.



Our intrepid researcher (who goes by the online moniker 'sssourabh') beautifully identified seven distinct denim jean evolution jumps over the period from 1950 to 2010. What's amazing is how well they correspond to generational shifts of late teenagers. Here are the seven periods in a bit more detail:

Era A (second half of the 'Suffocated' Artist generation): Star Stuck Jeans

The likes of Marilyn Monroe left guys lusting with modestly slim jeans, whilst Elvis rocked the world with the dude's version, as did James Dean, making it unisex at a time when gender fashion separation was quite prominent. The waist rise wasn't given as much dominance, and the classic fit was at the waist, as it supposedly should be. At this point in time, jeans were not a fashionable item, but just a casual addition to a wardrobe, akin to its roots of being used for comfort during laborious work.

Era B(first half of the 'Indulged' Prophet generation): Party Time Jeans

The Beatles proceeded with the slim jeans trend, but the introduction of what our parents and grandparents call 'hip hugger' jeans were a rage, popularized by rock icons, and were almost a precursor to the present day low rise trend. In retrospect, clearly this was the start of a rebellious and party centric trend that would eventually push the envelope in

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years to come, and bring jeans out of the casual closet and into the fashionable one. Interestingly, the newly positioned denim jeans were actually harder to get!

Era C (second half of the 'Indulged' Prophet generation): Hippie Disco Jeans

In this era, the disco scene became popular as the hippie culture took over the entire world, which, contrary to the tail of fashion following, wanted to be more 'Western'. 'Hip huggers' turned into low waist jeans, with wider and wider flares being christened as visually accurate 'bell bottoms'. As is the case with any fashion fad, diversification is inevitable to occur, and the likes of elephant bell jeans also popped up, with flares so large they covered the shoes in entirety! Talk about tripping hazards.

Era D (first half of the 'Abandoned' Nomad generation): Breathable and Workable Jeans

With the disco backlash, a derogatory term to something so culturally influential, flared bottoms reached an end as straighter jeans were demanded, in a modestly slim fit, thus marking a comeback of narrower ankles. However, baggy jeans came back in style with the hip hop and rap culture. These were also times of heightened global warming awareness, so perhaps people felt the need to breathe in their jeans. Waistlines also crept back up due to the more 'straight leg' feel (which I personally think is the least flattering of all fits). For practical purposes, including a rise in women joining the workforce, high waists and straight legs were in style, with baggy ruling the youthful boy's nest. Designers jumped on the band wagon to capitalize on the increasingly popular goldmine of fashion.

Era E (second half of the 'Abandoned' Nomad generation): Provocative Jeans

I call this era provocative since this marks a prominent rise in underwear exposition. If jeans were a fad on the framework of products, then this was the time when the low respect came into play, as jeans lost their fashionable and must-have position to other fabrics. Yet, a king never lies low for long, and the low rise 'bumster' jeans made a comeback, thus marking a repetition point in this cycle, as a successor to the earlier 'hip hugger'. The credit belongs to designer Alexander McQueen who changed the face, or the derriere, of denim jeans. Initially these were paired with baggy jeans and made popular by the oddly popular concept of 'sagging', thus revealing men's boxers and underwear (giving these a reason to become a raging trend of their own, for both men and women). Gradually, the jeans themselves began to slim down, too, particularly for women. The low rise was still a taboo, and restricted amongst the boldest of populations: the uber fashionable and extremely elite, or simply followers of Kate Moss's strategic first move at Alexander McQueen's show.

Era F (first quarter of the 'Protected' Hero generation): The Joyous Enjoyous Jeans

This is when laws got liberal, and the world became more united as if saluting entering a new century together. This was indeed the case, as celebrations became viral with joy, worldwide were shared via emerging social media forms and are still recalled today. The feelings seemed to have reciprocated on the world's most loved attire. The low rise jeans became more acceptable and less of a taboo, thanks to the acceptance of starry characters like Britney Spears. The next comeback, and thus a mark of cyclicality once again, was the widening ankles. Fashion enthusiasts thankfully glossed over the term 'bell bottom' replaced it with flared bottoms and the popularly called 'boot cut jeans', thus lending to a visual image of being less dramatic than their bell bottom parent. The difference was the slimness of the fit at the leg and knee. Freedom and breathability was thus the main association with denim of this era.

Era G (second quarter of the 'Protected' Hero generation): The Split-Personality Jeans

With the low rise style at its peak, the skinny, drainpipe style of jeans returned, marking a repeat in this element of the cycle too. This was to the critiqued dismay of populations worldwide, as it went beyond the slimness of the 80s and into a skin clinging skinny style, with the notion that its wearer had to fall into its size reference.

The strange thing about the mid 2000s onwards has been the dual nature of fashion. Whilst it is apparent that trends are leaning towards lower, skinnier, slimmer, it is almost as if the bulk of the population is starting to feel discomforted by the aspirational aspect, and is clinging onto what we may call fashion of the yore. This explains why boot cut and moderately flared jeans have not disappearing entirely. High rise jeans, such as the Not Your Daughter's Jeans brand, are also in style for their tummy tucking marketing to trendy baby boomer women. Men of hip cities, and particularly those of non-metropolitan areas, are completely averse to low rise and skinny fit, explaining their lack of adaption to the new styles of denim. The point was emphasized by Dockers' sexist advertisement which blatantly mocked the skinny jeans trend for men, albeit its archaic undertones probably encouraged a higher trial rate!

The most apparent finding here is the cyclicality of the trends, and how the three main fit elements, namely waist, leg and ankle, reliably seem recombine to form the next trend. The cycles of all three do not necessarily correlate, else things would be too predictable.

The low rise trend of Period B made a comeback in Periods F and G.

The slim leg trend of Period C made a comeback in Period G.

The skinny ankle of Period B made a quick comeback in Period D, and a more prominent one in Period G.

Jeans trends seem to return every 3 to 4 of the defined eras. So, the upcoming fashions may not be too difficult to foresee (albeit trends like diversification, along with the importance of fabric type, embellishments, etc., can cause significant differentiation; these require yet another insightful exploration!).

Naturally one may wish to anticipate what is next in terms of 'fit', obviously without ignoring the possibility of diversifying the current 'fit' elements via garnishing jeans with embellishments, destroying them via various strategic techniques, etc. The unveiled trends give prominent hints that the duality will continue, at least for some time, despite Kate Moss's influential prowess in sporting the high rise jean, marking an end to the popular and beloved (personal votes here, too) low rise. Ironically, she modeled Alexander McQueen's 'bumster' jeans too, so things indeed do come into a complete cycle. So, here is some basic yet strategic advice for emerging GenZ, Artist teens:

"Invest in both flared, lose and high waist denim, alongside low slung skinny jeans. Both are likely to remain for a while, but the more extreme a trend gets, the less it is lauded in the long run, and the more repulsive it looks in retrospect. The indication hear is of the way we laugh at bell bottoms, or laugh at whale tails. This does not mean that people should look identical, like packs of cards; individuality should and always will be praised, and one should not shy away from displaying a quirky or crazed streak. But with few likes, limited closet space and few resources and options at hand, invest smartly, as you would in stocks."

Biology – Sheep

Think about sheep and the first thoughts that come into your head probably don't have very much to do with creativity and innovation. Sheep, one might say, are probably the antithesis of breakthrough, contradiction solving behaviour. Or maybe not. Maybe the mental image we have is wrong. Here's what we recently learned from a team of researchers from the CNRS, CEA, and the Universities of Aberdeen, Nice Sophia Antipolis and Toulouse III in an article published on September 28, 2015 in the journal *PNAS:*

Imitation behaviors play a key role in many collective phenomena seen in animals. Many animal species live in groups, such as shoals of fish and herds of animals. This lifestyle offers many benefits to individuals by increasing protection against predator attacks. It can also sometimes vastly improve the efficiency of foraging for food. In these groups of animals, imitation behaviors are the cornerstone of many collective phenomena. However, individuals do not imitate one another constantly or at the same intensity over time, which has the effect of increasing the complexity of collective behaviors. Group behaviors are determined by the importance with which each animal treats the behavior of its neighbors relative to its own motivations. Knowing how these two types of influences combine to determine the decisions of each individual within a group is crucial for understanding the complex dynamics of many collective phenomena, not only in animals but also in humans.

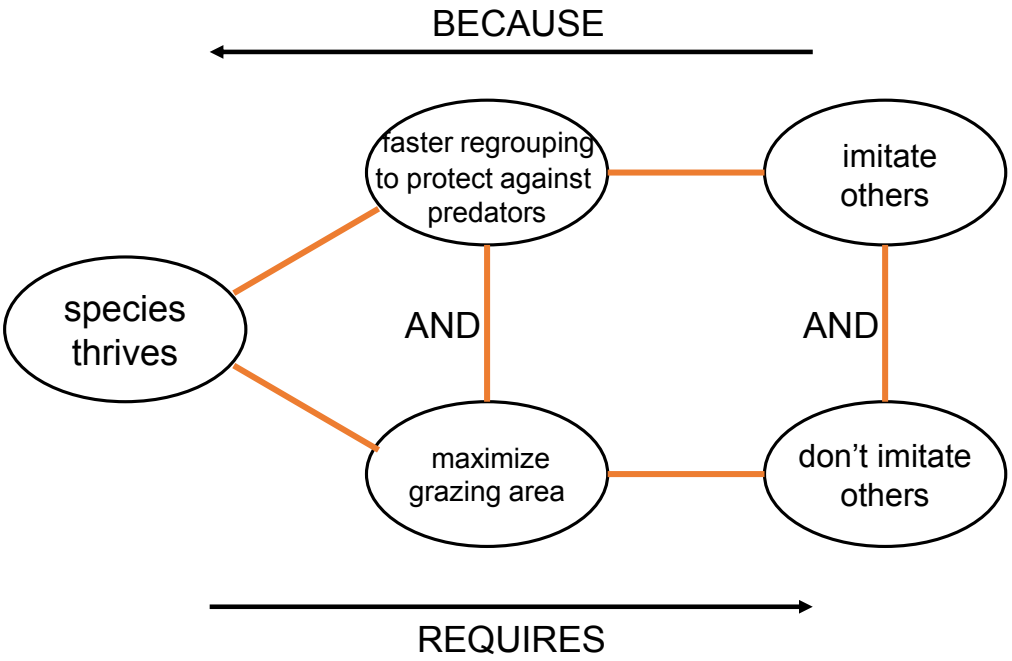
To study these phenomena, the researchers analyzed the collective movement of flocks of a hundred Merino sheep grazing under controlled conditions on the Domaine du Merle at Salon-de-Provence. They demonstrated that these movements have intermittent dynamics: slow dispersion phases alternating with phases of consolidation and very fast movement during which sheep mimic the group already in motion. The analysis of these regroupings, and therefore of the mimicry phase, reveals that they are similar to avalanches: their amplitudes are random and distributed over a range with a very large scale. At the scale of the group, this system appears similar to what is called a "critical" condition.

In addition, by using a mathematical model to reproduce the interactions between sheep and their effect on spontaneous behavior, scientists have shown that the intensity of mimicry plays a critical role in the ability of a herd to maximize the area foraged for grazing while minimizing the time needed to regroup. These studies demonstrate that the intermittent dynamics observed in sheep

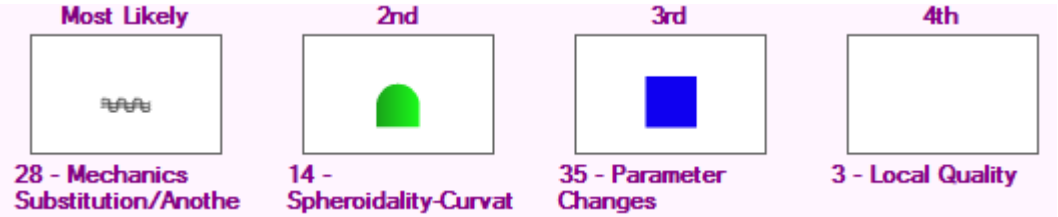
stem from the need for each individual to balance two conflicting motivations: to explore enough new grazing area to find food but also to stay in contact with other herd members so as to benefit from the protection offered by a compact group.

These results also offer new elements for the current debate on the issue of "criticality" of living systems. Being neither in too much disorder nor too rigidly organized -- one of the signatures of critical phenomena in statistical physics -- sheep would be able to respond effectively to external disturbances, an advantage that could have been selected by evolution. This study suggests that such behavior could be vital when sheep sense the presence of a predator. It would allow the group to develop a form of "collective intelligence" and circulate information.

The alternating slow dispersion phases and very fast regrouping, in which they imitate the behaviour of their neighbors offers up a really elegant illustration of Inventive Principle 3, Local Quality' in action: dispersion and regrouping both acting in 'locally optimised conditions'. Here's the basic underlying imitate/don't-imitate contradiction the strategy has solved:



And here's how human engineers have successfully challenged their own versions of this problem:



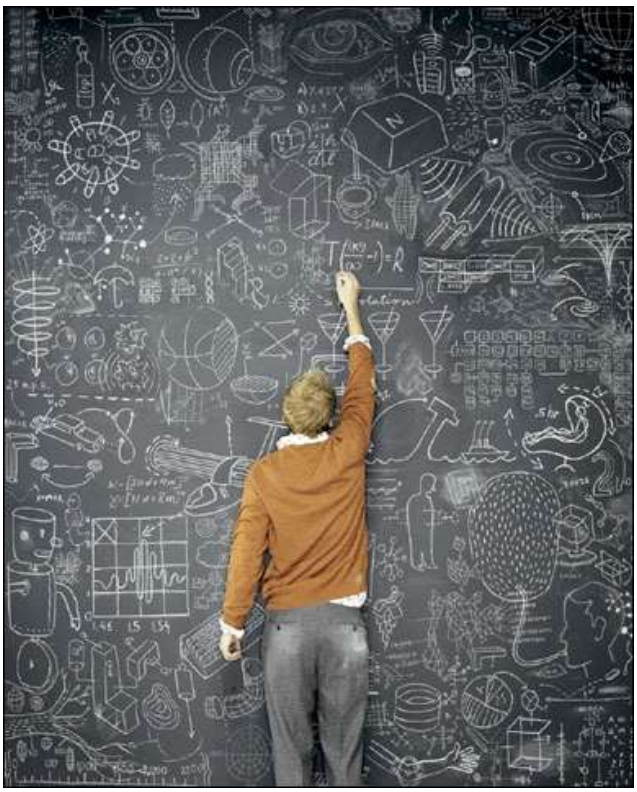
Hey, we're all sheep, harmlessly passing our time in the grassland away. Only dimly aware of a certain unease in the air.

Full reference for more details::

Francesco Ginelli, Fernando Peruani, Marie-Helène Pillot, Hugues Chaté, Guy Theraulaz, Richard Bon. Intermittent collective dynamics emerge from conflicting imperatives in sheep herds. *Proceedings of the National Academy of Sciences*, 2015; 201503749 DOI: 10.1073/pnas.1503749112

Short Thort

The only place you won't find an s-curve is in anyone's attempt to build a Theory Of Everything…



…which probably helps to explain why no-one has successfully built a Theory Of Everything yet.

News

India
Darrell will be visiting India again between 14-22 December and then again 11-20 January. The December trip still has a couple of unallocated days, and January has three unallocated days during the first half of the dates. If anyone is interested in doing something on one of these days, please get in touch with Darrell to see if something can be worked out…

GenerationDNA
…mention of the January India dates, means that we've had to re-schedule the 'friends and family' GenerationDNA workshop at our Cranford HQ. The new date is Wednesday 3 February. Sorry for any inconvenience caused… Darrell tells us the long-overdue book will 'definitely' be published in time.

IMechE '21st Century TRIZ' Workshops
And while we're on the subject of changing schedules, the IMechE one-day TRIZ Introduction workshop scheduled in London on May 10 next year has moved slightly to the 18th.

TRIZCON'16
Schedule clashes mean that Darrell won't be able to attend the conference planned for early March, but he's volunteered himself and the SI research team to co-author a paper with anyone that is planning to attend. If anyone is interested, please get in touch with Darrell to discuss possibilities.

Australia
Darrell will be in Sydney and Melbourne during the last week of November if anyone is interested in meeting him. He'll also be back during March for the big Innovation conference being convened by Simon Dewulf in beautiful Byron Bay. Who could say no to that one? More details on that one at the website shortly and at 'innometo.com' now.

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

- Financial Services – algorithm design and new product prototype build
- Construction – Evolution Potential study
- Automotive – consumer insight study
- Automotive – 'Service Innovation' workshops
- Medical Devices – PanSensic study
- Public Sector – PanSensic dashboards
- Leisure – PanSensic study
- Materials – technology road-mapping study
- Automotive – problem-solving project
- Automotive – SI workshops
- HR – PanSensic psychometric tools & study