TOM STAFFORD

SMALL WORLD

TOM STAFFORD IS A MAN. ITS A FAIRLY SAFE BET HE HAS A FACE AND AT LEAST RUDIMENTARY FINGERS.

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Who do you know? And who do they know? And who do they know? Answer these questions and we get a network of connections. This is your social world; not just your friends, family, colleagues but the people who know your friends, family, colleagues.

The tangled knots of this network make up our cliques and clans, its criss-crossing lines are loves, hates, loyality and mere recognition between all the people we are connected to.

If you do a precise survey you could start to analyse the structure of this network. For example, you could try and define cliques - tightly interconnected clusters of people who all know each other and don't know many people outside of the clique (you can try an approximation of this yourself - do most of the people you know, know each other? If so, then you're in a clique).

Once you've defined cliques you could define how central each individual is to the clique by calculating what proportion of people in the clique they know, or you could identify individuals who know individuals in different cliques, thereby creating a bridge between groups.

Academically, all this goes by the name of Social Network Analysis. But without doing a precise survey we already have an intuitive knowledge for these social words, the cliques that are part of the larger network. We recognise people not just as individuals but as part of social groups, cliques defined by how they spend their day, by the typical places where we see them or the hobbies they have in common with their friends; she's a climber, he's part of the Tuesday Club crowd, and I know them from school. We do this for people we don't even know, just as much as for people we know, maybe more.

We probably all know familiar strangers who we've never spoken to but recognise as a 'friend of so-and-so' or 'part of the Walkley crew' or whatever. Cliques define social space, they aren't just a description of what happens when we add up all the connections between all the individuals who we know.

Who we know is part of who we are, and as we look out at the world we try and make sense of it in terms of connections, in terms of tribes and gangs.

Living in a modern city like Sheffield we're lucky in that we can all belong to a number of different cliques, and, should we want, we can leave and join them relatively easily. For most of human history group membership was fixed, and the sort of thing that could get you killed, not just something to help you make sense of who-knows-who. Groupness facilitates trust, but the flip-side of this is distrust of people strangers, those who are outside the group.

This is why everybody loves the "small world!" game. Do you know it? The game starts when you meet a stranger and you take turns in asking questions which identify potential cliques that you both might belong to: "Where do you work?" "Where do you live?" "What kind of music do you like?". It ends when one of you recognises a common membership and uses it to establish a connection between the two of you ("The Vine?! Do you know Alan?"). It's a game where you both get to win, which you mark by saying (in unison, preferably) "Small World!".

We love small worlds because of the comfort they promise - a world where everybody is connected to everybody else, somehow, we just have to find out how. Small world moments offer us a glimpse of the larger network, the network which all our little cliques are just sub-clusters of.

Networks don't have to be small worlds, which is perhaps another reason why we are continually delighted to find evidence that our social network really is one. For example, imagine a world in which everybody is arranged in small, total, cliques (groups of people who only know each other).

If you picked two strangers at random from this world, unless you happened to pick two people from the same clique, the chances are that they wouldn't know each other - but not only that, they wouldn't have any mutual friends either. There'd be no surprising connection to be found, no small world. The same thing is true for less extreme versions of the same network, the more 'cliqueyness' in a network the less chance there is that any two random individuals will have a connection.

The paradox of this is that although cliques make up our social worlds, and define the landscape which we use to discover these suprising 'small-world' connections, cliqueyness is actually in direct competition with connectivity. If you only know people who know each other you won't have any connection to new people. You can also imagine the situation from the other direction: a world where nobody you knew knew anybody else you knew would also be a world where you had short connection to everybody. You would't want to live in this world, however - imagine never knowing directly more than one person in a group.

So cliqueyness and suprising connections look like they form a trade-off, with cliqueyness helping us to make sense of the world, but doing so at the cost of limiting our ability to connect to strangers.
This would be a sad story but for the discovery made a few years ago by two American network theoriests, Duncan Watts and Steve Strogatz.
They discovered something about networks which means that you don't have to lose a suprising connectedness if you keep a high degree of cliqueyness. What at first looks like a trade-off, for a suprising reason, turns out not to be.

Watts and Strogatz were looking mathematically at the two properties of networks we've already considered: cliqueyness and connectivity (which they define as 'average minimum path length', the average shortest distance between all pairs of individuals in the network). Like us, they considered completely cliquey worlds with very low levels of connectivity and they considered completely randomly connected world, which have low cliqueyness and high connectivity (short average minimum path length). Their discovery came when they used computer simulation to measure, step by step, what happened when you changed a highly cliqued network towards a completely random one.

Inspecting cliqueyness they found what you might expect; as you make connections in a cliquey network more random the degree of cliqueyness decreases steadily. The suprise is what happens to connectivity. Rather than change steadily, the connectivity of a cliquey network increases with massive rapidity as you add random connections. Just a few connections between cliques makes everyone in the network closer to everyone else. It seems there is a sweet spot, inbetween the two extreme kinds of networks, where each individual in the network is still in a clearly defined clique, but everybody is also closely connected to everybody else. Watts and Strogatz called networks that existed in this sweet spot 'Small Worlds', for obvious reasons. Armed with this definition scientists, starting with Watts and Strogatz, looked around for real-world networks they could analyse. Example after example turned out to be 'small-worlds'. The electricity power grid in the US, the network of collaboration between Hollywood actors, the neural networks in the brains of worms and humans.

'Small worldness' seemed to be something that many different kinds of networks have; not just something that's do to with social networks and our love of finding suprising connections with strangers.

The reason for this ubiquity may lie in the way small world networks combine local structure (cliqueyness) with global connectivity. To an individual who is part of small world network it looks pretty much like a world of cliques — most of the people (or power stations, or brain cells, or collaborators) you know also know most of the other people (power stations/braincells/collaborators) you know. But despite this 'ground level' view of things nobody in any clique is very far away from anybody else. Just a few extra-clique connections are enough to make the whole network connected. This means that information (gossip, electricity, neural signals, whatever) can spread through the network easily.

As individuals we can only see the larger network in terms of who we know, and in terms of the cliques we can make out, but there is a larger network out there which we, and our cliques, are just a tiny part of. And this whole network is a community, full of suprising connections between any pair of individuals that you choose to pick. Things like information, opinions, diseases and fashions spread through this network rapidly, taking advantage of these suprising connections. If we're lucky we occasionally get a glimpse of them ourselves, when we find a suprising connection to a stranger. But whether we do or we don't we shouldn't forget that we are always connected to the larger network, and what we do can affect everyone.

It is, after all, a small world.

FEED YOUR HEAD.
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WE ASK SELECTED ACADEMICS TO RAISE THE BAR.

FEED YOUR HEAD.
THIS MONTH TOM STAFFORD SPEAKS ON SOCIAL NETWORKS.
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