

# **Everything connects. (or To hell and back via Cambodia.) An exploration of Small Worlds and how they define new discoveries in psychology, social theory and creativity.**

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## **Abstract:**

*Small world networks are networks with the twin characteristics of high clustering and short distances. They emerge as an organic, natural means for cells, neurons, people and markets to organise themselves. This universality allows us to think about human thinking, about society, and about markets in a holistic way that challenges the somewhat fragmented viewpoint of people that we take not only from our dominant philosophical paradigm, but also from the dominant methodologies of market research itself. In research surveys and focus groups we aggregate the viewpoints of individuals so that  $1+1=2$ , but in small world networks that kind of arithmetic is not relevant or applicable.*

## **Introduction**

This paper is about small world networks, and was inspired by an absolutely awful period in my life in 2004 (a year that had been brewing badly for 9 years,) and by the confluence of events that emanated from that horrible year.

Put succinctly, I walked into my office one Saturday in 2004 with the express intent of ending my life. My intentions that day were an outcome from years of depression that had been triggered irrevocably by 20 months of stress in a previous job. During that time, in the mid-90s, I had driven home every night for a period of 9-10 months with one of the main symptoms of depression at the forefront of my mind. The symptom is “recurrent thoughts of suicide” and every night it crossed my mind as I drove over the Harbour Bridge that with just one swerve I could end it all. Every week night for 38 weeks: one hundred and ninety times when I entertained the thought of swerving off Lane One and into the cold concrete-hard waters below.

My Saturday afternoon was the culmination of weeks when, quietly, I had put many things behind me. I had stopped seeing friends. I had tidied up quite a bit of my work. I had dealt with a few loose ends and now, as I stepped over the road to the office I was ready: a little bit scared but also curiously at peace as well. I’d finally taken a decision, and when you’re depressed that’s not a common or easy thing. So it would be fair to say that I had totally lost all perspective.

There’s a fascinating difference between thinking about suicide, been there done that, and willfully intending to commit suicide. This time I’d clearly crossed the median barrier. Now, I can report, there’s also a fascinating divide between “intending” to commit suicide and actually committing the act. There’s a final railing to climb over.

Put it this way: each year some 5,000 young Americans between 18-24 commit suicide, yet of the same cohort some 80,000 make a suicide attempt. The success rate in youth suicides in the USA for example is so abysmally low, that you’re left to conclude that up to 15 out of 16 attempts are really about something other than seeking death. Only 15% of people who take poison actually die as a

result. Just 12% of drug overdoses end with what Raymond Chandler called The Big Sleep. Of every 100 who slash their wrists in the USA, just 5% bleed to death<sup>1</sup>. Perhaps these attempts are about getting attention, or revenge or something else entirely. Look at me world – I’m at the railing, I’m ready to go over.

Anyhow I was left after my doomy afternoon that Saturday in 2004, to wonder whether I was merely acting out the first part of the drama, or whether I was actually going to commit the act. I still don’t know.

What actually happened was really stupid. I was going to hang myself, but the ceiling in the office had no hooks or rafters from which I could string anything. And I wasn’t wearing a belt, and I didn’t have any rope anyhow and just as I was thinking that I’d need to rethink my plans completely, the phone rang and it was a client (on a Saturday for heaven’s sake!!) wondering if I could get some charts sent over on Monday. “No problem!” I hastily replied, ever eager to please. This is a strategy you find yourself taking when your self esteem has disappeared. And so, damn it all, I sat down and worked on the charts and that – really – was my brush with death. Later I went home and had dinner. We give our lives to research, but on that day I gave my death.

But what a fascinating moment, and what an interesting sequence of events it triggered.

My first reaction, upon reflection, was to recognise that my mental state of depression had reached a point that actually was life-threateningly serious. Not just a feeling of being down, but a state in which my brain was throwing up cries for help of the worst kind. Even *I*, through my black cloud, recognised that a decision or desire to end it all was a more serious place than I’d ever been before, and that I was in a deeper more precipitous state than I realised.

My mental and emotional condition was in precisely what physicists, dealing with energy at a molecular level call a *phase transition*: a chaotic moment when water is on the brink of restructuring itself and becoming ice. Hang onto to this thought because we encounter it later in this paper.

So began a journey to discover what the hell was going on in my mind, and this would lead me in turn to a renewed fascination toward how the brain actually works.

Secondly the crisis led me, quite directly, to go to Cambodia. It was as if that afternoon in the office I’d inadvertently triggered an unstoppable social networking process that continues to this day.

Thirdly the event sparked a creative flow that I hadn’t really experienced in 10 years, and as it turned out this was linked, inextricably with the neurological and social networking that I was discovering.

That was the discovery or realization from my situation. Sometimes when you go to an unusual place you see things from a fresh perspective. That’s what I saw: that everything is linked and the common thread here is the concept of *small world networks*.

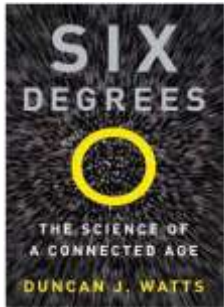
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<sup>1</sup> *Jumpers - Going to die at the Golden Gate Bridge*. Tad Friend. New Yorker, October 13, 2003.

## First let's establish this one: Small World Networks – what are they?

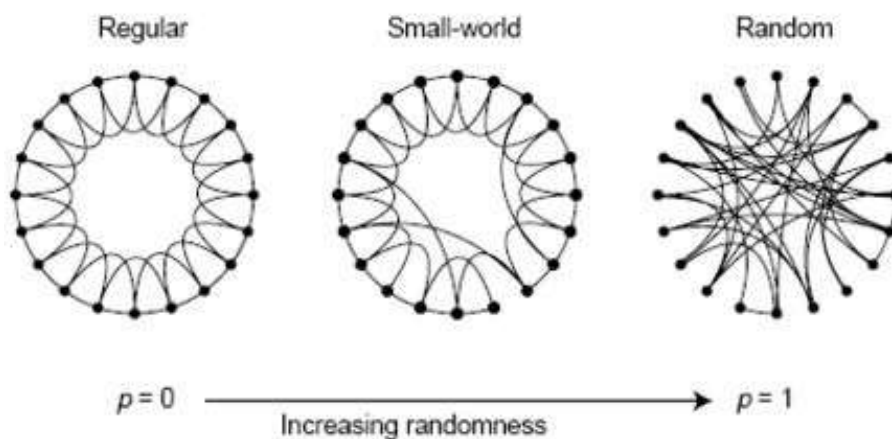
Everyone ought to be quite familiar with the *Six Degrees of Separation* concept popularized by Stanley Milgram who invented the audacious experiment, one of many<sup>2</sup>, that sent those packages from Nebraska and Kansas to Boston by a series of people “who knew people who knew people”.

In 1998 scientists managed to systematically explore the nature of networks and two of them, Duncan Watts and Steve Strogatz arrived at the concept of “Small Worlds.” They illustrated the idea in the diagram below.



The first network on the left is very regular. There is a high degree of clustering: every node is connected to 4 other nodes. That said, the average distance between nodes isn't as short as it could be. You'd need to jump through several links to get from any node chosen at random to any other node chosen at random. They measure this in terms of “mean distance.”

In the third diagram the wires are randomized and now the degree of clustering has dropped significantly. Many links are joined to only two others. But the mean distance is extremely short. To get anywhere between nodes you can jump across the circle and then connect locally rather than making a series of short hops. There appears to be a clustering/distance trade-off.



But the middle diagram is the interesting one. By taking a regular network and simply randomising even just a couple of links, we end up with a network that is both highly clustered *and* with a really short mean distance. It functions as a highly efficient, effective network. This is the classic “small world” network. You bump into somebody else in London and, gosh it's a small world, they now work with an ex-colleague of yours who is now in New York.

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<sup>2</sup> He also invented the notorious experiment in which students were asked to turn up the voltage on subjects strapped to an electric chair – a simulation actually, not the real thing as it turned out - which shocked academic authorities but rather proved that you and I are capable of inflicting torture if commanded to.

You or I might work and live in a relatively small highly clustered universe, but some of our contacts form those long-distance connections that put us just a couple of links from Hollywood or the White House. We're often surprised by what a "small world" it is.

The small world concept is proving to be quite universal. The small world efficiency of high clustering and short distances is proving to underpin the architecture of cells, of the human brain, and of social groups, of society and social structures such as the internet. The physics, if you like, that cause networks to evolve like this are not really so random as we might imagine. They're governed by underlying principles and laws.

It is a timely thing to consider small worlds because we're in an age when people have been waking up to the networked nature of our planet, and of our society, and we live in a marketing universe where social network sites such as FaceBook are part of the general media discussion.

What we don't often consider is that the architecture of small worlds leads to cellular, psychological, social and business phenomena that are often counter-intuitive or unexpected. So we're wise to study small world theory because it explains so many things that as market researchers we attempt to explain using our non-networked techniques of surveys (500 people, randomly selected, kept anonymous, responding as individuals) or focus groups (7 people, all strangers to each other.) We seem blind to the *network* effects that shape the very architecture of what we study.

### **So a note about our dominant research paradigm.**

Why don't we look at things in a holistic network way? The history of market research is to a great extent a story told in two chapters. In Chapter One, which covers events up to World War 2 our profession was defined by issues of measurement: how to measure readership and radio listenership, and how to do so in a scientific manner without gross sampling errors. To a great extent the genesis of market research revolves around the question of how we accurately seek a representative opinion: using our samples as a representation for the wider society. The roots of this lie in the history of statistical science since the 17<sup>th</sup> Century.

The events of World War 2, combined with the rise of popular psychology from the 1920s in the USA combined to give us Chapter Two, which covers the extraordinarily productive, inventive growth of market research methodologies between 1940 and 1960. During this period questionnaire scales were developed and locked into our methodology; focus groups were invented as a methodology, and by the 1950s new questions took on a psychographic dimension to complement the demographic structure in surveys, and the focus shifted from who you are and where you live to 'what motivates you' and how do you behave?

Today, 47 years after the close of Chapter Two – half a century! – the vast majority of market research conducted in the world today follows closely the templates laid down in those first two chapters. Surveys, focus groups, psychographic questions, issues of motivations and needs – all these were set forth and developed by the innovators of New York and Chicago in the 1940s and 1950s and using the DNA inherited from Chapter One. Sure, we now have computers to help us, and the respondent contact has moved from the front door to the phone and now to the PC, but the architecture of what we do has remained surprisingly constant.

The medium has been pretty effective, but if we stand back and accept that every medium has a message, or a wiring bias of some sort then the classic market research methods have these inbuilt characteristics.

The overwhelming majority of research studies rely on the opinions of *individuals*, and these are aggregated. In fact when we talk about privacy we positively celebrate the fact. But what this says is that we are assuming that our markets, or our society are a sum of the parts.  $1 + 1 = 2$ .

Our qualitative research follows the same architecture. Our “scientific” approach to sampling for face-to-face or focus group respondents remains predicated on randomness and on respondents around the focus group table “not knowing each other” – and with a few exceptions this is how we operate. Again we aggregate the views of individuals.

Our questions are about individual characteristics: demographics, motivations, needs and behaviours. While we may rate some individuals as more affiliative or individualistic in nature, we still study these people as individuals and then aggregate our data.

Now is there anything wrong with that? Well, how about all those things we learn about teamwork. Unity is strength. United we stand – divided we fall. The whole is greater than the sum of the parts.

If there’s any truth in these truisms, then do people really operate as individuals in the manner that we study them? Aren’t we intrinsically a mixture of individualism and collectivism: proud to some extent to be our own people, but all too willing to operate in groups? A rap artist has his posse. But so does my Mum aged 80. And most of us aggregate into organisations, clubs, social circles, book groups, sports teams, drinking buddies, fishing mates, business enterprises, professional organisations. That’s just how people tick. So it becomes quite obvious if we stand back and look at it that our research methods only operate on one side of the human equation. We look at the individuals’ characteristics, but we don’t study the group dynamics.

### **Mirror-Neurons and Social Intelligence. Human WiFi and social networks.**

The argument that we ought to be taking this *group perspective* became a whole lot more compelling in 1992 – thanks to a monkey and a lab assistant who was eating an ice-cream. Daniel Goleman in his fascinating book *Social Intelligence* cites the experimental work by Pellegrino et al<sup>3</sup>, a team of Italian neuroscientists who were able to identify those areas of the brain, in experimental monkeys where physical actions such as grasping objects, or tearing these objects apart were handled. The scientists were able to map these areas of brain activity with amazing precision, and could basically see parts of the brain “light up” as the monkeys asserted mental control over their actions.

One blazing afternoon a research assistant came back from a break to resume monitoring of the lab monkey. Suddenly a range of neural-monitors lit up – in the same areas of the monkey brain that would be activated if the monkey itself were eating. Goleman uses a nice metaphor: human WiFi –

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<sup>3</sup> ***Understanding motor events: a neurophysiological study.*** G. di Pellegrino, L. Fadiga, L. Fogassi, V. Gallese, and G. Rizzolatti. Istituto di Fisiologia Umana, Università di Parma, Italy. 1992.

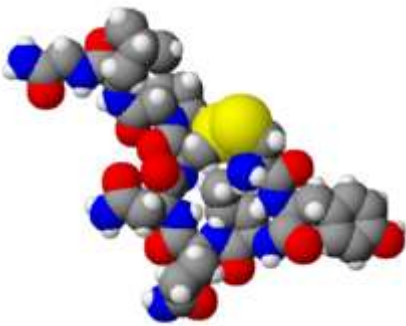
that same inter-relationship you occasionally when you walk into a meeting and all your laptops go bwa-a-a-ng! and start talking to each other.

The discovery of mirror-neurons that hot afternoon has had a profound effect on our understanding of how the human brains tick. As far back as the 1920s the concept of social-intelligence had been raised, but scientists had progressively sidelined the concept through a failure to measure the concept. It became subsumed by the general concept of intelligence, and social intelligence was largely tested in terms of crude (and highly judgmental) questions asking how individuals would respond to various social situations. There it was again: the individualistic viewpoint. How does the individual respond, not: how does the network of individuals respond?

With the discovery of mirror-neurons in the pre-motor cortex however, and more recent advances in neuro-science, scientists have given fresh credence to social-intelligence concept. In short, the evidence is stacking up to show how well we are wired to operate as parts of a social network.

Humans are good at reading each other's expressions, including micro-expressions, and experiments repeatedly show how our capacity for empathy can cause two people, for example, to more or less

operate as a single entity. A mother sees a crying child and instinctively strokes the child and sings a lullaby – inducing complex neural responses in the child including the release of oxytocin (pictured) a peptide sometimes referred to as the “hormone of love.” There's a feedback loop that goes from one being to the other.



The social network characteristic of humans, reflecting the social intelligence is evident in such phenomena as the harmonization of menstrual cycles among women who live together, and the increasing empathy between flat mates after living together. In one experiment cited by Goleman, guys were hooked up by neuroscientists who studied their responses to comedy and to weepie movies. The respondents, new to a hall of residence at their university, exhibited a range of responses. Months later when hooked up and asked to watch more movies, their reactions and the ways their brains fired-up had harmonized to a significant degree.<sup>4</sup>

### **And of course, social-intelligence works on a global level.**

While the way humans socially operate hasn't fundamentally changed in thousands of years, our technology has allowed our capacity to network to be amplified and enhanced. In the 1960s, just after market researchers closed the book on Market Research Chapter Two and started what has so far transpired to be a not particularly eventful 50 year Epilogue, our society didn't really talk in terms of social networking. Sure we did it, we joined golf clubs, and Rotary and other groups – we were huge on clubs in fact – but we didn't use the term *social networking* like we use it today. You can ask a 10 year old if they visit any social networking sites and they know exactly what you mean. We're

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<sup>4</sup> ***Social Intelligence. The new Science of Human Relationships.*** Daniel Goleman. Hutchinson. 2006.

increasingly attuned to the idea, it's pinging away on the collective radar thanks to the extraordinary impact of internet and email since the mid 1990s.

Marketers are gradually grappling with the impact of internet, and giants such as Microsoft are showing specific interest in social network sites such as FaceBook in order to create a community platform that give their products – for example their Zune music player, which has failed to really fire in the face of iPod – a peer to peer functionality. They're tapping into the idea that music is a shared experience. What's that you're listening to?

Here's what Jim Stengel, the global marketing officer of Procter & Gamble says about the role of internet in today's marketing picture. Recall that his firm is responsible for selling around \$US76 billion worth of product this year and spending around \$US6.7 billion on advertising. When interviewed in a recent issue of Fortune he was asked about the changing face of marketing in the internet era<sup>5</sup>. He told readers:

*"The end of the mass era of mass marketing is a very positive thing for our company, for our brands and for the industry. The biggest thing going on is that consumers want to trust something. They want to be understood, they want to be respected, they want to be listened to. They don't want to be talked to. People really do care what's behind the brand, what's behind the business. They care about the values of a company. This is an enormous phenomenon enabled by technology in many ways.*

*The marketing world, enabled by technology is very scalable. The impact of your efforts can be amplified greatly because of the connectivity and networking of consumers. If we do something that is worth talking about, word of it spreads very, very quickly at relatively little investment."*

Now where is market research in all of this? Apart from treating the internet largely as a kind of alternative to postal surveys (same basic sampling approach of individuals, same format, same questions, same tick the box structure, same analysis,) we haven't really moved our thinking into a social network paradigm. The 10 year olds have, but we haven't. We continue aggregating the opinions of individuals. Our qualitative thinking seldom mentions the impact of social intelligence as a concept, or the strange dynamics when more two or more people get together.

Okay. Let's park that and come back to it later. Here's an extended anecdote with some applicable observations for market research, stemming from my first post depression small world foray.

### **Social networking on a social level. How one regret turned into a global community.**

One thing about my non-fateful Saturday afternoon was that I had ticked off almost everything on my list of *things-to-be-tidied-up-before-I-die*. But, there was one outstanding item. I had one nagging regret that I hadn't resolved. Really, in 49 years that's a pretty good track record and it makes me

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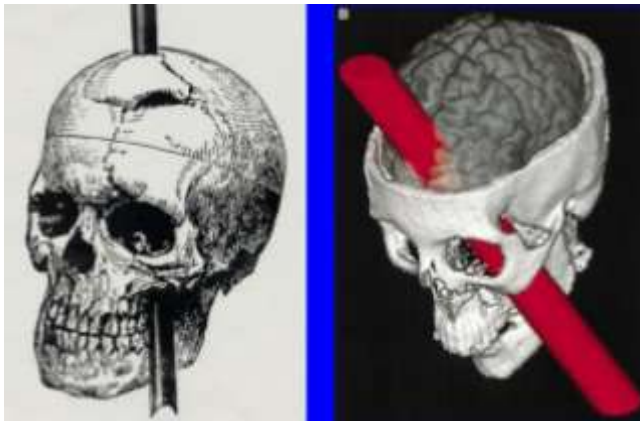
<sup>5</sup> *Selling P&G. Geoff Colvin Talks With Jim Stengel.* Fortune. September 17, 2007.

wonder why I didn't look at that this skimpy list of regrets – regret singular – and say to myself: “Buddy, you're not doing too badly here.”

But in a state of depression you don't see it like that. One facet of the mental condition is that your serotonin levels are too low, and a side effect of that is that your ability to link the thinky part of your frontal lobe with the emotive part of your amygdala is somewhat dampened. Neuroscientists are making startling discoveries now about how the brain works (more later) but one thing about some depressions has been understood for 2200 years: your emotions go numb, and without emotion your rational, decision-making capability goes out the window as well. You freeze up, you've got no gut instinct able to tell you to turn left not right, to choose right over wrong. You lose your emotional radar.

A significant part of our scientific understanding in this arena comes from the tragic story of Phineas Gage, (Gage: a good name for a railroad worker,) who well liked by friends and fellow workers on the Rutland and Burlington Railroad where he toiled in the 1840's. On September 13th 1848 he was victim of a horrendous gunpowder accident that it sent a heavy steel rod, weighing 13kg and a metre

in length, up through his face, out the top of his skull and almost 30 metres beyond.



Gage lived, miraculously, and a few months was fit enough to go back to work. However his case really opened the file on the inter-relationship between different areas of the brain. In essence the damage to the frontal lobes of Gage's brain did little to impair the main's memory or his general ability to function. But in ceasing the somewhat moderating role of the frontal lobes on the

emotive elements of Gage's mind, the accident resulted in a tragic change in personality.

According to Gage's doctor, Dr. J.M. Harlow:

*“Gage was fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint or advice when it conflicts with his desires, at times pertinaciously obstinate, yet capricious and vacillating, devising many plans of future operations, which are no sooner arranged than they are abandoned in turn for others appearing more feasible. A child in his intellectual capacity and manifestations, he has the animal passions of a strong man. Previous to his injury, although untrained in the schools, he possessed a well-balanced mind, and was looked upon by those who knew him as a shrewd, smart businessman, very energetic and persistent in executing all his plans of operation. In this regard his mind was radically changed, so decidedly that his friends and acquaintances said he was 'no longer Gage.'”*

If the system of Gage's brain was damaged physically, the same system in my brain was impaired chemically, and that accounts for the inability to put perspective on things. I must say, reading about Phineas Gage was quite illuminating about my own mindset – and more than a little humbling.

But metaphorically, that was me with an iron bar through my frontal lobes and a lost ability to reason. All I saw was a regret, unresolved, and it loomed large.

The regret was this. In the 1970s at the University of Waikato I had been friends, not all that close, with Chan Chay from Cambodia. In those days I was very active in student politics, marching down mainstreet, protesting wars and nuclear power: often I was the guy up front with the megaphone. Whadda we want? When do we want it? I once led a March up Queen St, and it was me with the megaphone. What we wanted that time was Bastion Point, Maori land.

I was 20 and political.

Or so I thought. But my battles were largely about distant concepts. It's easy to be angry about the prime minister, about nuclear energy, about the Middle East: really the political anger was a luxury that this middle class student could afford. I still scraped through academically, so on campus I had it both ways.

But in that time Chan Chay probably lost a quarter of his friends and family. In the 1970s under Pol Pot, some 2 million of Cambodia's 8 million people lost their lives through execution or starvation. It was the worst case ever in human history of what is called auto-genocide: killing off your own people.

So there I was marching for world peace, totally oblivious that Chay was virtually alone on campus, a million miles from home, out of contact from his family and knowing from the Herald's scant headlines, and from the stories from his grapevine, that he was losing loved ones each week. I honestly don't know how he coped, and over the years I have often wondered about that, and regretted that never once did I ask him if he was okay. In 1977 I finished University and moved back to Auckland and lost touch.

Almost 30 years later I still thought about Chay and felt an indelible, gnawing urge to apologise to him.

After my dumb Saturday I went to psychological counseling which was by turns useful, helping identify ways of dealing with my depression, but also not useful in that it kept me focused entirely on myself as the tragic centre of a black vortex. During this time I decided to shake my head around, re-throw the dice as it were, and do something really different. And around that same time I tracked down Chay, now living in Phnom Penh.

Now on the face of it, that's not an easy piece of detective work. Chan (and its cousins Chen, Chang and Zhang,) is one of the most common surname in the world. At Capping in 2002 in Auckland University, the Chans easily outweighed the Smiths. How would you find a Chan in an Asian country?

Well this was my first real post-depression *small world* moment. We have them every day of course, but sometimes a crisis turns your radar on in new ways. A small world has clusters of people, and it also requires a few long-links to inter-connect those clusters. A project in Wellington put me face to face with one such person who had these long distance links: an economist Kalyan Soss who is Cambodian, now at the National Bank. I told him about Chay and he smiled: "Chay, look – he was like an uncle to our family. He helped us come to New Zealand."



But I was surprised, when I thought about it to realise that I have short links to the cast of Ugly Betty, the even uglier John Howard, the late John F. Kennedy, Governor Arnie, Mick Jagger, Cher, the King of Cambodia, Bob Marley (via two pathways), Lady Di, John Travolta and three generations of gold-medal Olympians. My first famous link was to the cowboy next to Ed Hillary. I met the Cisco Kid (and burst into tears I was so overcome) when I was 5 years old.

But back to the story. Here I was, one link removed from dealing with my unique burden of regret. A few weeks earlier I had felt totally lost, disconnected and emotionally detached. Chay was in Phnom Penh. He told me it was fine if I paid a visit.

Pleased to have made a positive decision, I told my psychologist. Here's how the dialogue went - true story:

*"I've decided to shake my head around a bit. I've booked a ticket to go on a holiday."*

*"Good move. If you stay in your current rut you'll only step on landmines. Where are going?"*

*"... er...Cambodia."*

I was about to discover how small our world could be.

### **Cambodia.**

I met Chay Chan and I heard his story, about how the New Zealand government had flown all the Cambodian students in New Zealand, not many in those tragic days, and had carte-blanche handed them New Zealand passports. The Minister of Immigration had told the students how the Government recognised that their lives were in "grave peril" if they returned home. "New Zealand saved my life," Chay told me.

We met for lunch and we went to a local restaurant in Phnom Penh owned by a Kiwi-Cambodian couple who used to work for Air New Zealand. Their place was called the Sugar Palm Café – though they almost named it the Koru Lounge.

It felt exotic to be there in the heat, soaking up the local food. The couple, it turned out, own a house some five doors from my own in Auckland. So we ended up talking about the Parnell gossip: not what I expected!

But the real small-world moment came when I met up with locals in Siem Reap, near Angkor Wat and volunteered at a makeshift village school run by a young guy called Svay Savong. I taught there for three afternoons, became friends with Savong and on the day I left he told me about his dreams to build a school in the countryside. He also asked me for my email address – and I wrote down his. We were, after all, in the same global village. In the Duncan Watts model, I'd been rewired to become a long-link that joined up two quite separate clusters of people.

### **The Impact of Small Worlds on Markets and Market Research**

Earlier we established both the concept of social intelligence and how humans are wired to operate in a network – a wireless network even. We also established how the biggest marketer in the world, just by way of example, has recognised the intrinsic power of the internet and the way that social networks dialogue with brands, and with each other about brands.

In this light it is worth digging a little deeper into the relevance and power of social network thinking in our world of market research.

**First, almost all human consumption has a degree of social meaning.**

Princeton Professor of Sociology Viviana Zelizer has specialized in studies that discuss money. In taking this angle she reveals the extent to which the most fundamental medium of commercial human transaction is far from a neutral medium. Money isn't just the neutral stuff with which we buy things – every dollar note is coated in social meaning, every coin is positively grubby with assumptions and signals.

Even within an intimate relationship, a marriage, money conveys roles and a power-arrangement that is more complex than you might expect.

In this manner, money works as a good metaphor for the social currencies of any human exchange. There are implied signals in most transactions<sup>6</sup>.

Last weekend as I browsed the shelves of DVDs at my local Warehouse (sick of reruns on television I then sought to *buy* my reruns instead,) I eavesdropped on a group of three 16 year-old girls who were also shopping for a DVD. We were in the TV Series section. It was a Sunday, and presumably these girls were looking for something cheap and good to watch together, so group dynamics came into play: a mini-social network.

The dominant girl boasted how she already had absolutely every episode of *Sex In the City* and it was “s-o-o-o funny.” The quiet girl suggested *Heroes* as a programme to buy but the third girl practically gagged at the suggestion. Within 15 seconds I was aware that the conversation may have nominally been about which DVD, but – unless I'm mistaken - it was also about status, power, connected-ness, and affinity. “Quiet *Heroes* Girl” was clearly struggling to stay in the same orbit with the twin-stars of this little system: Dominant Girl and Cheerleader Girl.

And this was just a DVD. The purchase was merely a stage on which some deeper teenage bonding drama was being played. But the point here is that whatever decision they made, it was the result of a collision of minds – a joint decision not dissimilar to the hundreds of decisions we make each week as we negotiate our needs and, at the same time, our relationships.

The question for researchers is: could we have determined what these girls would have purchased if we polled each girl? If Quiet Girl and Cheerleader Girl were making the decision together without the presence of Dominant Girl, might they have agreed to buy *Heroes*?

When we study how flatmates go shopping, or how a home-leaver decides which brands to purchase we may find, as I did once with Alastair Gordon of Nielsen, that peer influence and “what mum always bought” are far greater influences than the media. So in this context we are challenged as researchers to better understand these small-world networks of influence.

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<sup>6</sup> *The Social Meaning of Money*. Viviana A. Zelizer. 2001

## Word of Mouth and Viral Marketing is more powerful than you think, even now.

How does news about a new product spread in our marketplace? Most of us measure this by tracking the recall of brands and the concurrent recall of advertising – top of mind and unprompted.

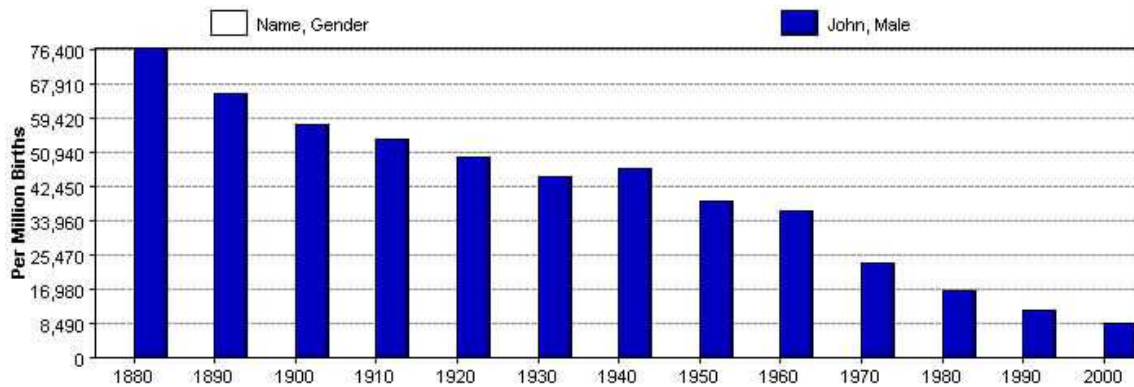
While the big research companies are scrambling to purchase companies that measure internet statistics – visits, clicks and so on – these measures still aren't letting us stand back and look at how ideas or brands catch on and get adopted by the marketplace. They still work *a priori* and still equate visits and clicks to TARPS. We effectively measure "what you saw" but ignore 'what you said about the ad with the others in your lounge.' We don't capture the networking effect.

But the inherent strength of networks is easy to measure at least theoretically. One way to do this is to look at "brands" in categories where there is no advertising or above the line marketing.

A good example is baby names, which are a carefully considered choice made by the parents, and usually in conjunction with family and friends. There's an element of risk avoidance here too – a desire not to name the baby with some label that will cause grief in the child's lifetime.

Here the parents have a vast range brand names to choose from, and the choice comes down to individual preference.

On that basis one might consider that names may ebb and flow in the public consciousness, but such trends won't be particularly dramatic. Witness the gradual linear decline in popularity of John as a name for American boys over the past century<sup>7</sup>.

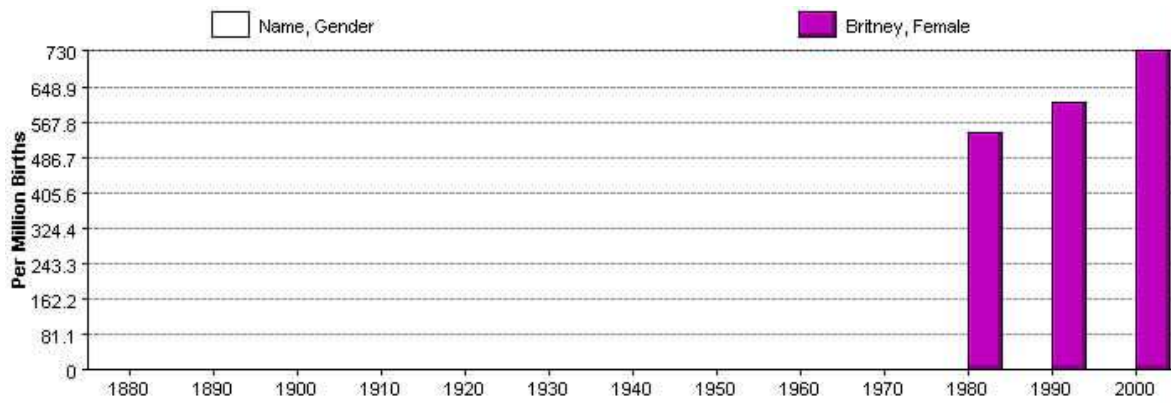


But how do you account for the explosive growth in popularity of certain names? There may be the odd media effect, where a cool character on TV inspires many parents, but these popularity surges often occur *before* the celebrity becomes famous: we can't credit television or the media with the

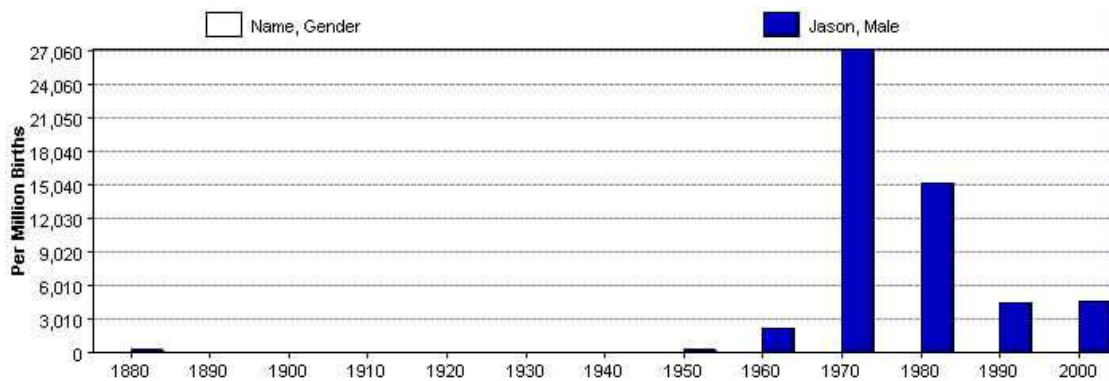
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<sup>7</sup> <http://www.thenamemachine.com/> The name machine website. Their methodology: The Name Machine identifies trends by analyzing vast amounts of data made available by the U.S. government and other public sources. This data, including social security statistics, provides detailed information on baby name popularity and trends in the United States.

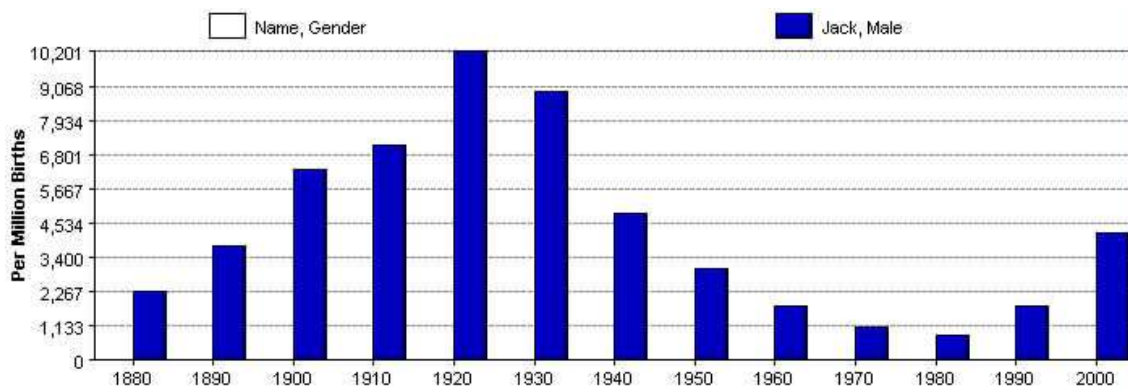
full story. Look how Britney, as a name, surged in the 1980s, well before Miss Spears hit the charts in the 1990s and hit rehab a decade later.



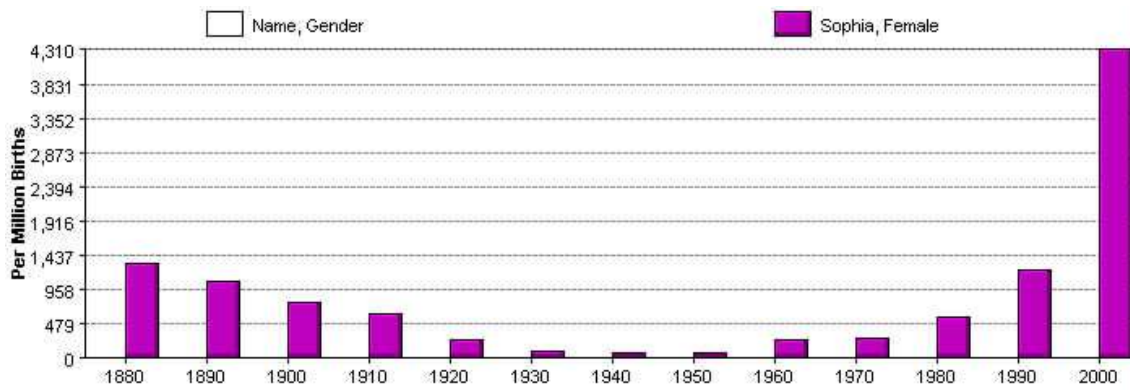
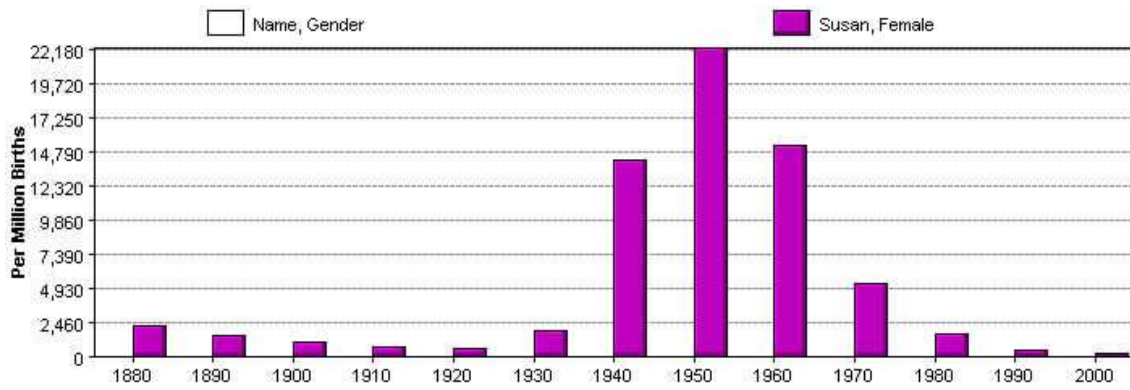
How come this name just came out of nowhere? Why did parents and their friends and family suddenly add Britney as a possible name for their infant daughter? Why did Jason capture the Zeitgeist of the 1970s (in the UK the rise was inspired by a TV show *Department S* – but the series didn't get wide viewership in the USA from where these figures are derived.) Besides, the Jason boom started just before *Department S* went to air.



And why has Jack surged, died and been resurrected over the past 120 years? How can you explain this roller-coaster? Where are the forces that one decade determine that jack is a cool name, but the following decade decide that Jack is passé. Frankly I'm surprised there wasn't a jack revival when JFK got elected in 1960.



Let's stay on this riff just a little longer and ponder the mystery of Susan. What the hell happened in the 1940s to cause a birthquake of Susans? I have been unable to find any potentially inspirational Susans who were famous at the time. No particularly major actress. No sensational sporting heroine. But there it is in the next chart, a tidal wave of Susans that receded by 1970 and has all but disappeared today.



I did the same with Sophia, expecting a surge during the heyday of Sophia Loren, the gorgeous, intelligent actress who starred in many movies in the 1960s. Nothing doing. But suddenly this decade we've had a Sophia moment.

### Sensible Networks give us unpredictable outcomes.

The reality is that name trends follow a variety of patterns: linear and non-linear, sudden-growth and sudden-decline that resemble the somewhat random mathematics of small-world networks. Drop a stone into a pond and you'll get predictable concentric ripples. Drop a stone into a small world network and you might get anything from a negligible response through to a tsunami – like the 20 year Susan Tsunami that swept the world of baby names in the 1940s through to the 1960s.

This wasn't driven by advertising, marketing, PR or any other conscious effort – yet Susan captured 2.2% market share in the 1950s, up from 0.2% (an eleven-fold increase) from 20 years earlier. This was a purely viral thing, and the magnitude of these name crazes, whether Jason or Sophia or Britney shows that small world networks can deliver the kinds of result that many marketers dream about, or have nightmares about. Yet it all boils down to a simple moment when a new mother thinks: "A friend of a friend has a baby and they named her Susan – that's a nice name."

What might be surprising to marketers who have lived with Gladwell's *Tipping Point* for 10 years is that the role of influencers (early adopters and mavens) may be vastly overrated. In *Brandweek* this year Duncan Watts was interviewed over recent findings that suggest that social epidemics don't always get fuelled by early adopters and high influencers as commonly supposed<sup>8</sup>. He was asked what this meant for marketers:

Duncan Watts responded:

*"First, marketers should focus less on who people influence and more on how people are influenced. It sounds like just the other side of the same coin, but the difference is important—identifying easily influenced people, and how they are influenced raises different questions, and requires different research design than looking for influentials.*

*Second, they should also think more about networks, and network structure, rather than treating everyone as behaving independently. And third, they should move away from the idea that buzz can be engineered to achieve some pre-specified outcome, and get better at measuring and reacting to buzz that arises naturally."*

What Watts alludes to is the unpredictability of outcomes. Different influencers work in quite distinct ways (an Oprah will have a different kind of effect than a Hillary Clinton) and the nature of the idea that is being transmitted will also affect the outcome, as will the architecture of the social network in question.

Watts and his research partner Peter Dodds conducted thousands of simulations and found that they could create explosively successful epidemics without strong influencers at all. That kid with chicken pox at Mt Roskill Primary need not be a maven, an early adopter or anything else, but may through a bit of luck be pivotal to the worst chicken pox outbreak in recent New Zealand history.

As Watts points out; you simply can't predict the outcome, and it is foolish to focus on the role of influencers: it is more useful to focus on how and why people are influenced. Says Watts:

*"It is relatively easy for us to imagine how we might influence a single individual, or as an individual, be influenced (although even that is more subtle and complicated than you would think). So it's tempting to think that influencing a lot of people is just like influencing an individual many times over (mass media marketing is, in effect, based on this simple principle). And from this reasoning, it follows that the more people you influence directly, the more important you are. This statement sounds like nothing so much as common sense, which is exactly what it is. And because it sounds so much like common sense, no one has really thought to challenge it. But it's wrong. Or more precisely, it is not clearly correct, and when investigated carefully, it turns out often to be wrong."*

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<sup>8</sup> **Brandweek** Buzz-Kill: Columbia Prof Blasts Influencer Model March 05, 2007. By Todd Wasserman.

### **Spreading AIDS in our own office. More small-world unpredictability.**

Using agent-based simulation software, MacroCosm, developed by colleague Miles Macklin in our small firm in 2002, we recently ran dozen of simulations whereby populations highly (but not totally) resistant to infection (our metaphor was AIDS and we programmed our 'agents' to be resistant to unsafe sex) mingled with a group of 'harlots.' With 50 harlots mixing with the 100 resistors we found, perhaps not surprisingly, that the resistors gradually succumbed. After 300 time clicks some 50 per cent of the resistors were diagnosed HIV Positive.

Next we ran the simulations again and again, each time reducing the number of harlots and expecting to see the infection rate drop each time. At every 50 time-clicks we stopped the social experiment, recorded the infection rate and then pressed the *resume button* again.

We found that the infection rate in our particular model remained just about the same, regardless of the number of harlots. We cut the number to 20, to 10, to 5 and the infection rate remained almost constant. Why was this?

One reason was the architecture of our social network and the presence of a few higher connectors amongst the resistor population. Once a highly connected resistor contracted AIDS then the epidemic took off – though as Watts points out, it wasn't just the connector to blame: there was also sufficient "willingness to be connected" to help explain the story. But in short, our findings went against the traditional media strategy that posits that high exposure, high TARPS, will result in higher reach.

Networks work in mysterious ways. 1+1 does not equal 2.

Underpinning this truth is the almost universal presence of a "power-law" distribution of players or agents (or hubs) in small-world models. In the sexual universe the average number of sexual partners for any adult is quite small – but studies repeatedly show that there are a few players who have a massive number of sex-partners. These super-connectors aren't necessarily harlots (or strong influencers, as Watts points out,) but may nevertheless link quite diverse clusters or cliques of the willing.

In the early days of AIDS within the gay community of America, some 40 of the first 250 reported cases had a common thread: a particularly handsome French Canadian airline steward. His numerous liaisons, at least 250 per annum until 1983 placed him at a pivotal place within the social networks of gays on two continents.

Instead of a bell-curve distribution, members of networks have more like an 80:20 distribution. This is true of sex partners (gay or straight) internet links, reviewers on Amazon and sales of brands. The concept of *The Long Tail* is built on this truth.

### **As networks grow their chemistry can change.**

The somewhat unpredictable nature of social networks makes them both fascinating and frustrating to study. One major development on top of the Watts-Strogatz models was the consideration of networks that *grow*. The internet is one example. In fact most networks DO grow.

Under the helm of mathematician-physicist Albert-Laszlo Barabasi<sup>9</sup>, and his team of academics at the University of Notre Dame, began exploring the nature of networks in the 1990s around the time that Watts and Strogatz cracked the initial code.

Barabasi is similar to Watts in terms of his curiosity toward the world around him. Both researchers see and enjoy the common-threads between cellular biology, big bang physics of our cosmos and the way atoms behave. There appear to be immutable laws and patterns that govern their behaviour.

One of these laws is one that Barabasi calls: The Rich Get Richer. In every network he studied: social, physical, atomic or cellular, a pattern emerges whereby some nodes attract exponentially more links than others. In internet terms, you'll get some mega-Google nodes and millions of personal home pages each with only a few links. Remember, if you can, that Google was only a negligible search engine in 1999, and trailing other search engines such as Lycos and Alta Vista. Somehow the huge network flexed its collective attention to Google, and since then it has grown faster and bigger than its erstwhile competitors.

Why do the rich get richer? The mathematics of this phenomenon is all to do with a concept that Barabasi calls "Fitness."

Even in a totally random network that occurs in nature, you'll find that instead of a random matrix of nodes and links, you'll get a fractal of some sort, with dominant hubs that grow in importance relative to others. If you could imagine a sticky marble, sitting in the middle of a room, and a random marble roller sends various marbles across the floor, sooner or later one of these marbles will hit the sticky centre and now we have two marbles stuck together. Now imagine that both marbles get sticky, and we keep sending more marbles across the floor. Each marble that hits the network gets

attached. Over time the network would grow.



Almost certainly it would develop a distinct shape with dominant arms that would, in time spider out to the walls of our room. The random marbles we keep sending would most probably attach themselves to these aggregating arms of sticky marbles. The rich would get richer.

The illustration here is of a Diffusion Limited Aggregation fractal – actually the growth of a copper sulphate cluster.

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<sup>9</sup> *Linked*. Albert-Laszlo Barabasi. Plume. 2003.

In social networks similar patterns occur, but instead of our “magic sticky stuff” new links join in the network according to preferences. If you start a website you’re more likely to link to where other people link – to go where the action is.

In social networks of a more human scale, circles of friends, or communities of interest, or business, the same dynamics occur. Google may have been late to the starting gate, but it had more fitness – the ability to attract new links.

Science literature is increasingly suggesting that the effects of network architecture can have unpredictable side effects. In our illustration above, the formation of the dominant arm (top-right) may have been the result of a random event – a marble that happened to hit from that angle. In social terms, that marble may now be the richest man in the network.

### **As their chemistry changes the functionality of networks can suddenly alter.**

Borrowing from the world of atomic theory and physics, network investigators have discovered other phenomena associated with networks. One is the incidence of phase transitions. This is a phrase mentioned earlier in this paper and one that we asked you to park. Remember it? This is a moment when the rules suddenly change: when water turns to ice, when the chemistry of our story quite suddenly shifts and galvanizes.

Magnets do this when they are heated beyond a certain temperature. The ions, which are parallel parked to give the metal its distinctive North South polarity quite suddenly leave their parking places and move off in random directions. Their individual magnetic effects, once working in unison, now cancel each other out.

A crowd of people can do the same things. An orderly soccer crowd can, with the right (or wrong) stimulus, undergo a phase transition and become a rioting mob of hooligans. Even a small network of people, each of them quite sensible, can undergo a phase transition – a point made in Golding’s novel: *Lord of the Flies*.

This phenomenon explains the hit and miss nature of crazes and fads, and while some of Gladwell’s high connectors and early adopters may be needed to trigger the phase transition, as Watts argues, sometimes the network itself is just wired that way.

### **Characteristics of Small Worlds.**

Here is a summary of small world characteristics.

1. Small worlds are characterized by high clustering (small cliques of players.)
2. Small worlds have high-connectors, and long-distance links: hence short distances.
3. Small worlds, in most cases, are “scale-free” thus they can keep growing yet still retain their properties. Intrinsicly tied up with this architecture is the power-law (80:20) distribution of links or influence within the agents or players in the network.
4. Small worlds are resilient. You can kill-off many hubs and they still function.

5. Small-worlds networks produce sometimes surprising effects – and can undergo phase-transition effects that lead to implosions and explosions of activity – the equivalent of water turning into ice, or steam. In a new network success may be a matter of chance.
6. Small world architecture determines that there is a rich-get-richer rule applying, whereby successful hubs grow faster than others.
7. Small worlds work at an atomic as well as biological level – but they are also a natural outcome of our social world and the way people are “wirelessly” connected.

### **A detour through the brain. A creative small world inside your own skull.**

Scientists in the past 18 months have been increasingly applying small-world thinking to their understanding of how the human brain works. Since the Gage accident in 1848 they have known that the various area of the brain can modulate each other, but until the 21<sup>st</sup> Century there really hasn't been the non-invasive equipment to measure and see what's going on. In fact there's been much speculation about the architecture of the brain and the way it works as a system. The first studies that *hypothesized* a small world structure of the brain came in 2000.

The capacity to conduct scans has changed all that, and neuro-scientists have this year been concluding that the brain has all the hallmarks of small-world networks. There are clustered areas, as we know, and some super-links that effectively bring quite different departments into the meeting room. The important thing here is that the architecture isn't simply suggesting that areas of the brain are linked – that's pretty obvious. What the scientific breakthroughs are saying is that the architecture of those links has the same underlying structure as the internet or other small worlds: with clustering, super-links and a way of functioning in which specific thinking tasks interact with the other ongoing activities of the brain. The processing of our thoughts, and the way our brains “command” our responses is more of a distributed process than we may have imagined.

Reports Bruce Bower in Science News<sup>10</sup>: *“Small-world brain networks [appear to] reverberate in an electrical limbo state that almost, but not quite, comes unglued ...these networks operate on the edge of chaos. In this precarious condition, synchronized activity relegated to a small brain area can rapidly expand into far-flung neural regions to deal with new challenges and new situations.”*

One study, conducted this year at McGill University, Canada has taken an elegant approach to measuring the way the brain interconnects as a system – by using MRI scans to ascertain the cortical thickness of links between different areas of the brain<sup>11</sup>.

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<sup>10</sup> **Net Heads. Huge numbers of brain cells may navigate small worlds.** Bruce Bower. Science News. Feb 17. 2007

<sup>11</sup> **Small-world anatomical networks in the human brain revealed by cortical thickness from MRI.** Yong He, Zhang J. Chen and Alan C. Evans. Oxford University Press.

Again, the team emerged with a picture consistent with the small-worlds architecture. I wrote to research leader Alan Evans about this and asked him if this sheds new light on such processes as decision-making.

He said:

*"I can't say that our findings "challenge" previous assumptions about how the human brain works. I would say that most people accept that decision-making is a complex process involving distributed brain systems. [But] I am pleasantly surprised that "anatomical connectivity" based on cortical thickness correlation appears to reflect known functional pathways".*

In other words the anatomic architecture matches the small-worlds hypothesis.

*"However, we are now moving into areas which are not accessible by more traditional methods. Notably, we are now able to explore and quantify anatomical and functional connectivity over the whole brain non-invasively. We can monitor changes in whole brain connectivity during development, aging, disease and learning."*

*"I think the next 10 years will see a wealth of studies which take a much more sophisticated view of brain structure and function than has been the case with the last 20 years of "blobology. Until now we haven't had the tools to measure what we wanted to in the past (i.e. distributed activity). So, neuro-imaging is coming of age. Relating brain networking indices to behavioural indices (and possibly to genetic sub-types) will increasingly be the way to understand brain function."*

Ed Bulmore in the UK is another neuro-scientist who has been examining the way the brain functions, and he too has also arrived at a Small Worlds view of the brain as a distributed network. I wrote to him also, asking whether his own confirmation of small-world architecture had challenged his views about how the brain works<sup>12</sup>.

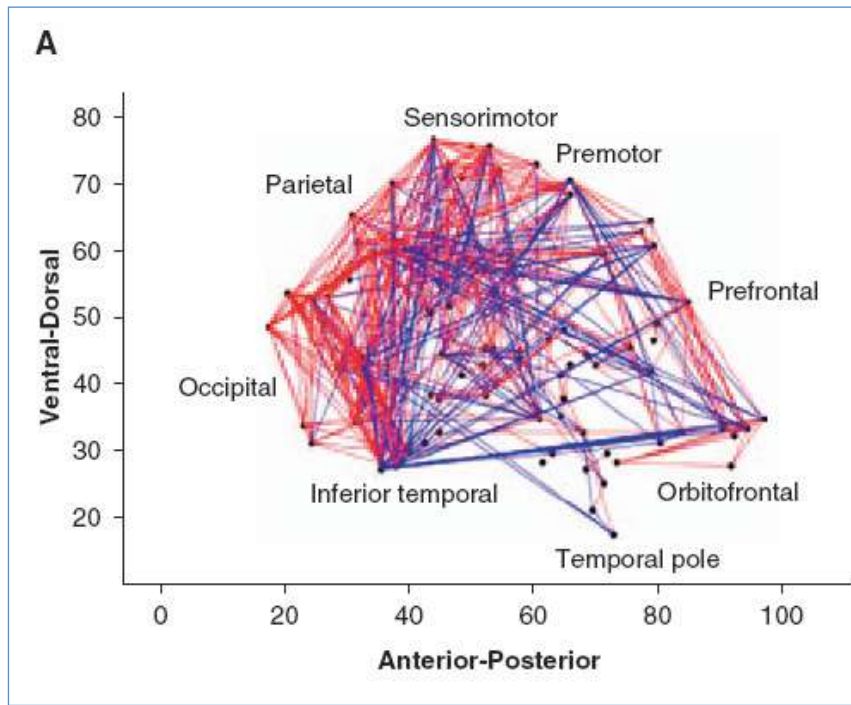
*"Yes - the small-world idea is interesting to neuroscientists partly because it seems to dissolve the long-standing controversy between localizationist and mass action models or between modular and distributed architectures, suggesting that brain has both characteristics."*

What the collective research is showing is how the brain's networked nature allows for greater flexibility and processing power than just the sum of the parts. Picture a system not unlike the airline systems of Europe or the USA whereby a huge volume domestic flights (the subconscious) and international flights (conscious thought) are handled across a wide number of airports including significant hubs – the Chicagos and JFKs of the human brain. The emerging picture tells us why the brain is so resilient, (to the point of a phase transition) and why it can handle so many different approaches to a problem. If Denver is busy, our thoughts can be-routed through Dallas. If there's a

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<sup>12</sup> **A resilient, low-frequency, small-world human brain functional network with high connected association cortical hubs.** Sophie Achard. Raymond Salvador. Brandon Whitcher. John Suckling. Ed Bullmore. Journal of Neuroscience. January 4. 2006.

“Thanksgiving weekend” – an overload of emotional information (including baggage) the system can still basically cope, despite stress.



*Representation of brain network based on fMRI scan data.*

**Creativity is well explained by the distributed processing of our brain networks.**

One area where the new viewpoints are helping scientists re-evaluate how humans function is the subject of creativity. Arne Dietrich of the American University of Beirut recently summed up current understanding<sup>13</sup> in suggesting a model for creativity that employs two general areas of the brain, and two main modes of processing resulting in four modes of creativity.

In this model, the brain can manage to switch knowledge sources (emotive inputs from the rear TOP cortices versus the intellectualised inputs from the frontal lobes) and can equally process the ideas and information in a deliberate and conscious manner, using our frontal lobes, or in the less logical parts of our brain that are better designed to store our working memories.

**Knowing our small-world wiring enables us to develop our creativity.**

Before Albert Einstein died he pledged to donate his brain to science, and the result was something of a mad scramble for bits of his brain after he died. Virtually nothing is left, and there is certainly no big jar with the mega-brain of Einstein sitting there, waiting to be re-connected as soon as science allows.

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<sup>13</sup> *The Cognitive Neuroscience of Creativity*. Arne Dietrich. Psychonomic Bulletin & Review. 2004

However enough was seen of his brain for scientists no note that where most human brains have noticeable cortical divisions – chasms between the frontal lobes and the TOP cortices – Einstein’s brain was somewhat less divided. The thesis, impossible to prove now, is that Einstein was incredibly creative precisely because his brain network was physically more-connected. It’s as if our own brains had Lycos, Alta Vista or Yahoo running – but Einstein had Google: a stronger more efficient link between every other website.

He could mix and match – or mash – thoughts into fresh combinations, a pivotal aspect of creativity, with more alacrity than most mortals.

<b>Model of creativity - four modes.</b>		<b>Knowledge Domain</b>	
		<b>Emotional</b> <i>(Limbic System)</i>	<b>Cognitive</b> <i>(Temporal, Occipital and Parietal cortices)</i>
<b>Processing Mode</b>	<b>Deliberate</b> <i>(Frontal Lobes)</i>	<b>1</b>	<b>2</b>
	<b>Spontaneous</b> <i>(Working memory)</i>	<b>3</b>	<b>4</b>

But by understanding the four modes of creative thinking, and knowing how the brain’s architecture facilitates a mix and match working style, we can draw more deeply from our own well of creativity by giving the wheels more spins and looking at problems from sensory and emotive angles as well as purely rational viewpoints: and by allowing ourselves more time to percolate. If a solution doesn’t present itself in our business: sleep on it.

### **Going large again. Out of the brain and onto the market researcher’s desktop.**

Since 2004 my colleagues and I have paid more attention to social network dimension of market research, and first of all we had to overcome the initial problem: what software do you use? This is a real problem for research design and analytics because if traditional survey design focuses on the individual and their responses, so too does the traditional spreadsheet based analytical software. We’re put in boxes.

I liken this to a butterfly collection, where we pin the data up in neat rows and columns, just like a butterfly collection. We can classify those butterflies, but if anybody asks the collector – how do these insects breed? Are they a social creature? Do they influence each other? The collector really can’t answer. The collection sits there mute, in its neat rows and columns.

After the software question comes a second challenge. What, even, is the language of network analysis? If I can calculate key data about a network, what exactly am I measuring?

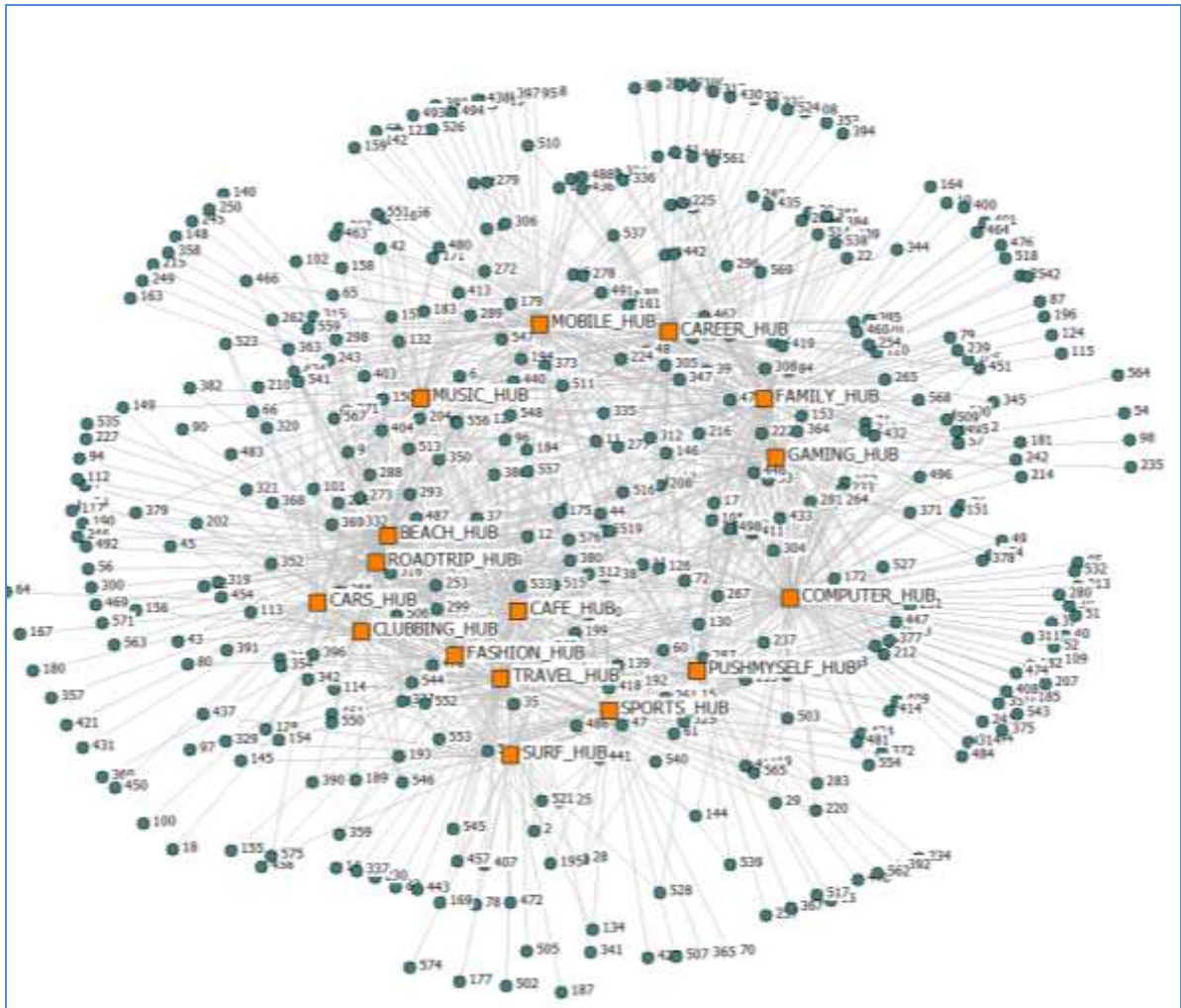
In fact, because social network analysis is a relatively new science there is still a degree of fuzziness about the terminology, and the number of metrics keep expanding. However, there are three key measures that are both useful and fairly universal.

- **Centrality.** The degree to which an individual is central to the overall network.
- **Closeness.** The average distance between the individual and all the other individuals. One could be less central to the picture than another individual, yet still be fewer handshakes away, on average, than the ego at the middle of the web.
- **Between-ness.** The degree to which an individual forms a link role between others. Think how a host at a party brings strangers together.

In actual research studies our team has developed actual social networks, for example through asking employees in an organisation which colleagues they find pivotal in the course of their own decision-making roles (poor old HR was represented as an island, disconnected from the main network) and through the creation of “virtual networks” in which we posit that if respondents *x* and *y* both express a strong passion for surfing, say, and they both read the same surfing magazines, then they belong to the same lifestyle group. In a large village like New Zealand this is a plausible approach: and is simply a form of segmentation.

The difference is that new softwares enable us to represent these segments as hubs, and allows us to see the degree to which these hubs inter-connect. In the chart below, based on a survey of 500 young people, the people are represented by the small circles, while their hubs of interest are represented by the labeled squares.

Looking at our respondent community this way, we were able to see things that conventional segmentation studies don't reveal. For example in the chart below, not so many people are members of the Café and Fashion hubs – they're smaller segments. But these people have a greater *closeness* and *between-ness* than any others in the diagram. They are, if you like, powerful connectors in our wider community of young people. You can't derive that insight using Excel.



***Portrayal of a virtual network based on a survey of 500 young New Zealanders. Those connected to the cafe and fashion hubs have a stronger between-ness score than others, as well as a shorter 'distance score.' They're a small group, but they're close to the hub of our youth universe.***

With increasing certainty that people operate in a more networked manner than classic market research has ever set out to measure, it is natural to ask where and how a small-worlds approach might be applied for classic FMCG or corporate clients. Here are a few suggestions.

1. Examining how groups of friends or contacts influence purchase decisions. By interviewing a finite circle of friends and contacts, we can better understand how adoption occurs, and how brands are evaluated. From these micro-studies we can extrapolate bigger patterns.
2. Youth research. Using *on-line* and/or *social links* to track the spread of ideas, the adoption of new brands and the way fashions, fads and brands are picked-up or discarded.
3. The development of network-based market segmentations. We aren't defined by Grey Lynn or Cuba Mall, perhaps, but by the way we connect and dialogue in our social universe.
4. Organisational research. Looking at how colleagues interact.

In fact we have conducted research using social network analysis in each area (it is very do-able) and in each case the approach has provided unique and in my view quite exciting insights.

In the future as brands start to reflect the dynamics of internet space, a direction in which giants such as Procter & Gamble are clearly moving, I find it conceivable that we'll see the brandscape in a similar fashion to the internet itself: a small-world network with hubs and some brands and agencies that act as super-connectors between different consumer cliques. In this brand-net, the rich will undoubtedly get richer, and we'll see sometimes random successes (and failures,) as well as phase transitions in which big brands implode and small start-ups do a *FaceBook* and grow exponentially.

These things once seemed to constitute a random universe, but once one adopts small-world thinking the patterns and explanations begin to emerge. It's all about connecting the dots.

### **Summary of small worlds and my Cambodian aftermath as a metaphor.**

This paper set out with fourth purposes. One is to challenge our current way of conducting research on the grounds that it is missing out on the *social-network, social intelligence* dimension of how humans operate. We've missed a huge story simply because we've remained in Chapter Two mode. As a profession we stopped growing. Today we have the scientific understanding, the technology and the analytic software to now handle our small-world universe: technology push.

Secondly, this paper has sought to highlight that networking as a phenomenon has become *more important* as we leave the age of mass marketing and we become more connected via the explosive growth of the internet. Demand pull.

Third, the paper has sought to illustrate that small-world thinking is scale-free. That is it functions in similar ways whether we talk about atomic-level physics, cellular level biology or if we look at the human brain or human society itself. The same dynamics and fundamentals apply.

The fourth purpose of this paper is more elemental. It has been written to introduce readers to the day to day presence small-worlds and social network situations, and to do this by using a personal story both as a metaphor and as a kind of coat hanger on which to drape the various strands of the subject – the mathematics of small worlds, the properties of networks, the relevant discoveries in neural and social science. I've attempted to share how once one takes a small-world perspective you start to see the familiar patterns wherever you look.

So it is befitting to round off the paper with the last chapter of my personal story and to use it as an opportunity to go over the main points – to show how social networks and small world thinking are part of our everyday lives.

The day I swapped email links with Svay Savong was the day that I became a long-range connector between New Zealand and Cambodia, or more correctly the day that Savong became a long range connector between his clique in Siem Reap and a potential network around the world. He was the hub, the not me.

That was in October 2004, and since then we collaborated to build a school in Cambodia which serves around 300 students who wish to learn English and Japanese. Each step along the way the project has reflected aspects of the small-world architecture, and I wonder if this is because the

project has all along been fundamentally a web-based creation. Or was it because two people, each with needs, Savong with a burning dream to build a school to give rural students a break, and me with a need to find some meaning in a chaotic, depressed, dysfunctional life simply met, connected and with the power of two minds created something that neither of us, independently could have created?



***Above: my mate Svay Savong – the hub of an expanding small world.***

Either way, when one goes through the checklist of small-world characteristics the project, which is now, after three years gaining a critical mass (and this last month has been attracting supporters from Malaysia, US, Japan, Ireland, Australia and England,) has grown from nothing other than a dream, a solitary sticky marble in a room no smaller than our planet, and become a reality. Some of the networking has been hard work, but the momentum has grown. The school isn't rich but we might paraphrase the rule by saying "the less poor get progressively less poor."

### **The Small World Characteristics of a volunteer school in Cambodia**

1. Small worlds are characterized by high clustering (small cliques of players.)

*Successes have come from localized communities. Word of mouth from small networks of volunteers. A Japan hub, with supporters becoming friends. A network of Americans who have compared notes, swapped stories and got involved. Fitness is increased through consistent communication and close friendship.*

2. Small worlds have high-connectors, and long-distance links: hence short distances.

*Whenever there's a query, Savong gets me to be secretary and communicator. Our emails go around the world. We use websites as hubs to attract queries.*

3. Small worlds, in most cases, are "scale-free" thus they can keep growing yet still retain their properties. Intrinsicly tied up with this architecture is the power-law (80:20) distribution of links or influence within the agents or players in the network.

*The network is growing and, since the underlying need of the school is quite limitless (how about building a library, adding computers...) the structure of the support network is growing but not changing in character. The various cliques or arms of support are each growing yet the architecture remains quite constant.*

4. Small worlds are resilient. You can kill-off many hubs and they still function.

*Our biggest test has been the ups and downs of Cambodian internet- so we tend to cc all our emails and contacts. We ensure that there are two or three ways, always, to contact the project.*

5. Small-worlds networks produce sometimes surprising effects – and can undergo phase-transition effects that lead to implosions and explosions of activity – the equivalent of water turning into ice, or steam. In a new network success may be a matter of chance.

*The project underwent a phase transition the moment a young Japanese supporter, Makoto Kimura sent the first \$1000 to get the land purchased. His action galvanized others. A second phase transition seems to have occurred three months ago with the sudden somewhat spontaneous growth in the support base.*

6. Small world architecture determines that there is a rich-get-richer rule applying, whereby successful hubs grow faster than others.

*Savong started with a dream and an email address. Where many millions of Cambodians live under the poverty line (\$30 per month income) Savong has moved out of that bracket and his project acts as an increasingly strong magnet for overseas visitors and support.*

7. Small worlds work at an atomic as well as biological level – but they are also a natural outcome of our social world and the way people are “wirelessly” connected.

*The Savong School small world has worked at several levels. At a community level, 25 minutes east of Siem Reap, Cambodia. In a global network level – joining people from many different countries to the point where we email each other regularly. In a small network level – as backpackers pass on the word to fellow travelers. His expanding small-world still obeys the same laws as Google: these things are scale-free.*

But a side-effect of this small-world network has been the reconnection of the various hubs and nodes within my own brain circuitry. The iron bar has been removed from my frontal lobe. I’m able once more, to read the non-verbal cues from the people who surround me. My mirror neurons are firing once more and I feel human again precisely because I’m inextricably part of a web: a network of kind, caring people who were there for me all along.

*Biggest thanks to my life partner Susanna.*

*My sincere apologies and plentiful thanks to my colleagues who worked with me and looked out for me during my depressive period – to Trung Tran, Tony Lu, Charlotte Crone, Rali Andreeva, Peter Beaver, Beena Patel, Monti Soothi o Soth and Carlo Magni. What excellent colleagues to have.*

***Duncan Stuart – October 2007***

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