# Systematic Innovation

## e-zine

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Our guarantee to the subscriber is that the material featured in the e-zine will not be published elsewhere for a period of at least 6 months after a new issue is released.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

# Societal Trend Hierarchies

Some trends are more important than others. Likewise, some seem to operate at a different hierarchical level than others. What we attempted to do during the research programmes that have now come to underpin the TrenDNA methodology was group together all of the societal and market trends that operate at the same basic level. Some still turn out to be more important than others, but the differences are measurable on a 1-10 scale rather than a scale involving orders of magnitude differences.

One of the main things we were able to demonstrate during the investigations into the sources  behind each trend is that their 'DNA' comes from three primary strands: Generational time, Thinking Styles and Cultural differences. The first two of these three form the core of what we now believe to be a 'universal' model. The third, Cultural, dimension we have incorporated by preparing and publishing different versions of the book and trends suited to different parts of the world.

Sometimes – if we examine the quite subtle differences between the UK and German editions of the books for example – the cultural impact is small enough that it plays out as a small percentage of the trends that appear or disappear depending on whether the focus is on one country or the other. Other times, we have found that the impact can be rather more significant. Having now come to the end of what has turned out to be a two-year, six-university study of China, we have found our most extreme impact yet.

While we were always confident that the Thinking Styles strand of the method would not alter as we shifted our focus from West to East, we have been amazed to find that the Generational pattern found in the West is also present in China. The third, 'Culture' strand, however has thrown up some differences that although on one level they still appear quite subtle, because they are differences at the (social)DNA level, they have the effect of having sometimes quite enormous effects on the societal and market trends at large.

What we also found in the China research is that there is also a third hierarchical level at which the trends need to be defined. Figure 1 illustrates these three levels: the inner two are the ones already present in the TrenDNA method, namely, the 'DNA level drivers and what we describe in the book as the 'trends'. But then there is an outer level set of 'mega-trends' that operate at a hierarchically quite different level. These megatrends are best viewed as societal drivers that come from the rules, regulations and conditions designed by 'the State'.
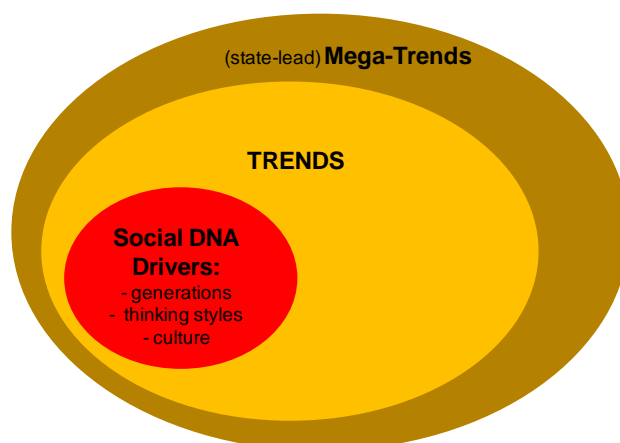


**Figure 1: Three-Level Societal Trend Hierarchy Model**

Without wishing to get into any kind of debate about the apparent differences in societal control imposed by Communist versus Capitalist philosophies (in actuality, both systems impart rules, regulations and conditions that ultimately come to affect societal and market trend patterns, just that one appears more subtle than the other), what seems clear when looking at China is that there are some top-down, Government-lead factors that cannot be ignored when looking at societal trends and their origins.

In one of what turned out to be a whole series of blinding flashes of the obvious that emerged during the TrenDNA(China) research, it was John Naisbitt's 2010 book 'Megatrends China' (Reference 1) that alerted us to the importance of hierarchical differences in the trend story. We initially approached the book in the manner that had become a standard part of our trawl through the trend literature: look for trends, then rank them on a 1-10 scale. But Naisbitt's megatrends quickly revealed themselves to be off-the-scale in terms of their likely influence and importance. Readers familiar with the TrenDNA method will know, for example, that a big part of the method involves constructing trend networks in which the connections between the trends comes from asking the question 'which of the other ones does this one 'lead to'?' When we try asking this kind of 'leads to' question for Naisbitt's megatrends, the answer quickly comes back, 'all of them'. That's 'all' as in impossible to pin it down to just the 'best' one that the method demands we select.

Figure 2 illustrates some of the trends that we now believe sit at each of the three different hierarchical levels defined in Figure 1. At the innermost, 'DNA', level China's cultural-driven trends include things like 'Face', 'Yin-Yang' and 'Harmony' – cultural norms that on the face of it, as already mentioned, are quite subtly different Western ways of thinking. Then at the outer, Megatrend, level, we have things like, a trend we called 'Deng's Cat' – in this case, a now famous proclamation by former Premier Deng Xiaoping's famous aphorism, 'No matter if it is a white cat or a black cat; as long as it can catch mice, it is a good cat.' Not something that is strictly speaking 'official Communist Party doctrine', but which nevertheless has come to have a profound effect on the way in which Chinese industry and then society at large has evolved in the last twenty years.
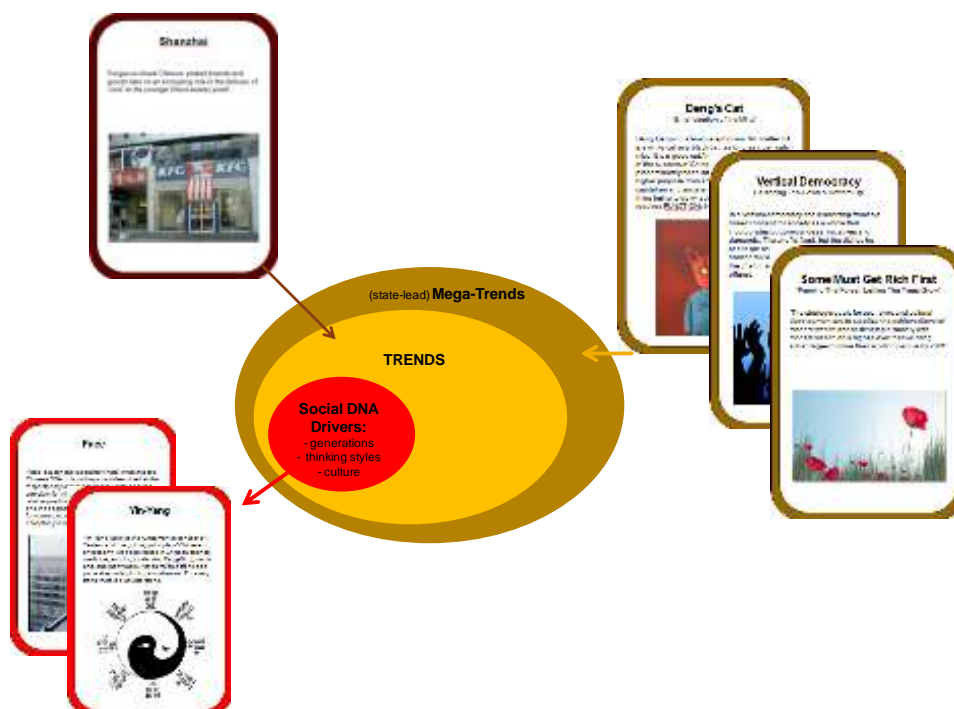


**Figure 2: Example Social-DNA/Cultural and Megatrends For China**

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Between these inner and outer layers, then, come the macro-level societal and market trends. The example illustrated in the Figure is a trend we called 'Shanzhai'. This is a trend all about tongue-in-cheek Chinese pirated brands and goods take on an increasing role in the delivery of 'cool' to the younger (West-aware) youth. So to take the example of the KFG fried chicken retailer illustration shown on the Trend card, here we have a trend that has emerged as a result of things like the Deng's Cat policy at the megatrend level, and also the idea of 'copying as a mark of respect' at the cultural DNA level.

Having now tested the TrenDNA(China) research output on a host of cases conducted with beta-clients in the region, we're rapidly approaching the point at which the book-of-the-method will be published to the world at large. We have also – we think – unraveled the mystery of how to incorporate the Megatrends into the overall TrenDNA process. In the next couple of months, we'll reproduce one of the case studies here in the e-zine so that readers can see how the different hierarchical levels of the trend story play out. In the meantime, the purpose of this article has been, first, to describe the presence of the outermost, third level of the hierarchy, and second to encourage readers to think about some of the likely implications for whatever part of the world they might find themselves in.

**Reference**

Naisbitt, J., Naisbitt, D., 'China's Megatrends: The Eight Pillars of a New Society', Collins Business, January 2010.

# Not Pushing Rivers
## ('It's The Economy, Stupid' Redux)



A few weeks ago we had occasion to be working with a charity organization based in the UK. The charity had been not long set up with the aim of addressing the current upsurge of teenage pregnancies in the country. Their aim in attending the (TrenDNA) workshop was to find better ways and means of engaging with the population of prospective teen mothers-to-be in order to convince them to rethink. At the end of the session, we decided the best strategy was to wait about 5-6 years and let the trend look after itself.

Or, taken another rather more cynical step, the smart teen-pregnancy-prevention charity would wait said 5-6 years before setting itself up, acquire the necessary funding and then sit back and watch teenage pregnancy rates fall without them actually having to do anything.

Put yet another way, a teenage-pregnancy reduction charity operating in today's UK environment (the country has, by some margin, the highest teen pregnancy rate of any European country) is fighting a generational tide it has virtually no chance of beating. Here is a charity that, in five years time will look back to measure the impact they've had only to find they've had essentially none. Here is a charity that it trying to push a river.

Smart charities – smart anybody – don't push rivers. Pushing rivers is hard work because rather than embracing and utilizing all of the energy contained in the flow, they are trying to fight against it. Smart charities make the energy contained in the flow work for them.

In the UK right now the teenage energy right now is being expended by a generation (Y) of Heroes. Heroes in the sense that whatever they do they will tend to do heroically: if someone is going to be abstemious, they will be heroically abstemious. Conversely, if they decide they will be sexually active, they will be heroically sexually active. Trying to stem such a flow of energy – especially if it's being done by a squadron of charity-establishing (Moralistic) Baby Boomers, the only likely result will be even more teenage pregnancies.

Looking at one of our Generational pictures (Figure 1), however, reveals the fact that in the above mentioned 5-6 year period, a generational shift takes place in our teenagers: all the Generation Y Heroes being replaced by a suffocated-becoming-sensitive Artist generation. But not only that, it will be a generation of teens that – according to the same generational picture – will be going through puberty at a crisis period in history.
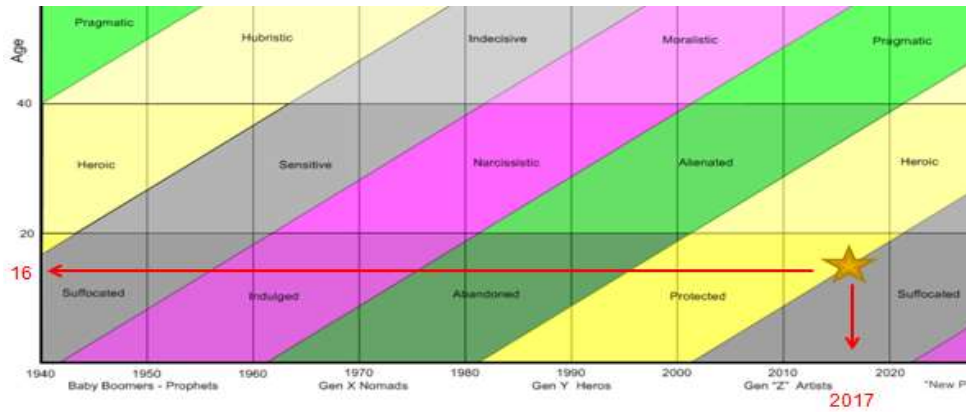
**Figure 1: Waiting For The Generational Teen-Tide To Turn**

What the Strauss/Howe generational cycle work tells us is that society is full of these kinds of oscillatory behaviours. Teen pregnancies go up, then, thanks to altering generational profiles, they come down again. Gender polarities go up and down and up again. Ditto age at first marriage, introversion/extroversion (see Generations article later in this e-zine), and so on seemingly ad infinitum.

There is, of course, nothing to say that these oscillatory patterns are set in stone and 'must' always exist. As we're seeing in our TrenDNA(China) research, extended periods of chaos can cause breaks in the pattern. But what we're also seeing is that once the chaos is returned to some kind of order, we tend to revert to the same self-sustaining oscillatory patterns that Strauss and Howe first observed.

As we've discussed in previous e-zines, these kinds of repeating oscillation are signs of societal contradictions that don't get resolved. A good way to think about why this happens is to see each oscillatory shift from one polar extreme to the next as an s-curve. And as we know, when we approach the top of one of these curves, a contradiction begins to emerge that first causes the trend to slow, and then eventually stall and begin its shift in the opposite direction.

Figure 2 illustrates what some of the main driving and stalling forces look like for the teenage pregnancy 'cycle':
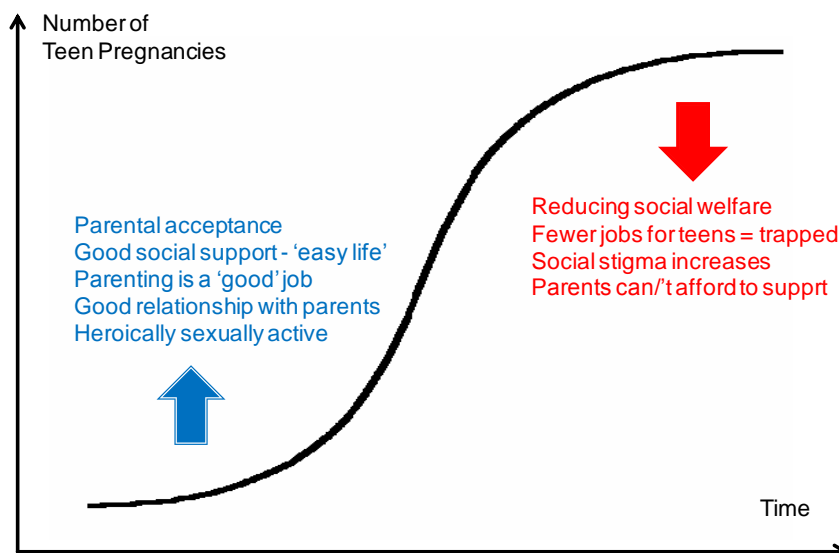


**Figure 2: UK Teen-Pregnancy Rate Driving Forces**

The trend arises in the first place, because a generation of Heroes has been raised by a generation of parents that are simultaneously alienated at a societal level and protective as parents. Heroes, in other words, tend to have a good relationship with their parents, have had a very pleasant – largely recession-free – upbringing, see their peer-relation oriented, non-confident parents and think to themselves, 'I want some of that, and, by the way, i can probably do it better than that.' Especially when they also see the Government providing lost of social security support to new parents (because, self-re-enforcing system again, the Government realizes the there aren't enough young people to pay the pensions of the swelling numbers of old people). If we've raised a generation of want-it-now children, and they can't win X-Factor, becoming a parent can very easily come to look like a very attractive and easy alternative to the other options.

But then, as inevitably happens, just as this trend reaches its peak and the social and prospective charity workers begin extrapolating the teen pregnancy figures and telling the media that pretty soon 'every' teen in the land will be pregnant before they leave school (more self-correcting: their scaremongering means the politicians are increasingly viewed as non-caring if they fail to do anything to 'fix' the problem – i.e. a 'caring' government has to be seen to be doing something. Like funding a charity.), the tide begins to turn.

It turns because of yet more self-correcting factors. First and perhaps most significant is the fact that the crisis-period economic woes mean that the Government has less money to devote to social welfare and pretty quickly, as inflation overtakes welfare payments, less-well-off teen mothers start to tell other prospective mothers that life as a teen-mother is not so great after all, and certainly isn't the 'easy life' it once appeared to be.

Secondly, albeit still related to the crisis period, the protective Nomad parents of the teens, who in the past decade have been more than willing to financially bail out their precious offspring no matter how heroically stupid their behavior, now find themselves also sitting on a financial knife-edge: much as they'd love to support their pregnant children, increasingly they can't. And, moreover, their teens, seeing recessionary times for the first time, are becoming increasingly aware of the fact and guilt begins to enter the picture.

Thirdly, and again ultimately relating to money, teen parents find themselves increasingly faced with the dilemma of having even more babies and relying on (not enough) state support, or going out to work to support their offspring in the suffocating manner they deserve. As option 1 becomes increasingly less attractive, option 2 – get a job – becomes the only other alternative. New problem: there aren't many jobs available, and what jobs there are, employers are much more likely to want to give to experienced older people over 'horrible' want-it-now, Heroes. Youth unemployment currently stands at over 25% in the UK largely because of this perception on the part of employers. And yet again, irrespective of the work or effectiveness of any teen-pregnancy reduction charity, the 'system' puts in place its own mechanisms to re-balance the trend.

Now, at this point, the representatives from the charity made what many readers might already have connected to in their minds: Maybe the establishment of the charity is also a causal factor in the re-balancing. In slightly disguised form, this is another causation-versus-correlation argument: do teen pregnancy rates drop *because of* the charity getting their message across or are the two things merely correlated?

The only answer to these kinds of question – on the basis of the saying that you can never expect a person being paid to do X that X isn't a good idea – is to let the pattern unfold.

Unfortunately for this particular charity, it was established and funded 'too early' in the cycle. As a consequence, now in their second year of existence, teen pregnancy levels

have continued to rise. Not only nationally, but, much to their surprise, also within the cities within their declared area of responsibility. This is what happens when we push rivers. And no amount of excuse ('we need a couple of years before we can get the message across to enough people') should carry any weight.

The effect of the charity in this case is second order at best. Like many other river-pushers, they find themselves in a classic Catch-22 situation: they want to help, but the only things that will actually help (working with the flow rather than against it) are politically unacceptable – i.e. they cannot be seen to be promoting the economic crisis, creating a social stigma, or reducing social welfare funding that are the actual, first-order, drivers that will cause the trend to reverse. As we've said many times, people do things for good reasons and real reasons. Very often, however, the 'real' reasons are precisely the ones that are politically incorrect.

In the 1992 US election, Bill Clinton famously won in no small part due to the 'it's the economy, stupid' campaign message. His meaning at the time was the desire to switch the electorate's attention away from wars in other countries to what was important at home. The saying has subsequently come to mean something different. Something again related to the idea of not pushing rivers. Teen pregnancy rates in the UK will naturally begin to fall after around 2017 and this fall, we predict, will have nothing to do with the charities: it's the economy, stupid.

Meanwhile, I've been speaking to the Charity Commission, and am all set to go. In, let's say, January 2017. Then after that has been shown to 'work', it will be time to switch from teen pregnancy to, hmm, an alcohol-dependency support programme. And then, towards the end of the crisis, I'm setting up my social welfare charity. Oh, and psychiatric services for GenYers that somehow still haven't become the CEO of Tesco's like their parents promised. Welcome to the charity version of the world of 'inevitable surprises'.

**Not So funny – World's Greatest Airport #2**


I'm beginning to think I've uncovered some kind of a pattern. Following my recent nightmare experience in Istanbul's version of the 'world's greatest airport' (see 'Worst of 2011' feature in last month's e-zine), this month I found myself connecting through Delhi's new airport. Apparently, according to the million signs I read within the first 100m after stepping off my plane, here was yet another 'world's greatest airport'. Putting aside the inklings of the nervous tic created in Istanbul, I figured maybe the Trade Descriptions legislation in India might be a tad stronger than it obviously was in Turkey: maybe this time it might actually be true. Given that I had thirteen hours to wait for my connecting flight, I crossed my fingers as I walked towards the Flight Connections centre.

On the way, I walked past a sign telling me how relaxing and sophisticated the airport's transit hotel was. A grin appears on my face: I get to spend eight of my thirteen hours sleeping on world's greatest fresh cotton sheets.

Five more minutes of walking along a string of travellators, I finally reach the Connections desk. No queue: fantastic. Okay, so it's 2.30am local time, but even so, the fact that there are six people sitting behind the counter and no mile-long queue of boarding-pass-less people standing in front of them allows me to put another tick in the world's greatest airport column.

I have an e-ticket, so just need someone to assign me a seat on my next flight and print me out a boarding pass. I've just come from Australia and Singapore, where I'd been told that because my connecting flight was a different airline, they couldn't print out my boarding pass for me.

I walk up to the desk. A youthful smile greets me. 'Hello,' she says to me. She has made some kind of intuitive connection to the fact I might be British. Despite the time, I manage a smile back, 'hello'.

'Can I help?' she asks. I can see her name badge. It says 'Sampoorna'.

I hand her my e-ticket information, 'I need the boarding pass for my Virgin flight to London'. I'm still smiling. She smiles back.

'You will need to come back at 8am,' she beams.

I look around me, 'excuse me?'

'The Virgin representative arrives at 8am.'

'But that's nearly six hours from now.'

She nods, obviously impressed at my time-telling capabilities, 'it is.'

'But. What do I do between now and then?' I look around again. There is nothing but travellators and empty walkway behind me, and a security guard manning the x-ray machines to the side. 'Where's the transit hotel?'

Sampoorna nods in the direction of the security guard, 'two minute's walk into the Departures Lounge.'

A moment of relief, 'can I go and come back later?'

'Sorry, no.'

'No?' I can already sense what is coming.

'You need a boarding pass to get into the Departures Lounge.'

'Can you really not print me one?'

I see her head shake, the smile disappear.

'So,' I say, going back to my original question, 'what do I do between now and then?'

Sampoorna points back towards the walkway, 'there are some seats around the corner, by Gate 15.'

'And?'

Her turn to look puzzled.

'What about something to eat? Drink?'

Her smile comes back now, 'sorry, no.'

I ask to speak to her boss. She says he will also be arriving at 8am. I ask her if she could phone him. Or someone. She cannot. She starts to look down at her desk, I think, to try and find some imaginary paperwork she can pretend to attend to. It seems she has finished helping me. She is nice, they wouldn't employ anyone who wasn't at the World's Greatest Airport after all, but now it has become clear that I must enjoy the world's greatest seats at Gate 15 all by myself. I tell her thankyou, and walk away.

The seats at Gate 15 turn out to be the sorts of seat designed to keep people moving. They are not comfortable. But at least I find one close to a power outlet. I decide that, in the absence of fresh cotton sheets, I will at least be able to do some work to make the time pass a little faster.

Another smile. The World's Greatest Airport has a wireless signal even in the walkways to Immigration and Flight Connections. The opening screen tells me that I can access the service for 20 free minutes. After which I have to pay. The price looks reasonable, so I elect to pay for some time. The screen tells me to enter my credit card details and mobile phone number. I see my money being taken, then the screen tells me that they will SMS my password details to my mobile phone.

I wait a minute, looking at my phone. Another minute. Then another. Then I start looking at the computer screen for some indication when I might expect to receive my password. Nothing. More minutes pass. I look for the number of someone I can call, or a help-line email address. Nothing. I start composing an email anyway, 'Dear sir or madam, you seem to have extracted money from my credit card and not sent me my password details…'

Ten more minutes go by. And another ten. My email to the non-existent helpline is now becoming quite long. I am giving them the history of my last 20 hours sitting on planes flying from Sydney to Melbourne to Singapore, and how I am sitting in a walkway on an uncomfortable seat next to Gate 15. How I have paid for internet access that I still don't have. How the representative from Virgin Atlantic is not coming for another five hours, how I'm not enjoying the World's Greatest Airport. When I find myself writing the first swear word, I decide it is time to turn my computer off.

Nothing happens for a while. No SMS arrives. No fresh cotton sheets. No early-to-work Virgin representative. I drift to sleep, wake up a couple of hours later when some of the staff from the Flight Connections counter decide that the seats next to Gate 15 are a good place to take a conversation break. One of them has a cup of something hot. I look at it longingly. The person holding the drink is called Vijit. Or if not, he is wearing Vijit's badge. I ask Vigit where he obtained his drink from. He does not want to talk to me, looks at me is a manner that is intended to clearly imply, 'I am sitting here with my colleagues, it is 5 o'clock in the morning, we've been working since 9, this is our only break, and please don't interrupt me'. When I keep looking at him, he finally nods towards the Flight Connections desk, 'the office'.

'Any chance….' I start.

Vijit shakes his head, 'staff only', then looks back to his colleagues.

I tell him, thanks for trying, and get up to go for a walk. There are more seats at Gate 22. They are the same design of seat, but they don't have Flight Connections people sitting in them. Finally, three eons later, the clock on my still SMS-less mobile phone says it is ten past eight in the morning. I can't see outside, because the walkway has no windows to the outside world, but I imagine it is light now, that the Virgin representative in the World's Greatest Airport has arrived into the building and is stood waiting for me at the Flight Connections desk.

When I arrive at the desk, there is no Sampoorna and no Vijit. But there is a small army of new people, and still only a handful of weary travelers negotiating their way to receiving a boarding pass that will allow them to pass into the World's Greatest Departure Lounge.

I walk up to the first staff member that makes eye contact. She isn't wearing her badge yet, so I don't know her name. She asks me what airline am I looking for. I tell her. She nods, 'they will arrive at 9.30'.

I look puzzled, 'your colleague said 8?'

She shakes her head, '9.30. Ten latest.'

'But. I've been here for six hours now. Waiting. I haven't had a drink. Nothing to eat.' I nod in the direction of what I assume is the office where Vijit's drink was made. She doesn't get the hint, '9.30.'

I take another walk, trying to remember that Effective people remember that there is a choice about whether to get angry about a situation or not. I am still on the 'not' side of the fence, but, when I look over at the other side, I'm beginning to think that angry feels like a preferable alternative.

Another hour and a half goes by at glacial speed. I manage to remain on the 'not angry' side of the fence. Even after, when I walk up to the Flight Connections desk this time, there is now a long queue of other people waiting to collect new boarding passes. I see the girl behind the desk that I talked to earlier look at me, then look away. She knows I'm going to ask if I have to stand at the back of the queue even though I've been here for now nearly eight hours.

I stand at the back of the queue. The queue also moves at glacial speed. There are almost as many people behind the desk now as there are hopeful passengers standing in front of it. Most of them don't seem to be doing anything except watch how the queue isn't moving.

Another small eon passes, and I'm now starting to contemplate the possibility that I may be the first person in the history of air-travel to somehow miss a flight after a thirteen hour connection.

Finally my turn arrives and I find myself standing in front of someone wearing a Virgin lanyard and badge. She smiles. I resist the urge to weep.

Even after she takes my details and tells me to go sit in one of the seats while she sorts out my details.

'What details?'

'Your baggage.'

'I don't have any baggage,' I hold up my two carry-on bags to show her what an experienced traveler I am.

'Your other details.'

I look over the top of the desk at her clipboard. It looks to be full of details. Including what seems to be a list containing only one name of a person connecting onto a Virgin flight.

'Is that me there?' I nod towards the list-of-one-name.

Her turn to nod.

'What else do you need?' I ask.

Her pen taps onto the board, 'you're not supposed to be here until the 8th.'

I remain calm. 'That was my original itinerary. We changed to today.'

She nods, 'I'll be back in 5 minutes.'

Twenty minutes go by. I debate whether to go back to my seat at Gate 15 or shackle myself to the desk. Other people in the queue are looking at me and the lack of Virgin assistant on the other side of the desk. I shrug. It's the best I can offer.

Finally my Representative returns. I see now her name is Padma. She is smiling, brandishing what looks like a Virgin boarding pass, 'you can go,' she says.

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I look at my watch, it is now over ten hours since I landed. I tell this to Padma. She smiles again, 'Security is just over there.'

I walk over to the next glacial queue. Better to do as you're told. A person can choose to be angry, or not be angry. Even when they're hungry.

When I finally get through into the Departures Lounge of the World's Greatest Airport, the first thing is see is the transit hotel. It looks exactly like the transit hotel in the World's Greatest Airport should. Except it is positioned 200m on the wrong side of the airport.

The next thing I hear is the pre-recorded flight announcer. I don't listen to what she is saying. All I'm struck by is how this voice is the exact same recording as the voice I heard in Istanbul. It is, as one would by now come to expect, the voice of the announcer at all of the World's Greatest Airports.

**Patent of the Month – Spherical Piezoelectric Motor**

Patent of the month this month takes us on a not-infrequent trip to Taiwan. US8,110,967 was granted to inventors at Chung-Yuan Christian University on February 7. The invention relates to actuator systems for multi-degree-of-freedom systems.

Here's how the inventors describe the problem their invention now claims to resolve:

*Generally, piezoelectric motor has the advantages of small size, light weight, less noise, high thrust at low speed, high holding force, fast response, and no EMI problem, and so on. It has been widely used in many areas such as digital still camera, watch, automobile, robot, micro positioning system, medical device, aerospace, and micro machinery, etc.*

*In order to achieve multi degrees of freedom by using piezoelectric motors, a few implementations have been proposed, such as (1) using piezoelectric actuators to support and to drive a spherical rotor so as to control the motions of the spherical rotor, this type of piezoelectric motor is used as the device of Scanning Electron Microscope (SEM); (2) using multi disc-type piezoelectric actuators to drive a spherical rotor, since each piezoelectric actuator is driven with a different vibration mode, therefore, multi degrees of freedom is achieved by mixing different vibration modes; and (3) using three sets of ring-shaped piezoelectric actuators implemented with equal spatial distance to drive a spherical rotor to achieve three degrees of freedom, this type of piezoelectric motor is used in multi-axis mechanical manipulators or CCD surveillance cameras.*

*Although the present piezoelectric motors provide various advantages and functions, the implementations of the above-described piezoelectric motors are still complicated; therefore, it is necessary to provide a simple rotary piezoelectric motor design which can achieve multi degrees of freedom.*

From a contradiction-finding perspective, the last paragraph of this description makes life rather easy for us: there is a need for actuation in multiple directions, and the current means of doing so are complicated. Here's how we might best map that problem onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Length/Angle of Moving Object (3)

WORSENING PARAMETERS YOU HAVE SELECTED:

System Complexity (45)

SUGGESTED INVENTIVE PRINCIPLES:

1, 19, 24, 26, 28, 5, 2, 29

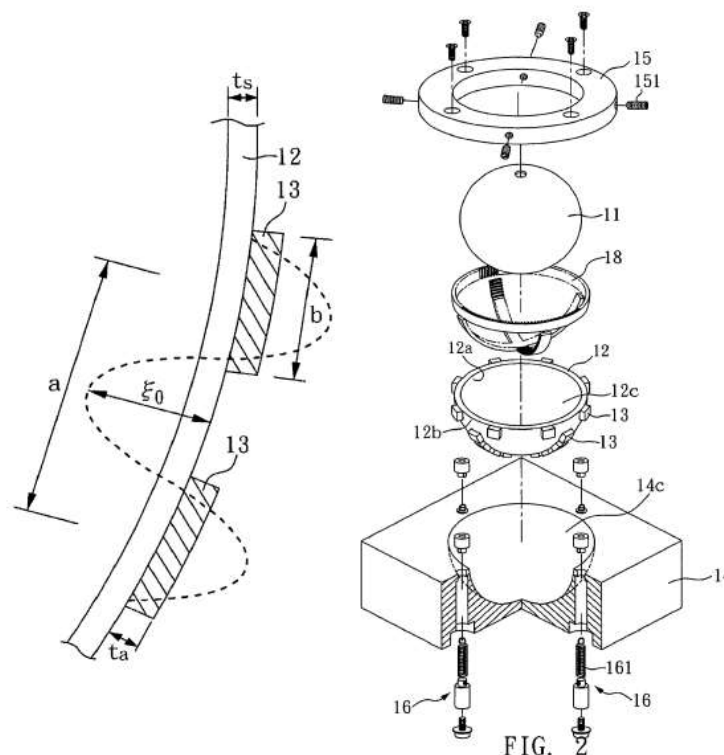And here's how the inventors describe their solution to the problem:

*…the present invention provides a spherical rotary piezoelectric motor, which comprises a spherical rotor, a hemispherical stator, and a plurality of piezoelectric actuators. The hemispherical stator comprises an inner surface and an outer surface, wherein the inner surface forms a hemispherical hollow portion, and the hemispherical hollow portion substantially corresponds to the spherical rotor such that the hemispherical hollow portion receives a portion of the spherical rotor (such as one half of the spherical rotor so as to facilitate rotation). A plurality of piezoelectric actuators is disposed on the outer surface of the hemispherical stator respectively. The plurality of piezoelectric actuators drives the hemispherical stator to generate a traveling wave with an elliptical motion, and the spherical rotor can rotate with at least one degree of freedom caused by*

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*the traveling wave with the elliptical motion.*

Perhaps the most apparent aspect of this solution is the use of segmentation (Principle 1) of the piezoelectric actuators. The most striking, however – at least for us – is the strategy of using a travelling wave to achieve the desired multi-directional motion. At its simplest level, a travelling wave is a special case of a Periodic Action (Principle 19), and for this connection alone, it is worth noting that what the inventors have done is completely consistent with what the majority of contradiction solvers in this kind of directionality-versus-complexity conflict have done.
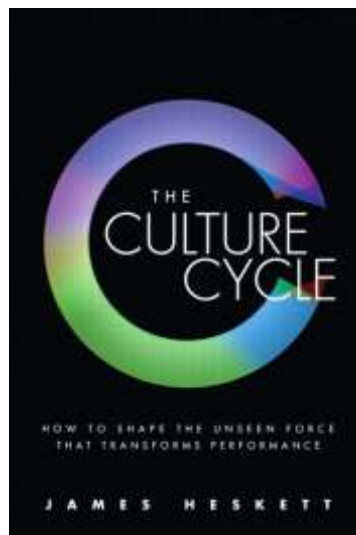
Much more important, though, is the recognition that a travelling wave represents the (at present) final stage along the Rhythm Coordination trend of evolution. Here's the trend that would also have told anyone working on this problem that continuous actions would benefit from evolving to pulsing. But it also clearly states that beyond the pulsing stage are two more stages: making use of resonance and making use of harmonics (or travelling waves). The fact that the inventors have 'evolved' a solution that is all the way along the trend gives us a new illustration of the trend in action.

We frequently find ourselves telling workshop delegates that Rhythm Coordination is one of the most important of the SI Evolution Potential trends. We mainly say it because, right now, in the majority of industries technical solutions are predominantly at the first stage of the trend. It is, in other words, a trend with a lot of untapped potential. Great to see, thanks to this patent, that indeed there is a benefit in going all the way to the end. No doubt we'll be keeping a close eye on this research to see if here's is a group of inventors that eventually manages to identify a new, fifth, stage at the end of the trend. Rest assured, you'll be the second to know about it if they do. In the meantime, bask in the elegance of the solution in its current form.



FIG. 2

**Best of the Month - The Culture Cycle**

For a while there we thought we were going to have to cancel the Best of the Month' slot this month. A trawl through over 1200 innovation-related books published in the last four months revealed a big fat zero. Other than a cluster of early potential candidates for worst of the year. Fortunately, Harvard Business School Press ultimately saved the day – as they still so often do. James Heskett's 'The Culture Cycle' turned out to be something of a sly gem of a book. Albeit, at close on 340 pages, it would have to count more as a reference book than a plane-read. Not that that fact should prevent you from checking it out.

THE CULTURE CYCLE

HOW TO SHAPE THE UNSEEN FORCE
THAT TRANSFORMS PERFORMANCE

JAMES HESKETT

First up, the negative stuff: three things. Firstly, Heskett spends a tad too much time reliving past glories in the form of his earlier collaborations on the culture subject with John Kotter. In many ways, this new book should be seen as something of an update rather than a radical re-invention. Secondly, perhaps linked to the first point, is that too many of the case studies (Wal-Mart, SWA, P&G) have probably now reached their limits in terms of over-familiarity. Thirdly, and most seriously, the chapter on innovation and culture is by some way the weakest part of the book. A fairly big 'ouch' given our focus on the subject…

…although, that said, if you read the offending chapter from the perspective of irritant rather than enlightenment, then you should still be able to squeeze out one or two interesting insights.

Still, enough of the griping, the remainder of the book manages to make a pretty darn good stab at turning one of the fuzziest elements of corporate life ('culture') into what might begin to be called a science. At the heart of the book is a circular diagram describing the titular 'cycle'. It contains the following steps:

1. Mission, Shared Assumptions, and Values -- Alignment with Strategies and Methods of Execution

2. Setting Expectations

3. Behaviors Consistent with Shared Assumptions and Values

4. Expectations (e.g. leadership, recognition, job opportunity, personal development)

5. Core Phenomena (Trust, Engagement, and Ownership)

6. Policies, Practices, and Behaviors (e.g. self-direction, accountability, transparency, collaboration)

7. Organization Learning (e.g. continuous improvement, adaptability, agility, and speed)

8. Results (Four Rs, innovation, growth, and profitability)

Steps 2 - 4 are labeled "Causes (Less Visible)" and steps 6 - 8 "Effects (More Visible)." Step 1 is at the top of the cycle and both the beginning and the end -- or beginning of the next turn of the cycle. Step 5 is at a halfway point and bridges causes to effects. No surprise to learn that the cycle in effect describes the various different stage of what we might like to think of as a corporate-culture S-Curve. Read in this light, the book starts to take on the sheen of an important addition to the management canon. And if not quite reaching such heady heights, it ought to do much to encourage you to give it a serious try.

The 'Four Rs' of Step 8 are 'the results of an effective culture'. They represent what we think is another insightful aspect of the book. The four Rs are:

Referrals: A higher proportion of potential employees recommended by current or former employees.

Retention: Lower recruiting, hiring, training, and lost productivity costs because of greater employee loyalty.

Returns to labor: Greater productivity per dollar of compensation.

Relationships: Better customer relationships, resulting in greater loyalty, lower customer acquisition costs, and more sales.'
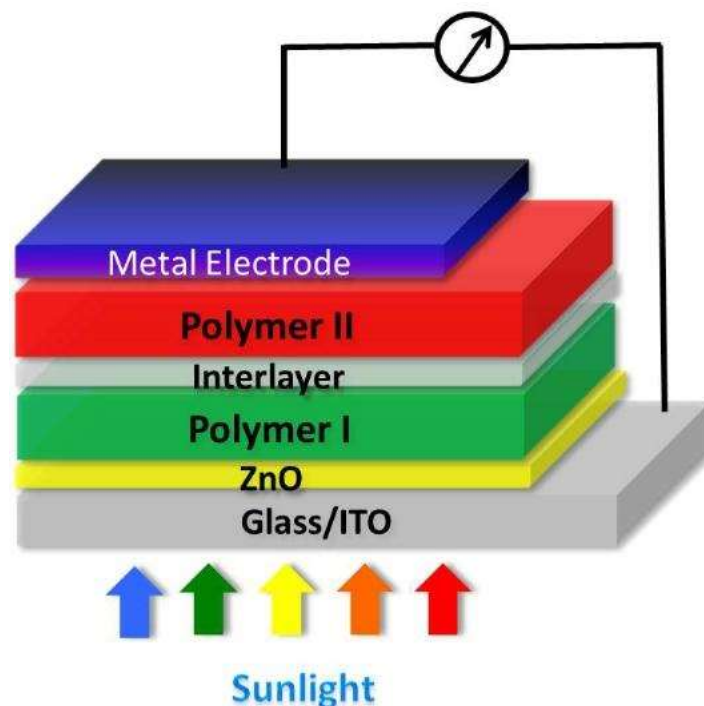
There are many management consultants out in the world who would argue that it is not possible to either measure or change culture inside an organization. Heskett goes a long way to counter the first argument (the survey instruments contained within the book have to be considered at the very least as a 'credible start point'), and has a fair amount to say about the latter. Culture-change might be something that can be measured on a management dashboard, but changing it can only be done indirectly by first identifying the available levers, and then knowing which way to move them. In this regard, again, Heskett provides at least some kind of foundation upon which to build upon. The book albeit strongly academic in structure and content, is not really a how-to book, usually ending towards the abstract rather than the concrete when it comes to closing out the many application stories and cases.

Ultimately, given the poor contribution of the 1200 other 'candidates' we reviewed, this book has to count as 'top percentile'. Both the Cycle itself and the four Rs for measuring culture will, we think, both come to be viewed as strong contributions to the state of the art.

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**Investments – Polymer Solar Cells**

In the effort to convert sunlight into electricity, photovoltaic solar cells that use conductive organic polymers for light absorption and conversion have shown great potential for some time now. Their biggest theoretical advantage is that they can be produced in high volumes at low cost, resulting in photovoltaic devices that are cheap, lightweight and flexible. The reality, however, has been that this cost advantage is offset by efficiencies some way below those deemed necessary to make a commercially practicable solution.

In the last few years, much work has been done to improve the efficiency with which these devices convert sunlight into power, including the development of new materials, device structures and processing techniques. In a new study, first published in February in the online journal *Nature Photonics*, researchers at the UCLA Henry Samueli School of Engineering and Applied Science and UCLA's California Nanosystems Institute (CNSI) report that they have significantly enhanced polymer solar cells' performance by building a device with a new "tandem" structure that combines multiple cells with different absorption bands. The device had a certified power-conversion efficiency of 8.62 percent and set a world record in July 2011.



Further, after the researchers incorporated a new infrared-absorbing polymer material provided by Sumitomo Chemical of Japan into the device, the device's architecture proved to be widely applicable and the power-conversion efficiency jumped to 10.6 percent – another new record – as certified by the U.S. Department of Energy's National Renewable Energy Laboratory.

By using cells with different absorption bands, tandem solar cells provide an effective way to harvest a broader spectrum of solar radiation. However, the efficiency doesn't automatically increase by simply combining two cells. The materials for the tandem cells have to be compatible with each other for efficient light harvesting, the researchers said.

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Until now, the performance of tandem devices lagged behind single-layer solar cells, mainly due to this lack of suitable polymer materials. UCLA Engineering researchers have demonstrated highly efficient single-layer and tandem polymer solar cells featuring a low-band-gap-conjugated polymer specially designed for the tandem structure. The band gap determines the portion of the solar spectrum a polymer absorbs.

"Envision a double-decker bus," said Yang Yang, a professor of materials science and engineering at UCLA Engineering and principal investigator on the research. "The bus can carry a certain number of passengers on one deck, but if you were to add a second deck, you could hold many more people for the same amount of space. That's what we've done here with the tandem polymer solar cell."

To use solar radiation more effectively, Yang's team stacked, in series, multiple photoactive layers with complementary absorption spectra to construct a tandem polymer solar cell. Their tandem structure consists of a front cell with a larger (or high) band gap material and a rear cell with a smaller (or low) band gap polymer, connected by a designed interlayer.

When compared to a single-layer device, the tandem device is more efficient in utilizing solar energy, particularly by minimizing other energy losses. By using more than one absorption material, each capturing a different part of the solar spectrum, the tandem cell is able to maintain the current and increase the output voltage. These factors enable the increase in efficiency, the researchers said.

"The solar spectra is very broad and covers the visible as well as the invisible, the infrared and the UV," said Shuji Doi, research group manager for Sumitomo Chemical. "We are very excited that Sumitomo's low-band gap polymer has contributed to the new record efficiency."

"We have been doing research in tandem solar cells for a much shorter length of time than in the single-junction devices," said Gang Li, a member of the research faculty at UCLA Engineering and a co-author of the Nature Photonics paper. "For us to achieve such success in improving the efficiency in this short time period truly demonstrates the great potential of tandem solar cell technology."

"Everything is done by a very low-cost wet-coating process," Yang said. "As this process is compatible with current manufacturing, I anticipate this technology will become commercially viable in the near future."

This study opens up a new direction for polymer chemists to pursue designs of new materials for tandem polymer solar cells. Furthermore, it indicates an important step towards the commercialization of polymer solar cells. Yang said his team hopes to reach 15 percent efficiency in the next few years.

More details at:
Letian Dou, Jingbi You, Jun Yang, Chun-Chao Chen, Youjun He, Seiichiro Murase, Tom Moriarty, Keith Emery, Gang Li, Yang Yang. Tandem polymer solar cells featuring a spectrally matched low-bandgap polymer. *Nature Photonics*, 2012; DOI: 10.1038/nphoton.2011.356
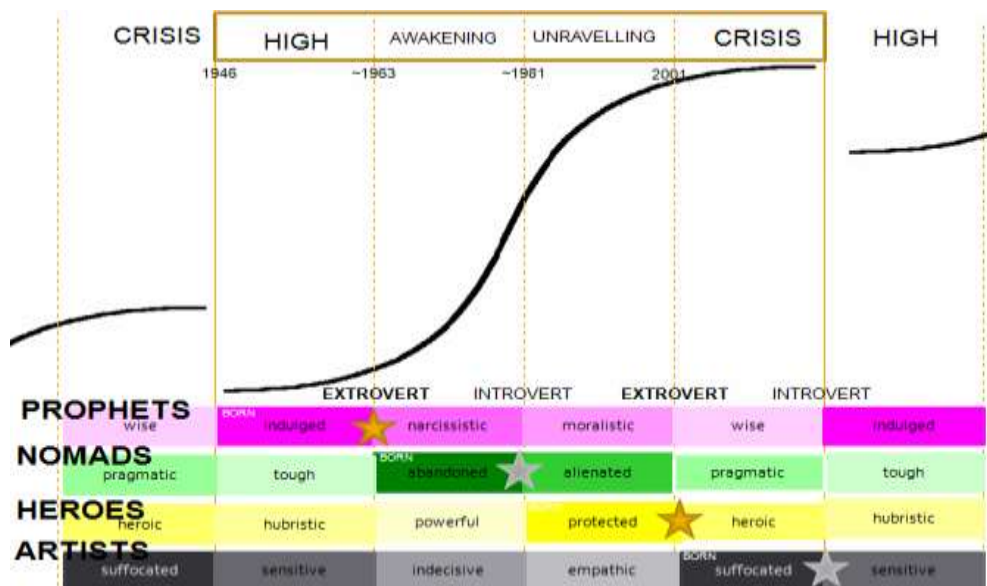
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**Generational Cycles – Introvert/Extrovert**

People reaching their late teens, and reaching a point of first escape from direct parental influence for the first time, all have the tendency to look alike when viewed by older generations: Loud, brash, obnoxious, opinionated know-it-alls being some of the typical descriptions. At the present time, with the bulk of Generation Y still going through this 'entering the world' phase, the forcefulness of the descriptions are perhaps as great as they ever will be. It's the time we discover the opposite sex and 'sinful' activities of many different hues; the time we have the chance for the first time to test some of societies boundaries rather than just those imposed by our parents.

But is it really true that all teens across the generations are the same obnoxious, difficult-to-like people?

They all come from quite different upbringings from their parents, of course: Generation Y Heroes have been protected; Artists will have been suffocated; Prophets indulged and Nomads abandoned. They all find themselves, too, in cohorts of widely varying sizes, such that Prophets and Heroes both find themselves as a part of comparatively big generations, while Artists and Nomads emerge in much smaller numbers.

One of the main things we see emerging through these core differences is a generational oscillation between introversion and extroversion during the 'entering the world' years. The Prophets and Heroes get to be the extroverts; while the Artists and Nomads get to be the introverts. Here's how we think those propensities connect back to the overall generation cycle pattern:



The stars on the figure illustrate the late-teens period for each of the four generational archetypes in relation to their relative position through the different societal phases. Let's have a brief look at each cohort to explore why they exhibit the introverted or extroverted trait:

*Prophets*: are born at the beginning of a new societal S-curve, after the end of a 'crisis' period. One consequence of the crisis ending is that birth rates tend to rise (hence 'baby-boomer'), the other is that the children are indulged. Being one among an enormous army of others, gives Prophets the first impetus to be extrovert – the easiest way to stand out
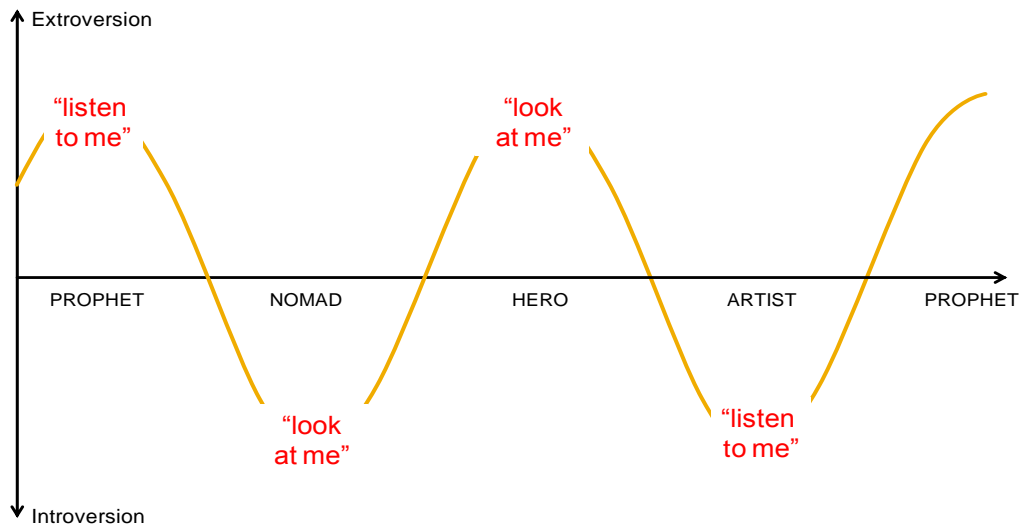
from the crowd is to be louder and more brash than everyone else in the crowd; being indulged and told they represent the dawn of a new age by their parents and teachers gives them an important second. Taken together, the extrovert Prophet enters the world with a strong desire to be listened to.

*Nomads*: shouty, narcissistic parents tend to have less babies, and so Nomads form something of a baby-bust period in the societal cycle. There's now much less need to be loud to stand out from the crowd, because, put simply, the crowd is much smaller. Their 'abandonment', however, tends to re-enforce their introversion. Nomad 'latch-key' kids did a lot of self-rearing when they were growing up and so pretty quickly learned to be self-sufficient. Albeit in a manner which frequently meant they did not receive much feedback during the process. Nomads tend to introversion, in other words, because there are less of them, and they've never been that confident that whatever they're doing they're doing correctly.

*Heroes*: the alienated (at society; at *their* parents) Nomads tend to flip to the opposite perspective on the world that their parents had. As a result, the birth-rate goes up to produce a big cohort and parents become very protective of their children. Heroes thus tend towards extroversion when they enter the world because, firstly, they have a bigger crowd to stand out from again, and second – more importantly – because they've continually been told how important they are ('Princess on board') and been isolated from as much negative stuff as possible, they now think they can do anything. And do it instantly, without the 'paying of dues' the Nomads had to. Heroes, as a result of these two drivers, tend to be extrovert in a 'look at me' manner.

*Artists*: the generation of youngsters currently being raise (children born after 2001) now tend to be protected to the point of suffocation by their parents. Historically, this means that they enter the world in an uncertain manner. Perhaps more importantly for this cohort, however, is the timing of their arrival onto the planet, during the final, winter, 'crisis' phase of the four-part societal cycle. Crisis periods tend to be periods in which the crisis becomes more important than the child ('little children should be seen but not heard'), less children get born as a result (how can we afford another?') and also, children raised during times when parents are short of money and often losing their jobs tends to plant important seeds of how difficult the world is, and how, you're more likely to keep your job if you keep your head down.

Putting the pieces all together again, here's how we think the late-teen introversion/ extroversion oscillation works:
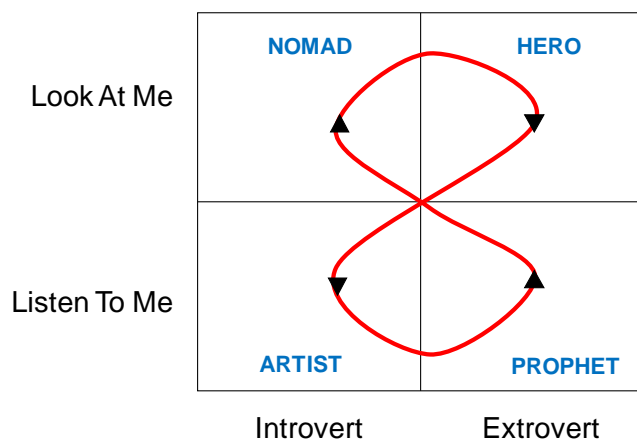
Important to note here are what we think are two quite different types of introversion and extroversion at different parts of the cycle. Prophets tend to have an extroversion focused on the knowledge and the spoken word ('listen to me'), whereas for the Heroes, and their world of instant gratification, the extroversion tends to focus – a al X-Factor – much more around the visual and 'look at me'.

For the 'introvert' generations, the look/listen trait is, for obvious, reasons rather less visible. We tend to have to look to the extremes to find which if either form of introversion is occurring. For the coming-of-age Nomads in the late 1970s and early 1980s, we see first of all punks, then disco then new-romantics then 'shoe-gazing' Goths. Or, put another way, a very visual kind of introversion. A lot of this quiet rebellion, we think, was as a reaction to parents whose proclamations about changing the world were beginning to ring hollow – 'for all your shouting, nothing has changed, so why bother shouting?'

For the Artists, we currently have to look back to the previous 'Silent' Artist generation to explore their particular type of introversion. We think the iconic drivers this time are people like Jack Kerouac, Allen Ginsberg: people who tended to express their coming of age rebellion rather more philosophically and reflectively. They were - and again perhaps in reaction to their 'look at me' parents – much more about 'listen to me'. The early signs are that the first of the new Artists – a group who will start coming of age starting from the second half of this decade – will react against their 'look at me' parents in much the same manner.

Which, taken all together gives us this intriguing picture:

# Biology – Humpback Whale (Megaptera novaeangliae) Pectoral Fin



Humpback Whales are distinctive in that they have the largest appendages of any living animal, namely their knobbly pectoral fins. Appendages which are close to 1/3 of the total length of the whale. These pectoral fins may be completely white or only white, or partly white, on the underside. The leading edge of these fins are crenelated with a series of bumps and knobs, often with encrusting barnacles. The pectoral fins are used for a variety of purposes including banking, breaking, propulsion (though only slightly as the bulk of their movement is controlled by the tail flukes), defence and as flails during mating behaviour.

The fins first struck our interest because it could be speculated that the crenelations represent another biological illustration of the surface segmentation trend – the trend that tells us that protruded surfaces are always more ideal than smooth ones.

Now, the next stage in an intriguing piece of biomimetics research from Germany has revealed at least a part of what that benefit is:

First, they inspired more efficient wind turbine blades. Next, their unique qualities were copied by sea-bed turbines to harness tidal flow energy. Now, they've led to rotor blades that allow helicopters to be more maneuverable. And this maneuverability benefit all comes down to the leading edge crenelations, more correctly known as tubercles.

For animals that are so huge and heavy, humpback whales are surprisingly fast and agile underwater. This turns out to be because of the tubercles on the front of their pectoral fins. The protrusions cause the water to flow over the fins in such a way that extra lift is created. Applied to both wind and undersea turbines, such bumps give them more lift, too. Rotor blades, on the other hand, are not so perfectly designed. When a helicopter is flying forward, the blade that is advancing forward (in the same direction as the aircraft) is traveling faster than the blade opposite it, which is retreating backward. This can cause the retreating blade to temporarily lose lift and experience a "dynamic stall." This in turn results in turbulence, places stress on the rotors and their control rods, and limits the top speeds and maneuverability of the helicopter.

If the retreating blade were able to generate more lift, however, the point at which it stalled would be delayed. That's where the tubercles come in.

Scientists from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt, or DLR) glued a series of six-millimeter-wide rubber bumps onto the edges of all four of a helicopter's rotor blades - 186 on each blade. The bumps have been patented as Leading-Edge Vortex Generators (LEVoGs).

After showing promising results in wind tunnel tests, the helicopter was tried out in actual flights by test pilots. Apparently, they noticed a definite improvement in performance. On subsequent flights, instruments will be present to actually measure the differences.
The researchers are now hoping that existing rotors could be inexpensively retrofitted with the LEVoGs, while new titanium blades could be made with them already milled into the metal.

All in all a really nice addition to the not-yet-big-enough portfolio of biomimetics success stories. From our SI perspective, it is perhaps more interesting to examine the tubercle solution as the resolution to a contradiction. Here's how we think that contradiction best maps onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Force/Torque (15)

WORSENING PARAMETERS YOU HAVE SELECTED:

Area of Moving Object (5)

SUGGESTED INVENTIVE PRINCIPLES:

15, 17, 10, 14, 19, 3, 29, 39, 40

The primary conflict, in other words, concerns the fight between the desire to generate more lift (and dynamic stall prevention) forces, and the desire to minimize the area of the fin (bearing in mind it is already, as mentioned, a third of the length of the overall whale).

Comforting, then, to observe that Inventive Principles 17, Another Dimension and 3, Local Quality – the Principles that best correspond to the tubercle design strategy – are both contained in the list of most frequently used strategy for this type of problem. Also interesting to note is the presence of Inventive Principle 15, Dynamics at the top of the list. There's no mention from the German research that there would be a benefit to having variable geometry tubercles, but our bet is that there would be.

Finally, and also going to have to be left here as an unsolved mystery, is whether the humpback's 'strategy' of allowing barnacles to position themselves on the fin is also deliberate: even better than evolving tubercles, attract tubercle-shaped creatures to attach themselves at judicious locations on the fin. Whether the same strategy can be applied in the helicopter world remains to be seen. Fortunately for the barnacles, the different Reynolds Number environment saves them from a life of being strapped to rotor blades spinning at several hundred metres per second.

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# Short Thort

# News

### Japan TRIZ Conference
It has just been announced that this year's Japan TRIZ conference will be held in Tokyo between 6 and 8 September. With a following wind, we hope to be there to present.. especially if we're able to make the trip coincide with the DSM conference scheduled in Kyoto the following week.

### Taylor's University
Our favourite Malaysian university has just appointed Darrell as an Adjunct Professor. Aside from being extremely flattered, we're greatly looking forward to working with some of the most forward looking academics on the planet. And an opportunity to conduct some great student projects. What we love most about Taylor's is a starting assumption that anything is possible. And then that limited resource availability shouldn't form any kind of insurmountable barrier. Here's to the achievement of great things in the coming months and years.

### World Innovation Forum
This year's big WIF event will take place in Kuala Lumpur. We'll be keynoting on one of the days. The overall event runs between the 4th and 6th of November. Hopefully it will represent an opportunity to formally launch the ICMM initiative in Malaysia… following a series of other national launches occurring through the year as we move towards November.

**TrenDNA(India)**
We have just commenced a project with IIT Guwahati to begin the process of collating and making sense of the generational-cycle research we have been doing on the India subcontinent. Several of our good friends in India have already offered their time to assist in the project (thanks! – you know who you are). Anyone else wishing to participate in some way might get in touch with Darrell in the first instance.

**trendna.com**
we expect to have our dedicated TrenDNA website up and running some time during March. The site is intended to reflect the needs of our VoC customers, without forcing them to plough through a mass of TRIZ/SI content.

**New Projects**
This month's new projects from around the Network:
        FMCG – IP strategy study
        Electronics – new product concept design study
        Conglomerate – Business Model Innovation workshop – 2 additional parts
        Mining – in-house SI Certification workshop series
        Aerospace – SI seminar and Certification workshops
        Financial Services – TrenDNA study
        Retail – innovation strategy study
        O&G – IP 'invent beyond' project
        Government – innovation capability assessment services

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