Systematic Innovation

e-zine

Issue 113, August 2011

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.

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Readers' comments and inputs are always welcome.
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Root Cause Fallacies
(Or: Why Did The UK Riots Escalate?)

The recent UK riots in London and other UK cities have provided yet another tragically typical illustration of how we collectively fail to make sense of complex situations. Anyone living in the UK during August will have faced a bombardment of media-driven hand-wringing by politicians, sociologists and, as is increasingly the trend these days, any member of the public fame-hungry enough to force their way to the front of the camera lens. All follow the usual frustrating patterns of Socratic debate: someone puts forward a theory – 'it was pure criminality' to take one of the more facile political comments – so that a panel of so-called experts can all debate it, no doubt concluding some time later that, well, actually that's where the whole shebang falls dead on its knees, because there is no conclusion. The person still proposing their theory sticks by it, and those with their opposing theory stick by theirs. And likewise the poor punter watching at home doesn't change theirs and probably spends the remainder of the evening either quietly seething at the 'inadequacy of our politicians' or writing them yet another strongly worded and utterly futile letter.#

A big problem with any of these kinds of either/or debate is that invariably the answer turns out to be 'neither'. Or 'a bit of both'. Put another way, every time we debate an either/or question, we've asked the wrong question. And because we've asked the wrong question, we will inevitably find ourselves crumbling into incoherence and, usually, more conflict than we started with because unfortunately another sad human trait in these kinds of complex situations is we use debate to merely confirm our already views and prejudices.

We can thank Socrates and Plato for this. Not that the style of debating they formulated was necessarily a bad thing. Merely incomplete. Their big omission was a recognition of the characteristics of complex systems.

In the Socratic world, we are encouraged to find 'the' root cause of a problem. Because we get this drive for root cause analysis drummed into us all the time, we tend to allow ourselves to believe it is a good thing to go and find. Indeed a whole industry of 'root cause analysts' earn a living from the assumption we've all made.

What we amateurs and those professionals all – alas – do when we go in search of 'the' root cause is make a key unwritten assumption: the assumption that if we dig far enough, we will find this single, beautifully formed problem statement. The belief is a fallacy. Particularly so when we are dealing with a complex system. And any system involving more than one human being is inherently complex. It is a fallacy because:

a) By seeking out one definitive root cause we fundamentally eliminate all of the other 'non-root-cause' candidates. By doing that we then fail to recognise that simplifying a problem by merely eliminating a bunch of inconvenient stuff means we fail to understand the relationships between one potential reason and each other. Physicist Niels Bohr famously said, 'every complex problem has a simple wrong answer'. What he meant by this was that it is simply invalid to look at a problem like the August Riots and simply reject a statement like 'pure criminality' because you don't think it's the root cause. Pure criminality may well not be (actually 'isn't' as we'll see later) the root cause of this particular problem, but that doesn't mean you

can simply ignore it as a factor in defining the real problem. At least, not if you genuinely wish to find a way forward.

b) The second evil of root cause analysis is that we will often find ourselves conducting a lot of work to find our root cause only to realise we either cannot solve it, or – usually worse – we discover it is beyond our gift to solve it.

As if this first root-cause fallacy is bad enough, there is a second even more difficult one we ought to worry about. This second one is more insidious than the first because it is so often never even considered, it being something so 'obvious' we assume it almost completely subconsciously. The unwritten fallacious assumption in this case is that, having found our golden root cause, if we're smart we will be able to solve it and deliver a magical, silver-bullet solution. This search for 'the' solution fallacy inevitably also ends in disappointment when we're dealing with complex systems. There is no such thing as 'the' solution in any complex system in fact. No sooner have you mouthed your own 'the solution' to a complex problem, someone else will invariably come back with one or a list of 'yes, but' rebuttals. So we hear on the news from, invariably in this case, the Conservative side of the political spectrum that 'making an example of the looters' will solve the riot problem. A statement that will immediately have the Left of the house shaking their heads and crying, 'yes, but that's simply solving a symptom' or 'the looters will turn criminalisation into a badge of gang-pride'. Or indeed a hundred other reasons. And so we all get confused and end up keeping on doing what we've always done… which in the UK tends to mean 'nothing'.

A well known management aphorism, supposedly to help people change, is 'if you always do what you've always done, you'll always get what you've always got'. It sounds really neat and utterly common-sensical. But again the statement is a complete fallacy in a complex system. In a complex system if you keep doing what you've been doing you *might* get the answer you've always got, but one day you definitely won't.

So?

Well, so far, this might have sounded like the same sort of blitherings we here on the news. It could be read as merely another lay person's pointless 'yes, but' on the whole Riot story.

Fortunately it isn't. It isn't because for the last 16 years this lay-person has been running a research team that spends pretty much all of their time looking at these kinds of 'yes, but' problem and seeing how people set about solving them. As in *really* solving them. 3.5 million datapoints later, here's what we've learned about complex problems: number one, define the problem you'd like to understand better. In this case, we defined the problem statement as 'the August Riots escalated because…' We don't at this stage know whether this is the 'right' question, but we at least know it is an interesting one (actually a better one than the question 'what triggered the riots?' – that was quite clearly the tragic shooting of Mike Duggan by the police. Lots of events like this don't end up in thousands of people being arrested – hence why did the rioting escalate seems the more pertinent from a societal perspective – for the family of Mr Duggan, an even more interesting question might be 'the police shot Mike because…' in which case exactly the same process we're about to go through would apply just as well).

Having formulated the question, the next thing we need to do is go and get peoples' opinion about the answer to the problem. Given the extensive press coverage of the Riots, this isn't such a difficult thing to do. Merely time-consuming since lots of people seem to have lots of different opinions. In all we've managed to collect, even after taking out all of

the duplication, over 80 different possible reasons for and statements about the escalation. Here is that list:

Identifier	The recent riots escalated because…	Leads to:
A	Police in Tottenham shot Mark Duggan	BR
B	Police handled the shooting aftermath badly	DE
C	There was an underlying youth frustration at police stop-and-search policies	DP
D	Social networking capabilities made it easy to organise	BK
E	The police were caught out by high level of organisation (fighting the previous battle)	T
F	Riots were a distraction to allow organised robbery	Y
G	Youth unemployment has created high level of frustration at society	Z
H	Boredom	I
I	It was a chance to be part of something exciting	U
J	Youth has been set a bad example by criminality of bankers	BX
K	Youth has been set a bad example by expenses corruption by MPs	CE
L	They gave an opportunity to hide personal vendettas inside a bigger issue	S
M	They gave an opportunity to hide racist attacks inside a bigger issue	DN
N	It was a chance to voice 'foreigners taking our jobs' statements	DN
O	Craving for gadgets/branded goods ~~forces people beyond the law~~	BJ
P	High youth expectations dashed by society (feel like they have no future – funding for studying post-GCSE has been eliminated (EMA), which in my opinion is a greater cause of inequality than £53k debt from a degree)	DG
Q	Everyone else in my gang is doing it	BK
R	'Pure criminality'	AL
S	Criminals made use of 'power of the crowd' to pursue aims	F
T	Police demonstrated they were out of control	AY
U	A chance for fame/to be on the news/front page of papers	W
V	Lack of positive role models	DK
W	Gang respect (ASBO as a badge of honour)	DK
X	Limited sense of consequences	AT
Y	"Getting our taxes back"	R
Z	Have nothing, have nothing to lose and no respect for those with	X

		something	
AA	Copycat riots/~~crime~~		BV
AB	Syllabus based on value to business, business evolving so fast that by the time people leave school/graduate their education is out of date		BF
AC	Raised as consumers, not citizens – hence unique form of anger		O
AD	Growing difference between rich and poor		CG
AE	Politicians take 4 days to come back from holiday (from second home abroad)		BV
AF	"We voted against all the major parties at the election last year and ended up with two of them in power"		AV
AG	Bookshops and museums largely left alone		*Not a reason*
AH	1580 arrests, "only" 330 juvenile (21%)		*Not a reason*
AI	Prime Minister: "Parts of society sick" "twisted morals" "moral collapse" "problem families" ~~In a speech that ranged through topics as diverse as parenting, health and safety legislation and the Human Rights Act, he did not spell out exactly how the government would change its policies.~~		CY
AJ	Discontented/criminals can no longer be shipped off (nowhere for people to go)		BE
AK	E-petition calling for anyone convicted of being involved to lose their benefits		*Not a reason*
AL	Successive scandals over the Police using excessive force suddenly replaced with "why aren't you using water cannons and plastic bullets?" (Switch from insufficient to excessive policy)		CF
AM	Nothing changes, same situation in 1716: http://the-history-girls.blogspot.com/2011/08/brief-digression-on-london-mob-now-also.html		*Not a reason*
AN	"The riots are clear confirmation of my long-held view that [insert pre-existing worldview here]." Tim Harfold		*Not a reason*
AO	Fair chunk of children leaving school illiterate		DJ
AP	"We're no longer scared of the police" (they can't touch us)		X
AQ	Class discrimination		BX
AR	"Morals have been compromised by disillusionment"		CD
AS	Insurance won't cover the damage – what is insurance for then?		DN
AT	A void/ lack of direction, "a sense that I was not invested in the dominant culture, that government existed not to look after the interests of the people it was elected to represent but the big businesses… I shudder to think how disenfranchised I would have felt if...{he had experienced} That state of deprivation... the condition that many of those rioting endure as their unbending reality. No education, a weakened family unit, no money and no way of getting any." (not a rioter)		BS
AU	"the egregious, deceitful message that you are what you wear, what you drive, what you watch and what you watch it on" http://www.guardian.co.uk/uk/2011/aug/11/london-riots-davidcameron		O
AV	"Politicians don't represent the interests of people who don't vote. They barely care about the people who do vote. They look after the corporations who get them elected."		BI
AW	"As we all intuitively know, the solution is all around us and it isn't political, it is spiritual. Gandhi said: "Be the change you want to see in the world.""" – politicians take note (lack of spiritual values)		BB

AX	"Cameron is acting the same way as the rioters, he wants revenge, he wants trophies in terms of political points and he wants to humiliate his captives and the enemy ranks that he perceives that they come from." "The backlash is becoming more frightening than the riots."	BM
AY	They feel they can get away with it	AA
AZ	'Asking why is not the same as excusing them.'/'STOP EXCUSING THEM!'/'No, i'm not excusing them - they deserve their punishment. I'm trying to understand what drove them to do...'/'NO! STOP EXCUSING THEM, BANG THEM UP!'/'Again, i'm not excusing them - but it's also important to understand the reasons why...'/'I SAID STOP EXCUSING THEM, BANG THEM UP! TAKE THEIR BENEFITS AWAY. SEND THEM TO AFGHANISTAN.'	*Not a reason*
BA	"Lack of discipline in schools"	X
BB	"Most families are honest and most families aspire for better, but we also know that many are leading very challenging lives./It is clear to us that many young people in such situations grow up with an inherent anger, hatred, resentment and the feeling that the world is against them, coupled with a deep lack of self-esteem. These are environment-caused mental health problems on a mass scale. Even nursery-aged children can show the early signs." http://www.guardian.co.uk/education/mortarboard/2011/aug/12/riots-anBDalysis-integrated-schools?CMP=twt_gu	BP
BC	It is easy to believe that increased discipline will work, if you yourself fear exclusion. (No fear of exclusion – already feel excluded)	BA
BD	Living only with people who have the same problems as you breeds collective anger and mutual resentment of the better off – just as living only with people who are as well off as you breeds collective underestimation of your own privilege, and mutual negative assumptions of the poor.	AD
BE	many young people never leave the square mile around their home, therefore it is no wonder that they grow up without prospects – they have no ability or desire to travel elsewhere for work or study. (Ghetto mentality)	BD
BF	They see their elders failing to get work, or working endless hours for a pittance.	P
BG	The vast majority of councillors within prisons report that the number one reason why their inmates say they committed the assaults and murders they did were because they felt 'disrespected' in some way.	C
BH	There is little to no funding available for activities for children and youths who haven't committed an offense + EU Social Fund postcode lottery funding. (Youth funding first to be cut)	P
BI	Tax loopholes	CC
BJ	For the rioters and looters, greed was good, everyone took their turn at the trough, and private interest took precedence over the public good. This is what the July 31st letter said of our leaders. http://opmblog.co.uk/2011/08/12/talking-about-the-riots-how-to-stop-england-from-burning-again/	AA
BK	"I just got caught up in the act, I did not mean to do it" (Crowd sourcing)	D
BL	"It would be infantile to cheer on rioters against corner shopkeepers trying to defend their already small livelihoods; but equally so to pretend that this had nothing to do with the demonisation of the young and poor, nothing to do with our brutally unequal society and our pathetic trickle-down attempts at amelioration." Owen Hatherley	C

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BM	People are watching television tonight, hoping that the rioting continues, so they can continue to mete out their judgement and share their sense of outrage and moral superiority with friends and on social networks./a young woman and mother: "Shoot the fuckers. Fuck 'em. Seriously. Disrespectful little bastards. Shoot them."... her little boy... didn't bat an eyelid to her language./"Get the army out, do the country a favour and just shoot them."/"If you break the law, you should automatically forfeit your human rights."/"Greenwich Council will seek eviction of any tenant proven criminally guilty of involvement in #LondonRiots"/'feral scum'/the 'pack mentality' we see in the groups of rioters, and in the wider general public – the vast majority of whom are not affected by these events at all… but they have chosen to take this drama onboard as their own. (Moral outrage)	CA
BN	The guy talking about his 140-year-old family business burnt down to the ground in less than an hour. (Sad personal stories provoke anger - media)	BM
BO	In the U.S., the masses are kept numb with junk food and their intelligence is dulled with reality TV, video games, viral YouTube videos and free internet porn. They're fed a constant stream of misinformation and opinion posing as news.	AT
BP	It does anger me to see innocent people lose their livelihoods, get hurt, or worst yet, be killed. It's deplorable behaviour and makes me wonder where the humanity is? How can these people behave like such animals? /And then I stop…let go of the anger for a moment, and realize that the people who need my compassion the most are those who've probably never had it before in their lives. (Lack of compassion in youth life)	CM
BQ	Waterstones, in one of the areas, and whilst other stores were closing, they announced they were staying open. One of their reps said something like: "Well, let's face it, if they steal anything from us, they might learn something." (Don't value or respect learning/education)	AO
BR	In one NBC report, a young man in Tottenham was asked if rioting really achieved anything:/"Yes," said the young man. "You wouldn't be talking to me now if we didn't riot, would you?"/"Two months ago we marched to Scotland Yard, more than 2,000 of us, all blacks, and it was peaceful and calm and you know what? Not a word in the press. Last night a bit of rioting and looting and look around you."/Eavesdropping from among the onlookers, I looked around. A dozen TV crews and newspaper reporters interviewing the young men everywhere '" (Cry for attention)	BS
BS	People riot because it makes them feel powerful, even if only for a night. People riot because they have spent their whole lives being told that they are good for nothing, and they realise that together they can do anything – literally, anything at all. People to whom respect has never been shown riot because they feel they have little reason to show respect themselves, and it spreads like fire on a warm summer night.	AA
BT	After thirty years of soaring inequality, in the middle of a recession, they could <u>take away</u> the last little things that gave people <u>hope</u>, the benefits, the jobs, the possibility of higher education, the support structures, and nothing would happen. They were wrong.	CX
BU	From what I noticed the instigators were older guys (20+) but a lot of the followers were teenagers. http://motowns.blogspot.com/ (Following example of gang leaders)	I

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BV	It took Cameron and Boris a long time to come back from their holiday's and it seems they came back for the wrong reasons i.e. they realised it was going to effect their political careers if they didn't rather than wanting to sort out the country. Now they are back it seems they are more concerned with looking good on BBC and Sky news than really getting the situation sorted. (Inauthentic)	CR
BW	As people we need to start obeying the law even down to those emotive subjects such as speeding, using a mobile whilst driving etc. If we cannot respect these basic laws how can we tell others not to steal, riot etc (General fall in law-abidingness)	DG
BX	It's one thing for a cabinet comprised of millionaires to make sweeping judgements about a society they are not a part of and have no desire to be part of, but to tell them that they are broken when their gated community fwiends get organized tax breaks as everyone else pays their bank deficit is cowardly and short-sighted. ('Gated community privileges unfair')	AQ
BY	I sometimes get the impression that politicians (particularly right wing ones) deliberately run policies to break society, just to give them the public backing to remake it with their own preferences. (Deliberate policy to justify restriction of freedoms)	CW
BZ	We currently educate people to pass exams and constantly search for the next win. (No place for losers – everyone must be seen as a winner)	DQ
CA	WHY do politicians feel the need to declare war on everything? Maybe if we weren't such a warlike nation and set a better example for the young we wouldn't have such a warlike young generation. (War language)	CM
CB	How dare Cameron blame this on absent fathers mine wasn't there all the time and I was not out there like an idiot ruining my future and setting fire etc (Single parent families)	DR
CC	Gas water and electricity cartels (Cartel culture)	AD
CD	What about addressing the 'moral collapse' of the City Mr Cameron?	J
CE	Andrew Gimson, biographer of Boris Johnson, reported about the Bullingdon club in the 1980s: "I don't think an evening would have ended without a restaurant being trashed and being paid for in full, very often in cash." David Cameron and George Osborne were also members. (Pot/kettle)	BV
CF	Enforce the laws we already have - they are more than adequate to deal with the rioters. /Increase Police numbers. /Enforce Magistrates and Judges to hand-out maximum sentences. /Build more prisons (Insufficient police)	T
CG	This is the second most unequal society in Europe. The gap between rich and poor is now at its widest since 1918. The cabinet, with 23 millionaires, want to scrap the 50% tax rate and slash corporation tax while cutting benefits and axing services. Bankers go on earning their vast bonuses, directors award themselves enormous pension increases.	BE
CH	As a young graduate (2009) who has been working part time since I was 13, from a middle class family, and am in full time work, I am now seriously considering moving abroad (Scorn of educated class)	BM
CI	He'll ask some Judge or professor to have a look at what's gone wrong. not even considering if the Judge or professor has ever lived in a area where the riots have taken place. end result = nothing will change.	BW
CJ	"Your government has done the same thing a few decades ago in	DM

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	Asia, the difference is that you have used weapons at that time, and you put the things you robbered in British museum!"	
CK	single-parent families are a sign of ill-educated young men and women	*Not a reason*
CL	Children on the streets/canals are shocked to be given a smile and a "lovely morning"/"evening" (Dislike/distrust of Gen Y by other generations)	BL
CM	If children grow up in a culture of abuse then that is all they understand	DK
CN	At a young age, kids are priced out of taking part in hobbies that could keep them occupied as teens.	H
CO	"Moral collapse" of our Government; politicians feeling entitled to unearned claims they make. It is not just the poor who claim benefits.	BW
CP	Things that are needed:/Career opportunities./Job stability./Decent pay so that you can live on ONE job, if you want to hold down another job then this should be optional NOT born from necessity to survive.	DS
CQ	If I was a policeman on the front line of the riots I would have thought twice about taking on the mob as when something goes wrong and say a drunk 5 times over the limit gets pushed over and hits his head on the ground then they find themselves up on a charge for manslaughter! Our police get no support from the people they are trying to protect! (Police inability to act – softly, softly)	AP
CR	Public school boys that have never had to do a proper job, dishing out solutions	AV
CS	The broken society tops his agenda? Yep, it probably does - breaking it even more. His mates, the employers, cause unemployment/low pay to improve their bottom line. (20% youth unemployment, 50% black youth unemployment)	G
CT	China have officially applauded David Cameron's plans for handling this unrest. if that doesn't set off alarm bells then i don't know what will. everyone needs to climb down off the emotion and anger and really think about what it is they are asking the government to do to them.	*Not a reason*
CU	"extra officers" were police working without sleep, facing injury and death threats for no extra pay?	DT
CV	Have I missed something, when exactly did we have a fully functioning society?	*Not a reason*
CW	Call me a cynic but I suspect the people in charge at the Met deliberately allowed these riots to happen so they could use it to argue they can't take the cuts. – someone else said that the police know that the tactics they were using (going in and then stopping) would make things worse.	AL
CX	I'm educated to Ph.D level but haven't had any luck in finding work for almost 1 year. I understand completely where the rioters are coming from - I have the same level of rage, disappointment, disillusionment, and see no future in this society, especially with the incumbent gov. we have at present. (Powerless)	BR
CY	The usual platitudes from Cameron and Milliband, both way out of their depth.	CI
CZ	Perhaps now isn't the best time for his Chancellor to abolish the 50% tax rate for the rich, aren't "we all in this together"	*Not a reason*
DA	We need to leave politics out of this or any reparation attempts will be met with extreme scepticism - justifiably! Politicians - especially very wealthy ones - are too far removed from 'normal' life to have	CI

	any idea how to deal with problems like these. A task force with people from the professions who actually deal with these types of individuals on a daily basis ought to be formed.	
DB	"Things got out of hand & we'd had a few drinks. We smashed the place up and Boris set fire to the toilets." David Cameron, 1986./"The looting and arson last night were criminality, pure and simple. Justice will be done and the people will see the consequences for their crimes" David Cameron, 2011	*Not a reason*
~~DD~~	The one key difference between the fulminations of politicians and media commentators, and people who live in the middle of riot-affected areas, was the lack of surprise. Everyone in the UK was shocked, but not everyone was surprised	*Not a reason*
DE *DD*	"What needs to be understood here is there is a lot of anger in the underclass, and a lot of the youth aren't quite sure where to aim their anger," he told me by email. "There are also a lot of underprivileged children who've grown up without boundaries, without the love, care and education a child should have. We grow up with less than most, but at the same time have everything we don't have rubbed in our faces; we're desensitised to drug dealing, drug taking, stealing and violence from the moment we are allowed out to play, as it exists on our doorsteps."	DG X
DF	"Dear Mr Prime Minister …" it begins, "was you travelling on London transport the day the bombs went off?/ How about you go and pay rent to the landlord, earn shit money doing a labouring job?	*Not a reason*
DG	The way the kids see it, everyone in this stupid world is out for themselves, even the parents, and everyone just wants to have everything. I don't even think they're doing it because they want money, they're doing it just because they want to run the place.	DC
DH	Tthe steadfast refusal to understand, or accept the reality of inequality, underscores all of these criticisms: they have an "irrational anger against the world", wrote Routledge. David Goodhart in Prospect referred to the "nihilistic grievance culture of the black inner city, fanned by parts of the hip-hop/rap scene and copied by many white people", centred on "mainly unjustified" disaffection.	BG
DI	"It's ignorance like that of Paul Routledge that breeds the hate and contempt seen in people during this tragedy... Why would you want to further silence the already voiceless"?	DA
DJ	I became a lot less angry when I learnt how to communicate, and began to understand exactly where my anger came from and what I was unhappy with.	CL
DK	Cool 'gangsta' culture	DH
DL	Parallels with Middle East – let's see how far we can take this	I
DM	Ethnic vigilantism	CA
DN	Communities decide to protect themselves	DM
DO	Police response becomes brutal	T
DP	Perception of inconsistent policy	BE
DQ	X-Factor Britain/Fame whores	U
DR	Pampering/nanny state	CQ
DS	Lack of dignity	P
DT	Low police moral	CW

Importantly at this stage, we will ignore who said them, how many people said each and why people might have said them. Neither do we make any judgment about any of the statements – people may have said them because they genuinely thought they were true,

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but equally well they may have had some ulterior motive behind saying them (e.g. saying we need more police not because we think it will solve the problem – it won't! – but because we want to grow our police empire). Whatever the reason for someone making a statement, we include it in the analysis, because in a complex system, whatever their motive is, it will inevitably have some impact on the real problem, and, even more importantly, may well have an impact on how we eventually solve it.

What we do now is the clever bit of the process. For each of the statements that have been listed, we ask the question, 'which of the other statements does this one LEAD TO?' For example, at the top of our list is the statement 'police in Tottenham shot Mark Duggan'. We don't know whether this actually has anything or not to do with the escalation, but we can legitimately ask, looking at the rest of the list, what does that act lead to?

The rule of the process at this stage is we have to choose one best leads-to answer. A statement *could* lead to several other things, but what we're looking for is the thing it *does* lead to *first*.
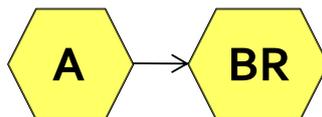
Looking at our list – collated from every media comment we could find, remember – the most appropriate answer seems to be the statement labelled BR, 'cry for attention'.

Looking through the list, you the reader might have a different answer to the 'leads to' question. In a normal complex problem solving session, we'd get all of the stakeholders in a room together and get them to collectively agree what each statement leads to… that way it's far easier to get everyone to buy into the eventual answers that will emerge. Alas, we can't do that here, so you'll have to live with our 'leads to' assessments. That said, by all means make your own version and send it to us though so we can see if or how the eventual answer does change – quite literally the more answers we receive, the more robust the process becomes.

Eagle-eyed readers will have noticed the right hand column of the table shows all of the 'leads to' assessments.

The 'leads to' phrase, by the way has some very important psychology behind it. Originated by Edward DeBono as it happens – another person famously dismissive of the Socratic way of thinking – in his book Water Logic.

So now what? Well, by this stage we've completed all the heavy-lifting thinking-wise so now we simply draw a map of all of the leads to statements. We do that by connecting the statements with an arrow, such that our first statement is drawn as:
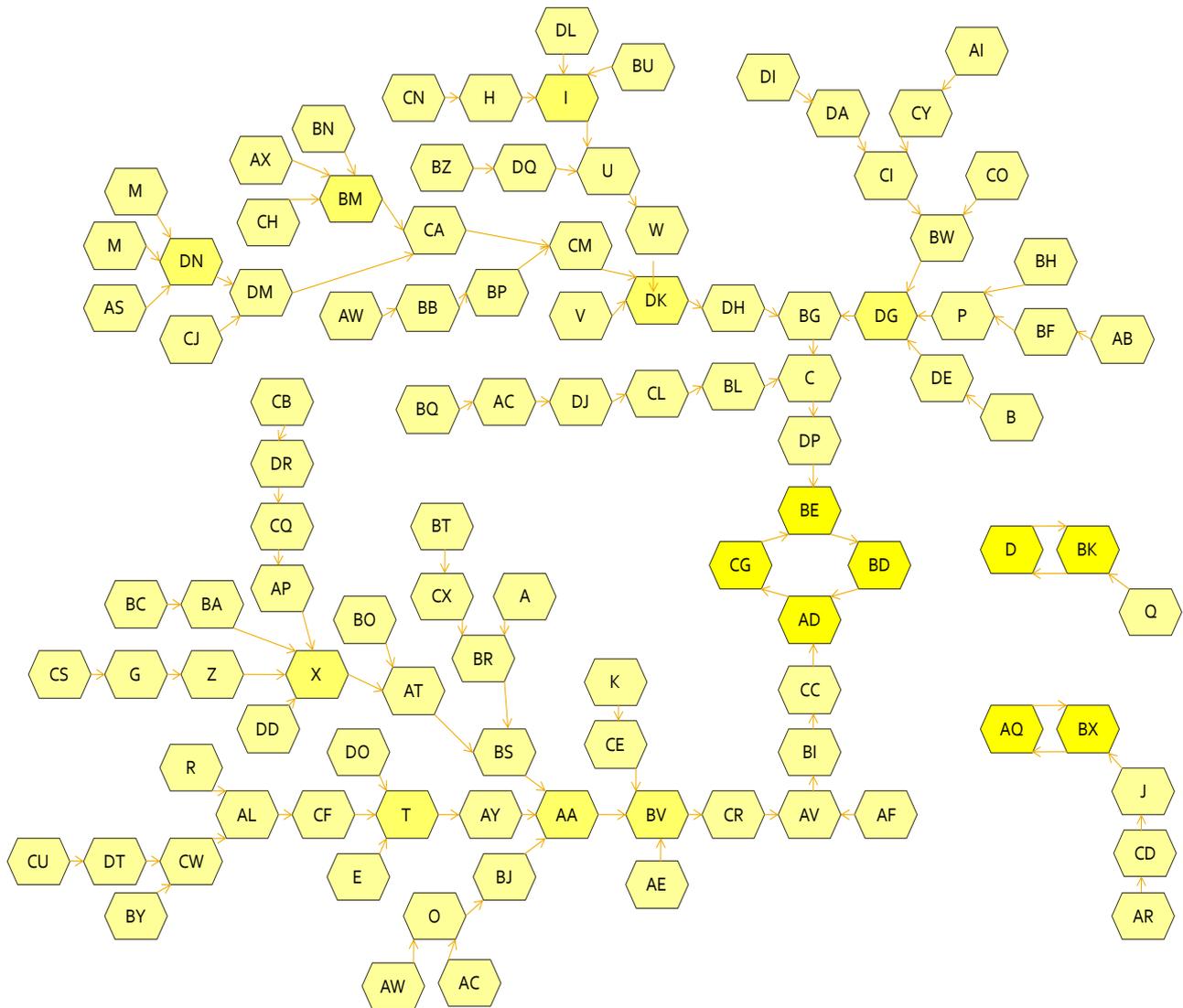

Obviously doing this with over 80 statements is fairly time consuming (we spent about two hours doing this analysis and drawing it), but hopefully the effort is worthwhile because when we've finished the map is going to show us how all the statements relate to one another. This is very definitely now a process of 'managing complexity' and very clearly not simplification – when we've finished, everything we said will still be there as a part of 'the answer'.

Managing complexity still, however, means working out which statements are important and which are less important. The first way to determine importance is to look for

statements that form a loop – i.e. a chain of 'leads to' statements where the head connects to the tail. Loops are particularly important because they highlight aspects of the problem that create downward spirals and act as a magnet for other aspects of the problem.

Downward spirals are really important in any complex problem solving situation because they describe a positive feedback loop in which each aspect feeds from the other statements so the situation finds its way leading from one statement to the next, all the time getting worse and worse and worse.
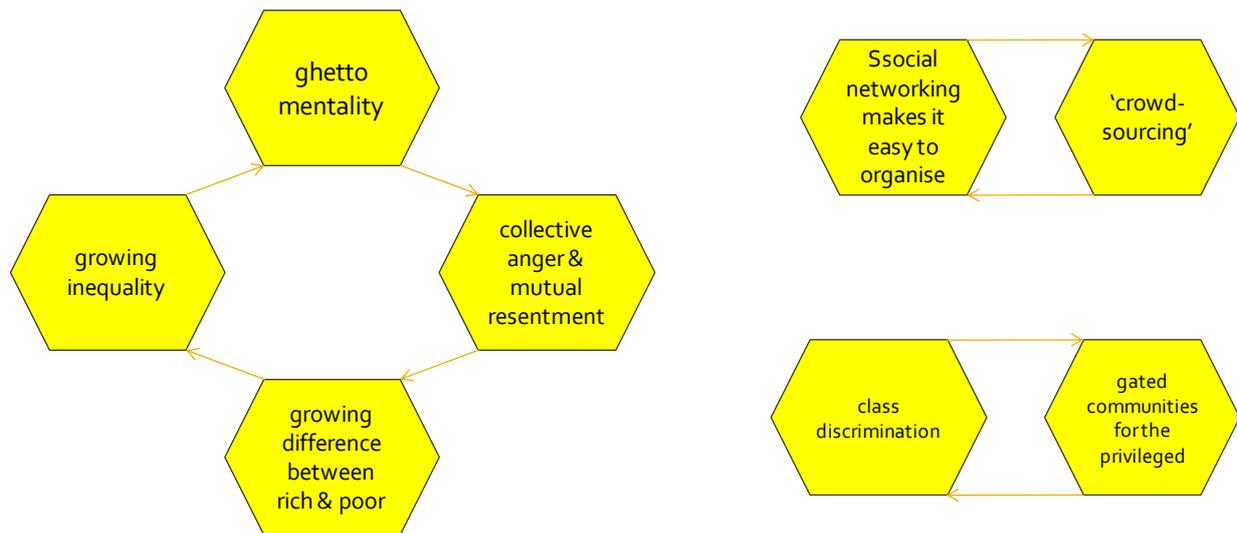
Here's what our full map ended up looking like after drawing all of the leads-to arrows:

Although it might not look it yet, this rat's nest is actually a much more valid representation of what's actually happening in the situation surrounding the Riots and their aftermath.

Importantly, there isn't a single root cause, rather a maze of interacting factors.

While it may be a maze, as the fog clears, it begins to be clear that there are three loops on the map. Loops, because they don't connect to one another, represent independent issues. This should tell us that in our situation there are at least three independent things that will need to be addressed if the riot escalation question is to be genuinely solved. Let's have a look at these three loops in more detail:

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Well, first up, it always being a good idea to test the flow around the loop, they appear to make sense: the widening gap between rich and poor leads to a ghetto mentality, which in turn leads to people only being exposed to people like themselves which in turn leads to increasing differences between rich and poor which then leads back to an even wider gap. And so on around the loop again. The more we allow ghettos to thrive, the worse the gap gets in other words.

Okay, so loops are significant, but they're not the only things we need to be looking out for. The next things to look for are what we call 'collectors'. These are statements which have lots of things leading to them. Look at statement X at the bottom of the biggest map cluster. This statement, 'limited sense of consequences' has lots of other statements leading to it. It is thus also important, and because it ultimately leads in to one of our loops, has potentially a lot to say about how we might start breaking the 'ghetto' loop and therefore ending that pernicious downward spiral.

Please don't think at this point that we're trying to say that this analysis represents the last statement on the Riots problem. We think it contains some important insights into what is inherently a very complex situation, but because it is the work of only a very small number of people that are only peripherally involved in the story, it can't be even close to a last word. Rather our intention is merely to show that there are ways to model the complexity, and that because there is a method, if the people who are directly involved in the problem use it, the answer they will produce will actually have some real meaning.

Part of that meaning is also the recognition that there could never be a perfect answer to this problem (in a complex system, everything connects to everything else, so when we change one thing we potentially change many others: in a complex system, all we can ever hope to achieve are solutions that move the overall system in the right direction). But what the picture does tell us – again bearing in mind the fact that the analysis was done by a small number of people – is that we need to start with at least three different things:
- breaking the ghetto mentality cycle
- doing things to tackle the social-networking/crowd-sourcing as it relates to its potential of organising unwelcome phenomena
- breaking the gated-community/class-discrimination cycle

Solutions to these problems won't deliver Utopia, but they are the right places to start in order to do the best we can to ensure similar escalations don't happen again in the future.

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The process is intended to shift from the subjective worldview to one of clear, reproducible objectivity. Not least of the reasons the process works – try it on any problem you're grappling with right now and see – is that whoever those experts are that you involve in going through the process, and no matter what their vested interests might be, it is a process that is impossible to cheat on in order to engineer the answer you'd like to appear at the end. You can't cheat because, as in any complex situation, the answer really does just emerge at the end.

Under normal Socratic debating situations, the fallacious process of finding the root cause leads people to be able to cheat (the one who debates best wins!), but asking people to examine a tiny bit of the problem at a time – 'what does this lead to' – means any attempt to cheat because immediately apparent. People can only answer the 'leads-to' question honestly.

The human brain is a wonderful thing. Great at managing complexity, but only – alas – seven or so pieces of information at one time. When we try and take a situation as complex as the societal ones around the Riot escalation, there will always be considerably more than seven pertinent issues. In such situations, we tend to want to simplify by filtering out information. This is invariably a mistake. Yes, again, our brains are good at managing complexity, but not when they are in this simplification mode. The way to embrace the complexity and to meaningfully work with it rather than against it, is to ask the right questions at a micro level ('what does this lead to?) and then let the complexity work for you. In the words of the now clichéd 'butterfly flapping its wings in Cairo causing a hurricane in London' everything is connected to everything else. Tamper with that complexity at your peril… watch the politicians do it on our behalf and don't be surprised when the answers don't work, or, worst of all – like the Global Financial Crisis (another complex system where the players had no idea how to map the complexity) – really cause a hurricane.

Emotional Levers - Prior Action/Counteraction

Finding untapped resources that are already present in or around a system is an important element of any problem solving process. The most powerful types of resource are known to be those that deliver non-linear benefits. A resource, in other words, that a small amount of delivers a proportionately much greater effect. Many moons ago (Reference 1) we examined some of these 'levers' from the world of tangible entities and phenomena present in the physical world. Thus, things like natural frequency – a resource present in every physical object – was shown to be a very elegant way of transforming a small input into a much larger output. Vibrate a kidney stone and nothing will happen; vibrate it at its natural frequency and it will destroy itself in a matter of seconds, thus allowing a previously very difficult piece of invasive surgery to remove one from a patient to be replaced by a simple, non-invasive ultrasound device.

In this article we shift our non-linear resources focus to the far less well understood world of human emotion. Smart companies and especially marketers know that there is an emotional equivalent of a resource like natural frequency, and that if this frequency can be identified and tapped into it is possible to elicit extremely non-linear behaviours. On one level we're talking here about the 'exciter' factors found in the Kano diagram – Figure 1 – things where a small increase in 'performance' results in a much larger increase in customer satisfaction.
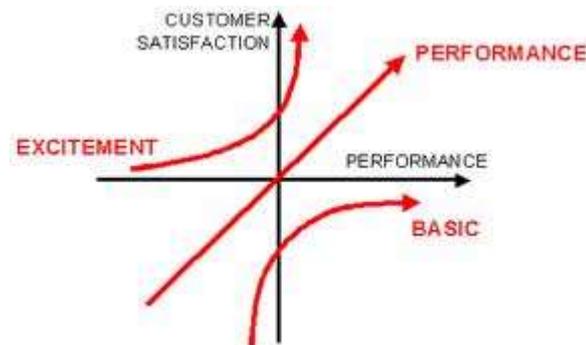

Figure 1: Kano Diagram

On another, we are trying to identify what these exciters are and how we might best trigger them. In many ways the idea of an 'emotional natural frequency' or 'emotional resonance' is precisely what we are looking for. Many researchers have talked about such resonances, but few appear to have made any kind of progress into understanding them in any kind of repeatable, reproducible manner. Perhaps one of the best is the work on 'emotion-driven' choice by Elliott (Reference 2). He constructed a model into which he assembled all of the factors he believed sat behind the reasons customers decide to purchase one product over another. That model is reproduced in Figure 2.

One of the main strands of Elliott's thesis is that we almost always make our decisions based on the emotional (limbic) centre of our brain, and only later do we rationalize those decisions with our more rational brain parts (pre-frontal cortex). In relation to our oft used 'a man makes a decision for two reasons: the good reason and the real reason' quote from J.P. Morgan, according to Elliott, the 'real' reason very much comes before the 'good' reason. Both reasons need to be present ultimately, but because the real reason happens very quickly (fractions of seconds) as opposed to the slow calculations and machinations

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of post-rationalisation to find the 'good' reason, the 'natural frequency' we're looking for is very much to be found in the 'real reason', limbic brain.
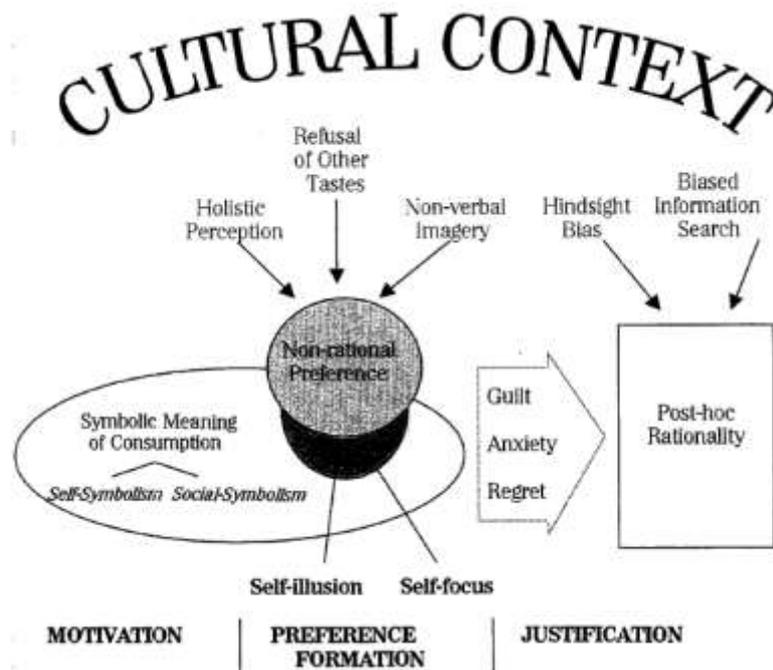

Figure 2: Elliott's 'Emotion-Driven Choice' Model

From an emotional lever perspective, Elliott suggests that it is the 'symbolic meaning of consumption' that our search for resonant frequencies should turn:

> If consumers "identify themselves by the formula: I am = what I have and what I consume" and it is symbolic meaning that is used in the "search for the meaning of existence" (Fromm, 1976 p.36), then we can think of the extraction of symbolic meaning from consumption as a powerful motivational force. Symbolic interpretation is essentially non-rational improvisation that does not obey the codes of language but operates at the unconscious level (Sperber, 1975). A Jungian analysis goes even further and suggests that the full significance of a symbol cannot be grasped in purely intellectual terms. if it becomes fully definable in rational terms it is no longer a true symbol (Storr, 1973). This suggests that perhaps the function of emotion is to make up for the insufficiency of reason (O'Shaughnessy, 1992) and to help us carry out the vital task of symbolic interpretation so that we can effectively construct an identity and communicate it to others. Thus the symbolic meaning of consumption can be seen as a potent and perhaps prime motivation for emotion-driven choice.

As can be seen from Figure 2, there are two sides to this 'symbolic meaning' – self-symbolism and social-symbolism. In terms of our Outcome Map template, what we're talking about here is the 'me' and 'we' aspects of why we do things.

Homing in on 'symbolism' as a potential source of resonance resources leads us – in classic 'someone, somewhere already solved your problem' fashion – to the world of cinema and other mass media. In many ways, the sole job of any film director worth his or her salt is to trigger emotions within the audience, and the only way to do that if your intended audience is measurable in the millions is to tap into universal symbols and codes. With this in mind, Reference 3 seems to make a pretty decent first attempt to unravel what film directors find themselves doing. The title of the paper talks about
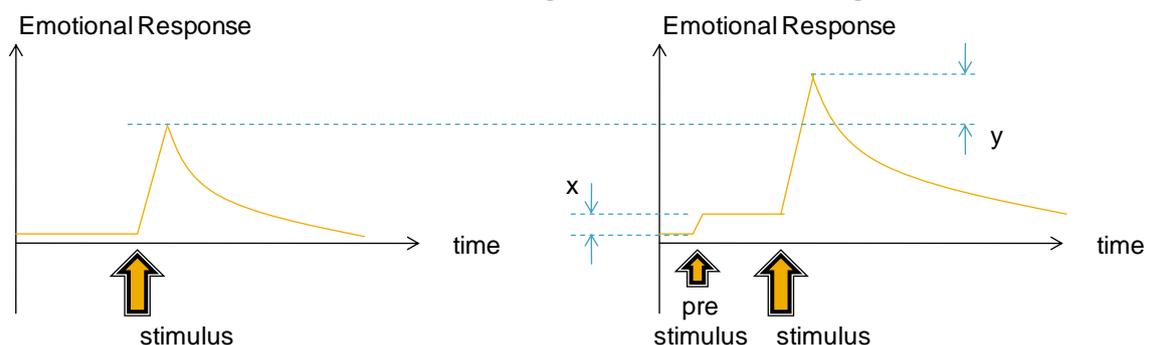
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'nonlinear analogues', the authors version of precisely what we're looking for in our hunt for emotional levers. Here's what the authors of the paper have to say:

"A variety of vertebrates produce nonlinear vocalizations when they are under duress. By their very nature, vocalizations containing nonlinearities may sound harsh and are somewhat unpredictable; observations that are consistent with them being particularly evocative to those hearing them. We tested the hypothesis that humans capitalize on this seemingly widespread vertebrate response by creating nonlinear analogues in film soundtracks to evoke particular emotions. We used lists of highly regarded films to generate a set of highly ranked action/adventure, dramatic, horror and war films. We then scored the presence of a variety of nonlinear analogues in these film soundtracks. Dramatic films suppressed noise of all types, contained more abrupt frequency transitions and musical sidebands, and fewer noisy screams than expected. Horror films suppressed abrupt frequency transitions and musical sidebands, but had more non-musical sidebands, and noisy screams than expected. Adventure films had more male screams than expected. Together, our results suggest that film-makers manipulate sounds to create nonlinear analogues in order to manipulate our emotional responses."

In layman's terms, a good film director taps into our emotional resonances firstly via tapping in to universal symbols (a scream for example), but then secondly by placing the symbol at a judicious moment in the action in order to trigger the desired non-linear reaction. Classic small input (the shrill violin notes in the shower scene in Hitchcock's film 'Psycho') turns into big reaction on the part of the viewer. Watch that famous scene with the soundtrack switched off and it is not nearly so shocking as when the sound is on. And likewise – Hitchcock really was a master – not nearly so shocking either if the gentle orchestration of the previous scene didn't turn into silence followed by mundane everyday sounds (toilet flushing, running water) immediately prior to the appearance of Anthony Perkins and his (her?) steely knife.

Also important here is that those shrill violin turns have now become a universal symbol in their own right; the moment we here similar tones and timbres, the hairs on the back of our neck begin to prickle. Ditto another wonderful example of a sound that enters the public consciousness – Jaws. Hear anywhere in life the low 'daa-da, daa-da' tones that, in the film, precede the moments the shark is about to do something terrible and again the hairs on the back of our neck are standing to attention. Indeed, one of the most successful slot-machine games of all time has been one that taps into those self-same tones, only in their case, to send out a cunningly coded cue that a jackpot win is potentially on the way.

Like Hitchcock, Steven Spielberg is a master of tapping in to our emotional resonances. Although never before deconstructed as such, what Spielberg, Hitchcock and other film directors know is that a Prior Action can be used to great effect to enhance the emotional impact on the viewer. Drawing a generalized model from these solutions we obtain an important general clue as to what marketers and sales people need to do in order to trigger similar effects in their customers. Figure 3 illustrates that general model:

Figure 3: Prior Action As A Means Of Levering Emotional Response

The basic idea here is very simple: we amplify the emotional response of a person (customer) by pre-triggering symbolic meanings such that the emotional response with the stimulus is greater than ('y') would otherwise have been the case without the pre-stimulus. Ideally, the lever effect is also such that y is greater than the pre-stimulus, x.

Further study reveals that many of the most successful of all of the solution that tap into our emotional resonances go a step further than this kind of Prior Action. There's an element of it in the aforementioned Psycho shower scene, but we can see a much more vivid example right at the end of the original, 1976, version of the horror film, Carrie. The film is rightly known as a classic of the genre, and not uncommonly a far better film than its (2002, TV) remake, partly for the iconic poster image of poor Cissy Spacek covered in pig's blood, but mainly for the unrepeatable scene where the film is essentially over and the only survivor, Amy Irving, wearing a very innocent white nightdress and to the accompaniment of soothing music, lays flowers at the site of Cissy's now disappeared house. Those readers that know the film know what's going to happen next; those that don't know the film need to see it. Needless to say, what does happen next evokes a non-linear reaction that will stay with you for, in my case, the last 35 years.

Again, in general, what's happening here is the director used a Prior Counter-Action to trigger what turns out to be an even bigger emotional response. Figure 4 illustrates the effect:
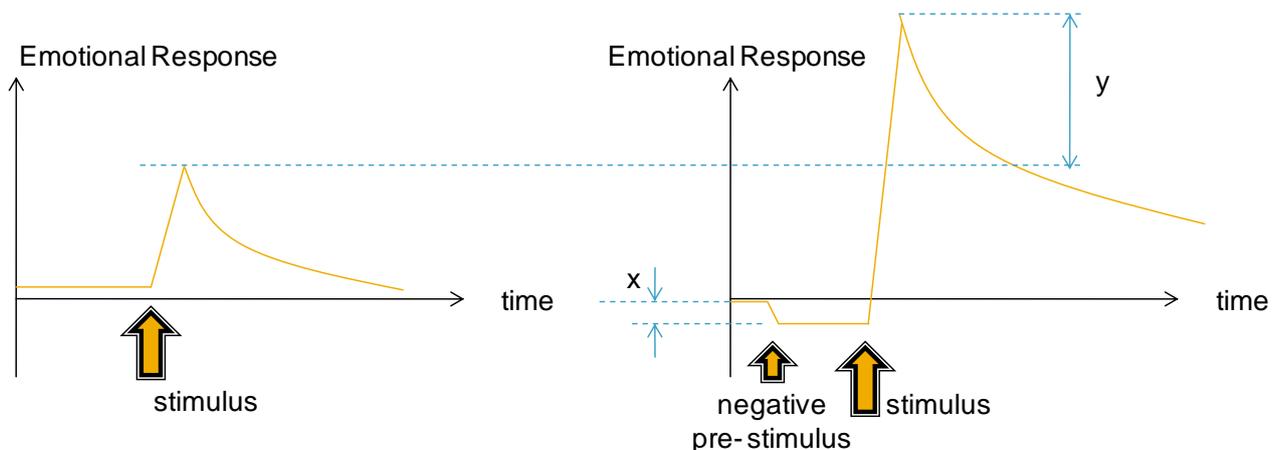
Figure 4: Prior Counter-Action As A Means Of Levering Emotional Response

In simple terms, we can create the most non-linear of reactions – and most durable – by sending people (customers) in one direction prior to then jolting them into another very different direction. 'x' in this case, if we've done our job right, is very much smaller than the impact, y.

Think of it like a much more intense version of what many organizations find out by accident: a good way to endear a customer to you is to, first, make a mistake or do something wrong to them, and then put the situation right. All the research in this area tells us that a customer that has been through this experience is far more likely to stick with you than one that has 'merely' had the good service without the bad bit at the beginning.

Clearly, this Prior CounterAction strategy sounds a little bit more tricky to implement (even trickier to sell to your boss!), but then, ultimately, that's what the innovation story is all about: turning things that are highly counter-intuitive into the next common sense. And so, yet again, it all pretty much comes back to symbols of meaning and emotional levers.

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Humour – Keer Cleap

The big problem whenever we're working on things that are physically big is its very difficult to simultaneously see both the fine detail and its place in the bigger picture. At least that's what Hertfordshire County Council have been trying to explain to their local residents following their latest 'Keer Cleap' road safety prevention incident.

Or maybe the sign-dyslexia problem has something more to do with the failing school system?

Or maybe it's just a motivation problem. After all, painting road signs isn't necessarily the most interesting job in the world:
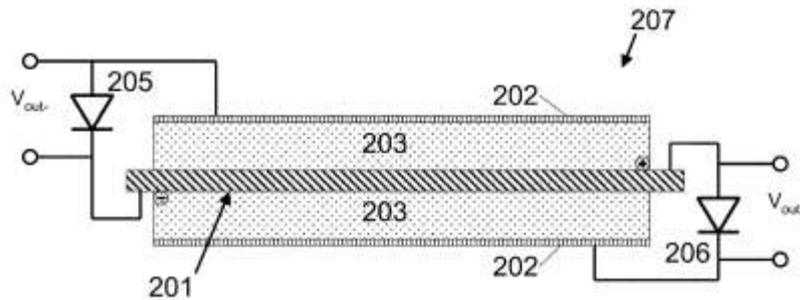
Personally, I'd look to solve the problem using a bit of TRIZ: Principle 25, Self-Service looks the most promising – ideally, the roads should paint themselves. Simply pour the paint on the road and let drivers work out where to put it:

Almost perfect.

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Patent of the Month – Elastomeric Piezoelectric Ultracapacitors

"What would be ideal, and is needed, is an energy generation technology employing an abundant input, providing potentially significant energy output, avoiding environmental hazards and which is readily deployable." So says the inventor of this month's patent of the month, Joseph A. Mikallef, a lone inventor from Maryland. Now, if the expression 'lone inventor' sets off some immediate alarm bells, let's be clear that US7,999,447, granted to Mr Mikallef on 16 August is certainly not the first of his inventions.

Whether he has made substantial amounts of money from any of them is, of course, another matter. This latest effort perhaps might also fall into the same category, but that most likely won't be because of any technical reason. The invention feels like a very intriguing merger of different technologies to us. Here's what the invention disclosure describes:

the present invention employs a piezoelectric ultracapacitor to harness efficiently the energy in physical motion, such as walking, driving or vibrating. While some have attempted in the past to use piezoelectrics for energy generation, the extremely small electrical current piezoelectric materials are capable of producing have limited those efforts. Ultracapacitors, of course, have been known and used in various contexts for energy storage. They have not, to the inventor's knowledge, been used for energy generation purposes. The combination of piezoelectric and ultracapacitor technologies, particularly in the combinations described as examples herein, provides extraordinary efficiencies in the conversion of movement to electricity.

Moreover, the current invention may be used in conjunction with other power generation technologies, such as fuel cells and solar cells, to increase the efficiencies of those technologies. For example, the piezoelectric ultracapacitors of the present invention may be coupled to the electrodes of a fuel cell, creating an electric potential across them and lowering the activation energy necessary to invoke the chemical reactions at the heart of the fuel cell.

As disclosed herein, multiple piezoelectric ultracapacitors may be coupled together in such a manner as to create an output voltage that is substantially the sum of their individual output voltages. Moreover, many different materials may advantageously be employed in the construction of piezoelectric ultracapacitors, including electrolytic gels, expanded conductive grids and activated carbon electrode structures.

An elastomeric piezoelectric ultracapacitor embodiment is also disclosed. An elastomer is a polymer that exhibits the characteristic of elasticity. It has been known for some time that dielectric elastomers may be configured to operate in a "generator mode." In generator mode the dielectric elastomer operates like a variable capacitor, and amplifies the energy of charge placed on a pair of compliant electrodes, formed on opposite sides of the elastomer, when the elastomer is in a compressed state. See, for example, R. Pelrine et al., "Dielectric Elastomers: Generator Mode Fundamentals And Its Applications", Smart Structures and Materials 200, EAPAD, vol. 4329, pp. 148-156, 2001, all parts of which are hereby incorporated by reference for all purposes. Dielectric

elastomers operated in a generator mode, however, do not themselves create energy. Rather, they merely amplify energy placed on the dielectric elastomer when it is in a compressed state. An elastomeric piezoelectric ultracapacitor employs generator mode techniques to further increase the power generation capabilities of an piezoelectric ultracapacitor.

This is an invention, then, that rather than solving a contradiction (unless you call it an administrative contradiction – 'I want to increase power generation versus I don't know how to do it') is all about bringing to bear a new solution to the task at hand. Where in this case that new solution represents a new combination of known elements. In that sense, we find ourselves in classic 'nothing new under the sun' territory, merely billions of different ways of combining known pieces. That being the case, this invention bears all the hallmarks of pulling together a very intriguing combination indeed. Apparently the patent examiner thought so too – another interesting sign of the value of a patent is the amount of time between the application being submitted and the patent being granted – in this case, that period being a very impressive 9 months. Even more impressive given the amazing first granted Claim:
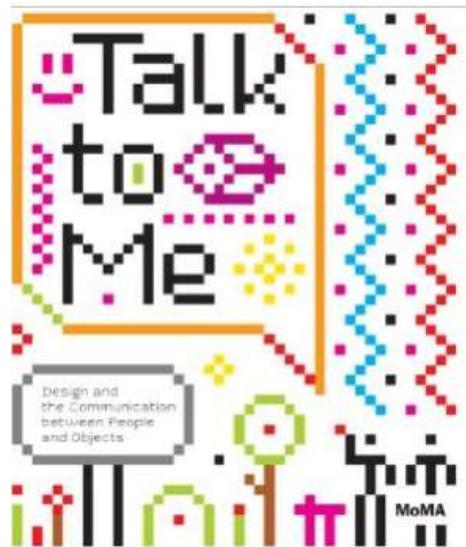
A device comprising a piezoelectric element coupled to an electrode coupled to an elastomer material, wherein said piezoelectric element includes a first face and a second face and said electrode is disposed opposite said second face and electrically coupled to said first face.

Smart materials, micro-scale nesting and a shift from rigid to flexible structures should also give us important SI trend jump clues that this is a solution making jumps in all the right directions.

With a potential to apply the solution in a wide variety of different everyday objects from shoes to car tyres, we think it opens up the prospect for some highly compelling 'self-powered' solutions across a range of industries. Keep an eye on this one!

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Best of the Month – Talk To Me

The consistently rather wonderful MoMA in New York is currently running an exhibition on Design. This month's 'best of' recommendation is 'Talk To Me', the book beautifully put together to accompany the exhibition.

The underlying premise of both book and exhibition is that, whether openly and actively or in subtle, subliminal ways, things talk to us. Tangible and intangible, and at all scales—from the spoon to the city, the government, and the Web, and from buildings to communities, social networks, systems, and artificial worlds—things communicate. They do not all speak up: some use text, diagrams, visual interfaces, or even scent and temperature: others just keep us company in eloquent silence.

The purpose of design began to shift in the late 20th century from utility toward a more holistic combination of purpose and meaning. Thus far, 21st-century culture is centered on interaction: "I communicate, therefore I am" is the defining affirmation of contemporary existence, and objects and systems that were once charged only with formal elegance and functional soundness are now also expected to have personalities. Contemporary designers do not just provide function, form, and meaning, but also must draft the scripts that allow people and things to develop and improvise a dialogue.

New branches of design practice have emerged in the past decades that combine design's old-fashioned preoccupations—with form, function, and meaning—with a focus on the exchange of information and even emotion. Communication design deals with the delivery of messages, encompassing graphic design, way-finding, and communicative objects of all kinds, from printed materials to three-dimensional and digital projects. Interface and interaction design delineate the behavior of products and systems as well as the experiences that people will have with them. Information and visualization design deal with the maps, diagrams, and tools that filter and make sense of information. In critical design, conceptual scenarios are built around hypothetical objects to comment on the social, political, and cultural consequences of new technologies and behaviors.

Talk to Me explores this new terrain, featuring a variety of designs that enhance communicative possibilities and embody a new balance between technology and people, bringing technological breakthroughs up or down to a comfortable, understandable human

scale. Designers are using the whole world to communicate, transforming it into a live stage for an information *parkour* and enriching our lives with emotion, motion, direction, depth, and freedom.

Some of the 200 or so examples contained in the book are probably best described as 'baffling'. Their 'purpose and meaning' content being rather difficult to discern, certainly to these eyes. That said, almost every single image manages to provoke some kind of a reaction, which is probably as much as any designer worth his or her salt is looking for. In theory, designers are the great solution integrators of our time; the people bearing the biggest responsibility for the success or failure of a new product or service. In practice, as Talk To Me more than amply demonstrates, creating a successful solution is still closer to art than science. What Talk To Me does, however, is takes the discussion a step further into the domain of repeatable science. And for the money, that can't be a bad thing….

…especially for those readers that have attended one of our Edward Matchett, 'Fundamental Design Method' workshops. This book is probably the best single source of 'find the meaning content of this' examples currently in existence.

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Conference Report – ISTIC-ISESCO-UNESCO STI Workshop

The International Science and Technology Innovation Centre (ISTIC) was established on 21 January 2008 in Malaysia as a UNESCO initiative to promote collaboration and cooperation among South-South Countries in Science, Technology and Innovation (STI).

One of the objectives of the ISTIC is to enhance capacity building in science and technology through providing policy advice and exchange of experience and best practices. In order to accomplish this particular objective, these countries need to be exposed to the right techniques and tools to assess the needs of industry which can then be incorporated in their STI plans. ISTIC invited us to design and facilitate a week-long workshop on Systematic Innovation at an event that was eventually attended by over 80 senior government official delegates from 20 countries. The event took place from 13th - 17th June 2011 in our home-from-home, Kuala Lumpur.

This training workshop was intended to provide the necessary preparation that participants need to put in place in order to for them to be able to develop their countries National STI Policy with a focus on assessment of industry needs. In view of the strong interest in strengthening the level of innovation in industry, this year's training workshop had a greater emphasis on structured innovation within organizations. This was the third training workshop to be organized by ISTIC. The first was held from 22nd – 26th June 2009, followed successfully by the second workshop from 21st – 25th June 2010. From the two workshops, a total of 78 international and local participants attended, of which 28 were participants from developing countries and 18 participants from ISESCO member countries.
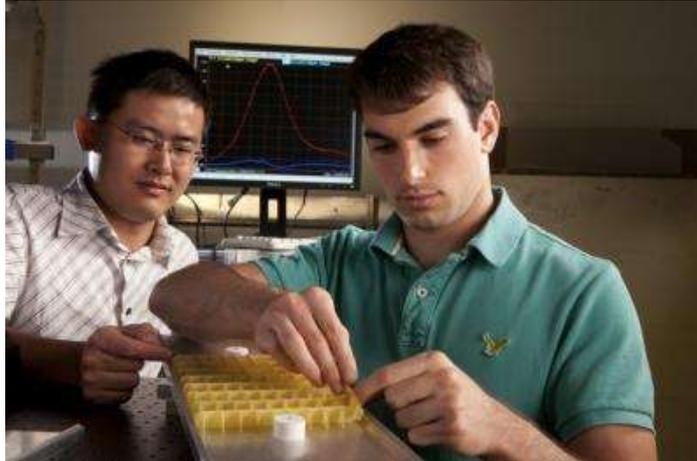
The workshop deliberated on the following topics:

- Overview on the overall framework of STI policy development and the importance of foresight in driving STI's strategic agenda for the nation.
- Assessing national organization for innovation.
- Creating structured innovation through TRIZ.
- Commercialization and Entrepreneurship.
- Study visits to research institutions and industry.
- Presentations on local case studies.

The workshop also included a variety of case studies, visits, training sessions and talks related to technology, industry and innovation from leaders of Malaysian organizations. Delegates from each country were also invited to give a short presentation on the status of STI initiatives in their respective countries. Interestingly – albeit not necessarily surprisingly – almost every speaker reported on how difficult the whole innovation subject was, how they were struggling to make any headway, and how they didn't really know where to look in order to make any progress. The session containing these presentations, in fact, came to sound a bit like Confession. No signs of presenters trying to stick out their chest and tell put on the usual 'look how great we are in my country' bravado act (or, if they were, things must be *really* bad), rather a genuine attempt to open up a dialogue to try and fathom out what needed to be done.

If nothing else, what we got out of the event was a host of invitations to come and do more SI work in very nice parts of the world like Mauritius, Jamaica, Trinidad, Peru and Bangladesh. All in all, not a bad outcome from what turned out to be an extremely informative four days.

Investments – Phase-Matched Negative-Index Metamaterials

Electrical engineers at Duke University have developed a material that allows them to manipulate light in much the same way that electronics manipulate flowing electrons. The researchers say the results of their latest proof-of-concept experiments could lead to the replacement of electrical components with those based on optical technologies. Light-based devices would enable faster and more efficient transmission of information, much in the same way that replacing wires with optical fibers revolutionized the telecommunications industry.

The breakthrough revolves around a novel artificial metamaterial (one of our favourite topics right now) structure. These exotic composite materials are not so much a single substance, but an entire structure that can be engineered to exhibit properties not readily found in nature. The structure used in these experiments resembles a miniature set of tan Venetian blinds.

When light passes through a material, even though it may be reflected, refracted or weakened along the way, it is still the same light coming out. This is known as linearity. "For highly intense light, however, certain 'nonlinear' materials violate this rule of thumb, converting the incoming energy into a brand new beam of light at twice the original frequency, called the second-harmonic," said Alec Rose, graduate student in the laboratory of David R. Smith, William Bevan Professor of electrical and computer engineering at Duke's Pratt School of Engineering.

As an example, he cited the crystal in some laser pointers, which transforms the normal laser light into another beam of a different color, which would be the second-harmonic. Though they contain nonlinear properties, designing such devices requires a great deal of time and effort to be able to control the direction of the second harmonic, and natural nonlinear materials are quite weak, Rose said. "Normally, this frequency-doubling process occurs over a distance of many wavelengths, and the direction in which the second-harmonic travels is strictly determined by whatever nonlinear material is used," Rose said. "Using the novel metamaterials at microwave frequencies, we were able to fabricate a nonlinear device capable of 'steering' this second-harmonic. The device simultaneously doubled and reflected incoming waves in the direction we wanted."

The research results were published online in the journal *Physical Review Letters*. It was supported by the Air Force Office of Scientific Research. Smith's team was the first to

demonstrate that similar metamaterials could act as a cloaking device in 2006 and a next generation lens in 2009.

"This magnitude of control over light is unique to nonlinear metamaterials, and can have important consequences in all-optical communications, where the ability to manipulate light is crucial," Rose said.

The device, which measures six inches by eight inches and about an inch high, is made of individual pieces of the same fiberglass material used in circuit boards arranged in parallel rows. Each piece is etched with copper circles. Each copper circle has a tiny gap that is spanned by a diode, which when excited by light passing through it, breaks its natural symmetry, creating non-linearity.

"The trend in telecommunications is definitely optical," Rose said. "To be able to control light in the same manner that electronics control currents will be an important step in transforming telecommunications technologies."

While it is difficult to call anything still in the laboratory an 'investment' opportunity, the potential prize attached to a successful commercialization of this research finding is so enormous, we thought it justified its place in this section of the e-zine. Not to mention all of the other pioneering work being done at Duke on meta-materials in general – Professor Smith alone has close to 30 patents and patent applications going through the various patent offices of the world right now.

Generational Cycles – 'Jilted Generation'?

Returning to the theme of the August Riots in London and other UK cities, it is becoming more apparent to the whole population that many young people in Britain are set to be in a worse economic position than their parents. Whether this will provoke any sympathy among older generations and support from politicians is perhaps another matter:

"I'm 100% livid, I think that's the best way of putting it. We're going to get more angry than we are now."

Twenty-five-year-old, Generation Y, City worker George Lewkowicz is mad about the economy.

He is typical of many young Brits under the age of 30 who have come to realise that their financial prospects are substantially less bright than that of their parents' generation.

Last year George predicted young people would take to the streets - and he proved right as thousands of students from across the UK protested against the rise in university tuition fees and the scrapping of the Educational Maintenance Allowance (EMA).

Today, George predicts this disquiet is only set to escalate:

"There is this huge population of older people who have essentially had it all, and my generation are then paying for their retirement."

When this dawns on people, George argues, "the riots will happen".

Pessimism

Shiv Malik, author of Jilted Generation - a book which examines the prospects for the 80s generation onwards - looks at his peers and sees further evidence of the impact a financially tight future is having on young people.

"From my middle-class cohort of friends - people who should be doing well - they're delaying having children, having families, settling down. They don't know what to do with their lives.

"They get personally depressed about this stuff, and it's a quiet depression that happens everyday.

"No-one is paying attention to it, and that's the most upsetting thing. The impacts are going to be huge."

Is the sense of pessimism that Shiv sees among his friends valid, or are young people just whining?

James Morris, pollster with Greenberg Quinlan Rosner and former speechwriter for Ed Miliband, says his research confirms Shiv's observation across generational lines.

"If you ask people 'Is Britain going to be a better place to live in five years time?', the majority are saying no.

"If you ask older people... there's a consensus that this generation of teenagers, and particularly people in their 20s, are going to have a much harder time than their parents did."

However, Mr Morris makes an interesting qualification.

He says that while the dominant view among young people is that success requires effort, there is an important difference.

"If you look at my grandparents' generation, the kinds of hours they worked, the kind of work they did, the drudgery of [the] work... it's something young people today aren't minded to accept.

"They want a more interesting career. So there's a legitimate concern here that people's expectations about a decent job have changed."

Political priority

But what do the accused - the baby boomers - think?

James Morris says his research indicates that people people in their 40s and 50s are the most pessimistic about the prospects for the younger generation - they are more worried about young people than young people are themselves. So does the older generation feel they have a responsibility to do something about it, too?

"They don't buy into that," say James.

"Baby boomers don't feel like their wealth should be taken away from them and moved to the younger generation.

"They feel the government ought to act to create the right sort of opportunities for younger people to move on."

Pollsters like James Morris see evidence of a gathering movement of support of the financial prospects of young people, and are advising the Labour Party that this is something people really care about.

And party leaders from across the political spectrum are responding by making this a real priority.

We need to address consequent problems... but it's not fair to have a revolution where most of the victims are of a certain age"

In the government's Spending Review announced last October, the Chancellor George Osborne put forward the case that "there is nothing fair about running huge budget deficits, and burdening future generations with the debts we ourselves are not prepared to pay".

Labour leader Ed Miliband is taking a slightly longer-term view. He talks about the "promise of Britain" - the expectation that next generations will do better than the last, whatever their birth or background.

He says he is worried that is being eroded.

Who will shout loudest?

There are also some signs of sympathy among the baby boomer generation. Angus Hanton, a baby boomer himself, has founded a new think-tank called The Intergenerational Foundation to lobby for fairness between the generations.

He sees clear culpability on the part of his older peers.

"Let's take my own house [which] I bought 16 years ago for £160,000. It's in south-east London. It's now worth about £1.15m.

"So I've gained a million pound windfall to which I do not feel entitled, and that windfall, at the moment, is tax-free. Were I to sell [the house], there's no tax on that gain."

"It may appear very lucky for me, but the reality is when I sell, it will probably be to a younger person who'll be getting a mortgage and spending most of their working life paying off that windfall which went to me. I don't think that's fair."

Angus Hanton recognises that people from across the generations face a tough financial future, but he offers a final observation that captures the bottom-line perspective for Britain's youth:

"We need to address consequent problems... but it's not fair to have a revolution where most of the victims are of a certain age."

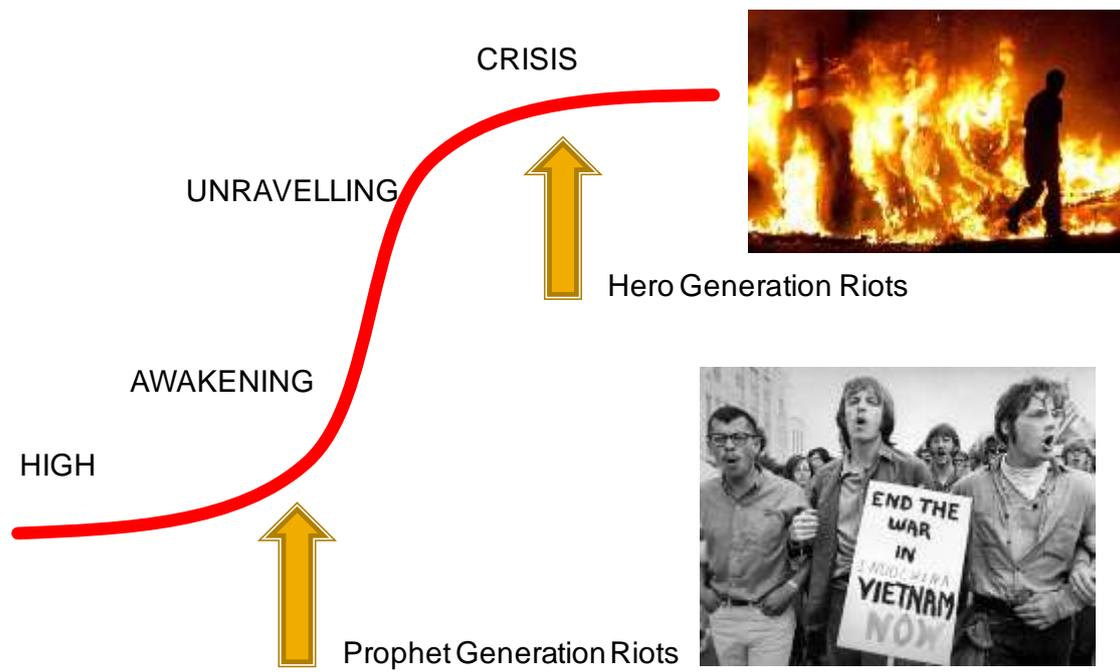On this the under-30s would definitely agree.

But with government spending being slashed, it is not just students who have taken to the streets in protest.

Just as young people may feel they have started to persuade the politicians and opinion formers about the seriousness of their plight, the generations before them are not sitting by quietly waiting to see what happens - as the recent pension protest in London showed.

One must wonder: since there are so many baby boomers in the UK - an estimated 12 million - will their protests drown out the voice of the disaffected youth?

However events pan out (we predict 'not well'), what is clear from this discussion of the Jilted Generation book is that Generation Y'ers find themselves in circumstances where public protest is about their only means of getting their voices heard. Big generations tend to be the ones that protest: The big post-war Boomer generation protested; the Artists ('Silent Generation'!) didn't; the much smaller Generation X tended not to (plus their healthy dose of apathy probably plays a fairly significant role); now the bigger Generation Y is doing it again.
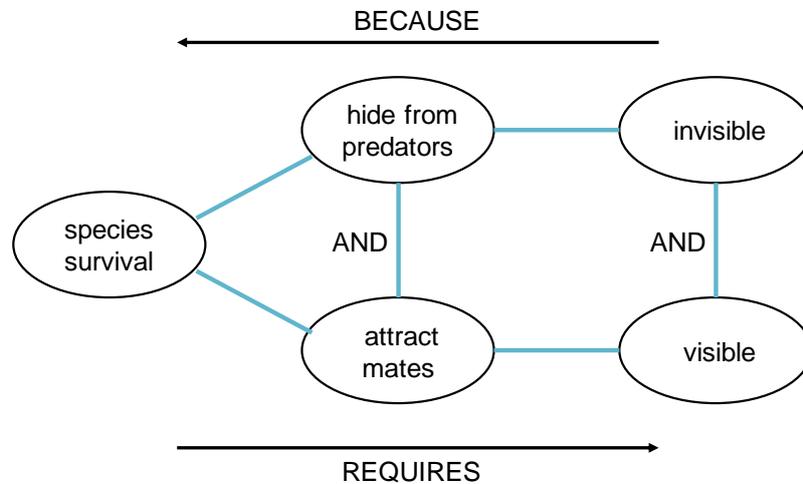
While generation size is a factor, what also has to be remembered is where we are in the 4-generation societal S-curve pattern. Boomers were protesting because they wanted to rethink the way that society worked. Generation Y are currently protesting because the changes the Boomers brought about haven't worked. The other two generations are either picking up the pieces or trying to make sense of the mess.

CRISIS

UNRAVELLING

Hero Generation Riots

AWAKENING

HIGH

Prophet Generation Riots

Strap in, this is going to be a rocky ride for some time to come yet.

Biology – Milk Snake

One of the most pervasive of all contradictions found in the natural world is the parallel need of prey creatures to be both visible and invisible:

One of our very favourite solutions to the problem is the one evolved by the milk snake. The milk snake is a non-poisonous mimic of the very-poisonous coral snake. A different story to the one we're telling here, but this strategy of co-existing with a poisonous double is a common survival strategy for many forms of life. What has confused naturalists studying the milk snake, however, is that it also inhabits places and regions where the coral snake does not. In theory, this shouldn't be such a smart move – predators having the opportunity to quickly realize that these red, black and white snakes are both easy to find and good to eat.

It was only relatively recently that their amazing solution to the problem was unraveled. From our visible-invisible contradiction perspective, the milk snake's vivid coloration certainly ticks the visible box. Potential mates have no difficulty spotting each other. So why can't predators also pick them out from their (usually jungle) surroundings just as easily?

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In theory, being a red, black and white thing in a green environment doesn't sound like the smartest survival strategy in the world. In practice, though, the relative combination of the three colours turn out to be precisely the right one in order to create a very neat optical illusion trick. Somewhat amazingly, when in motion with the usual alternating s-shape movement characteristic of many of their snake cousins, the red, black and white become blurred into a single colour. That colour is a drab olive.

Imagine what that must look like to a potential predator: you see a vividly coloured milk snake ahead of you and start approaching it; it sees you and immediately starts to move away from you; you speed up to catch it; it accelerates and –zap – immediately blends into its background and disappears from view.

A real 'isn't nature wonderful' moment we think.

Albeit one that isn't completely unpredictable. Here's what the technical conflict associated with the visible/invisible contradiction looks like when mapped onto the Contradiction Matrix:

IMPROVING PARAMETERS YOU HAVE SELECTED:

Compatibility/Connectivity (33)

WORSENING PARAMETERS YOU HAVE SELECTED:

Safety/Vulnerability (38)

SUGGESTED INVENTIVE PRINCIPLES:

17, 25, 9, 3, 31, 19

Principle 19, Periodic Action appears to be a pretty good clue pointing towards the colour blurring solution – clearly suggesting that what we might traditionally think of as a static problem (i.e. look at a photograph of the snake and it is very unlikely that the actual solution would emerge) needs to be re-framed as one involving a periodic time element. Local Quality (Principle 3) provides a further clue, and overall, Principle 25, Self-Service looks like a nod towards the overall integrated colour-combination/ movement solution.

Maybe macaws and zebras also read the book – they too use exactly the same colour-blurring/merging effect when in motion (bright blue and yellow macaws 'become' green; black and white zebras become a savannah-matching buff tone). Suddenly zebras take on a whole new level of respect.

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Short Thort

Tell a man there are 300 billion stars in the universe and he'll believe you.
Tell him a bench has wet paint on it and he'll have to touch it to be sure.
Murphy's Law

A fact in itself is nothing.
It is valuable only for the idea attached to it, or for the proof which it furnishes.
Claude Bernard

News

Duke
Having established a relationship as 'innovation education' provider to Duke University's Corporate Education organization, we have begun a series of client engagements with them, predominantly at the senior executive level. Duke is consistently voted the world's best Business School, and we feel very fortunate to have built this partnership with them. Hopefully the potential win for existing SI clients is that, should they desire academic accreditation, it should shortly be possible to obtain a Duke badge.

Public Workshops
The next round of UK public SI certification workshops will begin again at the beginning of October. The workshops will be co-sponsored by the local Manufacturing Advisory Service, so the focus is likely to be on process innovation and the SME community.

Oman
We will be running a government-sponsored series of innovation capability workshops during the coming months. The first will be taking place in mid-September. Check out the website for details.

TRIZ Journal
The slow, sad demise of the TRIZ Journal finally ended last month with the bankruptcy of the sponsoring organization. We have secured back-ups of all of our articles and content linked from our 'TRIZ Explorer' web-site, so hopefully nothing useful will be lost. With a

following wind, the relatively small number of regular 'TRIZ-authors' will be rising phoenix-like from the debris in the coming months. Watch this space.

Building Society Association
We will be presenting a short slot on consumer trends at this year's big BSA conference. According to the programme, we're the 'interesting, non-economist' part of the day's agenda. That's what they think. The event will take place in London on 13 September and will be mainly attended by the collective C-Suite of the industry.

New Projects
This month's new projects from around the Network:
> FMCG – Voice of Product Strategic Study
> FMCG – Voice OF Customer/TrenDNA Study
> Medical Devices – IP study
> Oil&Gas – Eyes on the World programme
> Oil&Gas – SI Certification workshop series
> Financial Services – 'Innovation Rejuvenation' Event
> Financial Services – new product feasibility study
> Financial Services – process innovation project
> Utility – 'Beyond Lean' programme
> Government – Innovation Strategy study

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