

Regression and Barabasi's Law by Trevor Silvester

The dictionary describes a *network* as “ a system of interlinking operations“. By that definition we are surrounded by them. Social networks, business networks, even the ecosystem which keeps us alive are examples. In fact, we ourselves can be described as a network, we are probably the most complex organic network we currently know of. Recent research by Albert-Laszlo Barabasi into the mathematical properties of networks has uncovered a universal law which could be of great significance to the field of therapy. Now, having used the word mathematics in the last sentence I need to follow on quickly with a disclaimer before you throw this in the bin and run for the door. I took three attempts to pass my GCSE maths, so you can trust me not to get too algebraic on you. If I can understand this principle it means it is very understandable.

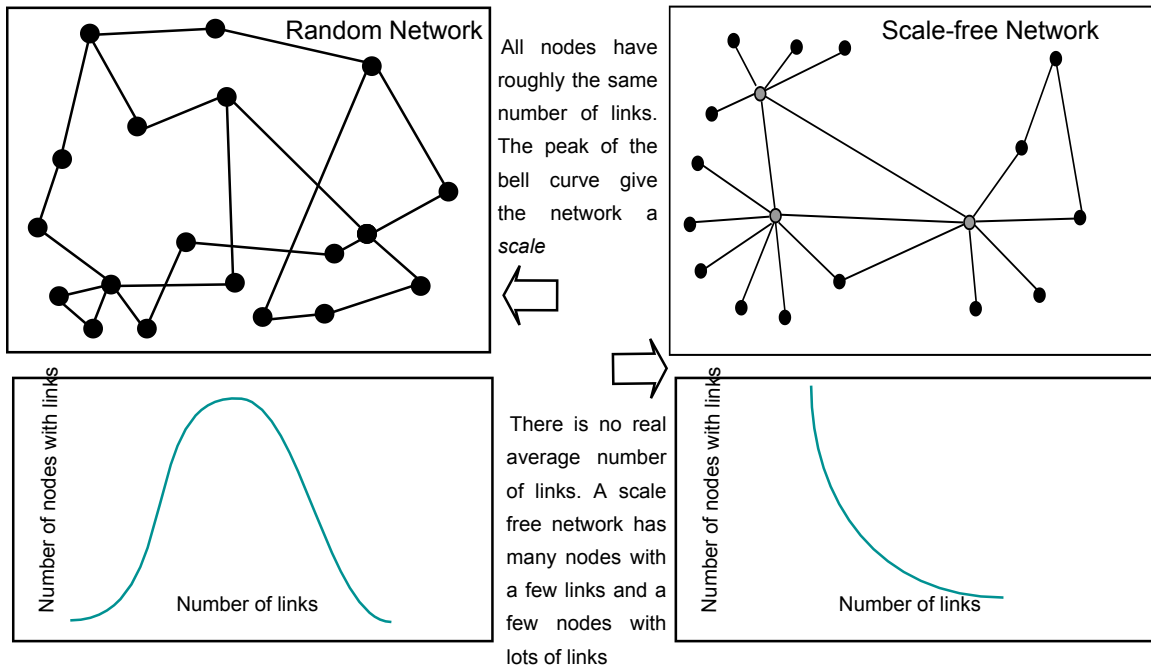
Barabasi's interest was in discovering more about the properties of complex networks and his research used the world wide web as an example of one. Prior to his work the conventional model of a complex network had a random structure - like drawing some dots on a page and drawing lines connecting them at random. You tend to end up with a network where, on average, all the dots - or *nodes* - have the same number of links. By counting the number of nodes with one link, two links etc and plotting the results on a graph you end up with a bell curve where the mid-point of the curve is the average number of links per node. This is described as a *scale* network

Barabasi expected to find this arrangement when he looked at the web but he was wrong. Instead was a situation on the Web where lots of sites had a few links, a few had a medium number of links, and a very few sites had numerous links. This produced a very different curve on the graph, there was no average scale, instead was what Barabasi called a *scale-free* network.

The dominating feature of this arrangement is that the Web's structure is dominated by a few, highly connected sites, which he called hubs. Classic examples are search engines such as Lycos and Yahoo. The usefulness of this architecture is that it only takes a few clicks to get from one site to any other, similar to the idea made popular by John Guare in his play *Six degrees of Separation*, that to pass a message from one person to any other on the planet would only take an average of six intermediaries.

At first Barabasi thought this arrangement was unique to the Web, but he soon discovered it in other networks, from the interaction of proteins, to networks of who eats whom in various ecosystems. Even the web of human sexual contacts turns out to be scale-free (a few people have a lot of sex with different people, many have sex with a very few.) So Barabasi's work has begun to expose a pattern of organisation that crops up time and time again in the natural world. To quote David Cohen, “Somehow the collective actions of individual agents - be they websites or proteins - generate networks that conform to a single, well-

defined mathematical formula.” And every agent in all these systems seems to share the same behaviours. There are two key ingredients. First, a scale-free network needs to be growing . Second, the things which comprise that growth must show some form of preference as they attach to the network. The outcome of this is that the highly connected nodes tend to become even more connected, or, if you like ”the rich get richer.“



The Therapy Connection

How does this connect with therapy? Let’s look at regression. The key principle behind regression is that past events are connected to the meaning an individual gives to present events. So a client who had a negative experience in a school play when she was five may develop an aversion to talking in public - a social phobia. Now, our memories are a complex network. They also conform to the first of Barabasi’s key ingredients - we are adding new memories every day. What if the architecture of our memories is a scale-free network?

Proponents of regression have differing views about which memories the therapist should target in order to alleviate the client’s problem. Some seek to ‘peel the onion’, by taking client’s progressively back through the chain of negative experiences. Others, such as Tad James, think the first event is the one

to focus on because that is the one which was first given the meaning that is being used as a comparison with a present problem - every other event between that one and now is just derivative and may not need any attention. A third point of view is that often utilised by Gil Boyne, of asking the client for ' a past event connected to the problem', which will naturally take the client back to the key memory, whether or not it is the first one. Whichever turns out to be true there is no disagreement that memories are linked in some form in order to build meanings to things we perceive through our senses. Belief systems in individuals evolve over time, and can also be thought of as *hubs*.

If the mind is a scale-free network, then it suggests that certain significant memories will be *hubs* - memories which have more connections than others - in order to conform to the second of Barabasi's key ingredients - that hubs will continue to attract connections to new memories as they occur. Could this be why people become set in their ways?

Initial events which are viewed as emotionally significant are given a certain meaning. New events, as they are sent to long-term memory, tend to connect to these *memory hubs*, so just as "the rich get richer", the phobic becomes more phobic, and the pessimists become more pessimistic. Don't we find that the longer the person has a problem the more they tend to become attached to it, and say things like "It's just the way I am."? After a period of time the problem has become lodged at the level of identity and takes more to shift than where the problem is still viewed as a behaviour, and they say something like "It's something I do which is really irritating,"

Each of us will have a number of such hubs which form the reference points for how we view the world we live in (and how we judge ourselves). Over time the way we see the world will tend to become more and more fixed. New events will be interpreted in the light of their connection to the meaning resident in the hub they connect to, so our behaviour becomes more set and predictable.

This theory would tend to support the use of regression as a therapeutic intervention, but if these hubs are so set within the network, can revisiting them have any effect? For the answer we need to return to the work of Barabasi.

Barabasi found that scale-free networks were robust and vulnerable at the same time. He subjected a scale-free network to two forms of attack. In one, they randomly hit individual nodes, while in the second experiment they only attacked the hubs. Scale networks are very vulnerable to random attacks. As more and more of their nodes are attacked it takes more steps to get from one point in the network to another. Scale-free networks, on the other hand, are more robust in such situations. Even with 5% of their nodes taken out the performance of the network is unaffected. However, scale-free networks fare much worse if their hubs are targeted. Once 5% of the hubs are removed the number of steps needed to cross the network doubles. This is giving scientists vital clues about

how to deal with a range of serious medical conditions, from the best way to carry out mass vaccinations, to the development of drugs to treat cancer. How about in therapy?

If we assume the *memory hubs* are the source of our behaviour - and I accept not everyone who reads this believes this to be so - then targeting those specific memories by regressing the client back to them and changing their meaning (using whatever techniques you prefer) will transform the nature of those hubs, and every other memory connected to them. This could be the reason why brief techniques based around reprocessing old memories can have such a great effect in a short space of time - because a scale-free network is vulnerable to this form of attack, whereas it does not respond to random approaches - which might be what some other, more traditional therapy approaches, offer. Talking therapies which focus on the current example of a pattern of behaviour is unlikely to have much effect on the overall, long term transformation of the problem.

This mathematical law may in time lead us to a definitive model of therapeutic intervention based on identifying the memory hubs connected to a client's problem and reducing, removing or transforming their impact on the network (personality). In the meantime it does provide us with a new theoretical paradigm which can guide the way we approach the memories of the people who come to us for help.

The study of scale-free networks may even reveal one of the great mysteries - of consciousness. The idea that many interacting components following simple rules can collectively produce complex behaviours -*emergence* - like a bee hive or termite colony, may also apply to the trillion brain cells we all have.

The most modern theory of the mind is that there is no physical location for the conscious (or the unconscious for that matter), they are both emergent properties of an incredibly complex network performing millions of simple functions every moment.

How uncomfortable is it to face the idea that the part of you that you recognise as your 'self' doesn't actually physically exist. Our identity may only be a software programme.

I'll leave you with that thought.