

Reed's Law and How Multiple Identities Make the Long Tail Just That Little Bit Longer

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Abstract. Reed's Law or "Group Forming Network Theory" (as Dr. David P Reed originally and modestly called it) is the mathematical explanation for the power of the network. As with many great ideas, it is quite simple, easy to understand and enlightening. This paper sets out to explain what Reed's Law describes and includes more recent understandings of the collaborative power of networks which should help to make sense of and gives context to the exponential. It also suggests that the multiple complex identities we are adopting in multiple communities are not necessarily a "bad thing". The contention of this paper is that the different modes of thought these actively encourage are to be welcomed when viewed in the context of unleashing the power of self-forming collaborative communities of interest and purpose.

1 Introduction

In the beginning, we had Sarnoff's Law¹: a mathematical description from a broadcast, mass media age. It was first applied to cinema screens, and latterly to TV. Sarnoff's Law states that the value of a network grows in proportion to the number of viewers. It is basically a straight line: the more viewers, the more value the network has. Most audience measurement techniques have simply followed this rule ever since. Some (such as unique users/visitor counts) have, inappropriately, continued to apply it to websites and social networks. However, this is a serious underestimation when you move out of broadcast models.

Metcalfe's Law offers a better fit. It offers a better way of measuring the relentless growth of the power of the Internet. This law states that the value of the network grows in proportion to the number of nodes on the network. For example, one fax machine on its own is useless ($1^2 = 0$). Two ($2^2 = 4$) has more utility. For each one that is added to the network, the value of all nodes in the network is increased ($3^2 = 9$ etc). If your website is getting 10,000 unique users a month more than a rival, the gap between you and them in terms of potential value created is 10,000 squared (100 million!). Having 10,000 more nodes on a network – even if there is just a linking from one to one – is much more valuable than having 10,000 passive viewers for a broadcast (assuming you have gone to the trouble of doing more digitally than simply replicating the broadcast model).

¹ http://en.wikipedia.org/wiki/Sarnoff's_law

Metcalfe's N-squared value explains why the growth of networks used for one-to-one communication (e.g. phone services, e-mail, instant messaging) follows the pattern it does. Simply, new users will almost always join the larger network because they will reason it offers more value to them. Frankly, it usually does: a tipping point is reached, and the floodgates open. For example, if and when a VoIP provider assumes dominance over our mobile identities (as defined by our personal 'number'), then the operators may be in trouble. Metcalfe's Law charts an impressive and rapid rate of growth of utility. However, even this, according to Reed [2], is a gross underestimation. What Metcalfe's Law fails to take account of is that each of the nodes on the network can choose to form groups of their own, of whatever size or complexity they choose, with near neighbours or distant, initially unrelated, nodes. They can choose small groups, large groups, be part of multiple groups, uber- and subgroups, etc.

2 Wild Growth but Counterintuitive: Do the Maths

If we add up all of the two-person, three-person, four-person, etc. groups, the utility is 2 to the power of N (Figure 1). This represents astonishing, wild growth potential. Reed quotes the example of a minister who was offered whatever he chose as a reward from his king. He asked for two copper coins on the first square of a chess board, four on the next, eight on the third and so on, following the progression of 2 to the power of N. The King thought he had gotten off lightly, until when they reached the 13th square the number of copper coins had reached 8192. If he had owned a big enough abacus he would have discovered that by the 64th square he would be handing over somewhere in the region of 18 quintillion copper coins, a number rather higher than there are grains of sand in the world. However, he did not bother, beheading the smart minister instead (not something we can do with our web rivals).

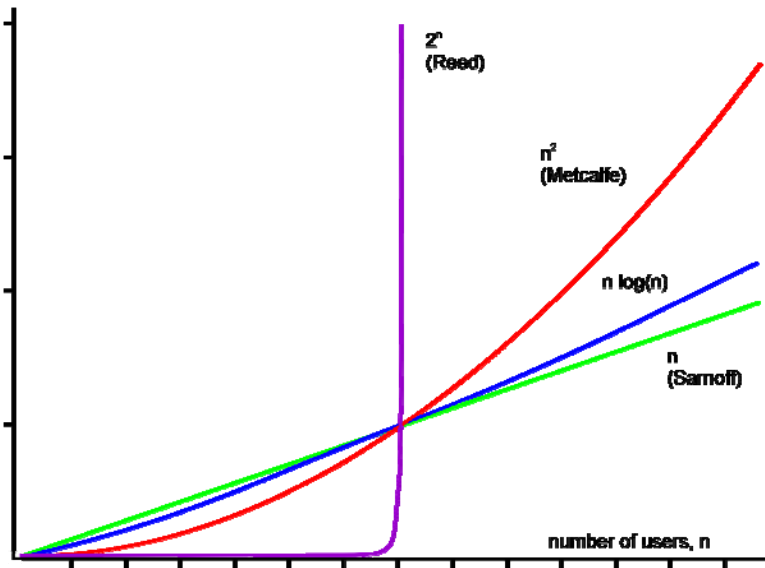


Fig. 1. Various measures of the growth of networks

There are those who argue that Reed's Law [2] is counterintuitive. [1] states that: *"Reed's Law says that every new person on a network doubles its value. Adding 10 people, by this reasoning, increases its value a thousandfold (2^{10}). But that does not even remotely fit our general expectations of network values - a network with 50,010 people can't possibly be worth a thousand times as much as a network with 50 000 people."* They argue that $n \log(n)$ offers a more accurate interpretation of the growth of networks. This is illustrated in the following diagram adapted from their well-reasoned argument [1].

Reed has refined his law in the following mathematical terms. The number of possible sub-groups of network participants is $2^N - 2$, where N is the number of participants. Therefore, what Reed's Law describes is the possible number of sub-groups, and this reveals a potential, not an actual, value. That theoretical value gets closer to being realised if the network is used in a particular way - in a way which is becoming more and more the norm as the digital native generation takes charge. Groups offer their greatest potential value when they work together to do much more than chat.

3 Collaboration, Flow Not Focus

In charting the possible number of sub-groups, Reed's Law reveals the collaborative potential of a network. When collaboration happens, new value - often immense value - emerges. What do we mean by collaboration? [7] offers: *"Collaboration is more than just 'working together' ... Collaboration implies that multiple people produce something that the individuals involved could not have produced acting on their own ... Technology advances have meant that some level of time-shifting and place-shifting is now possible, reducing the simultaneity inherent in the original scenario."*

Stowe Boyd [3] suggests the greatest value unleashed by networks comes when the group is not only one which has self-formed with a collaborative purpose, but one in which people are willing to drop everything to join in the flow as and when they are required to by their connections - i.e. drop everything to act in real time. Boyd believes that far from the pipe dream that some may regard this as, this is the natural place our involvement in networks leads to. He asks us to think of attention (i.e. demand on our time) as being more about flow than focus [3]:

- *"Don't listen to industrial era or information era (the last stage of industrialism) nonsense about personal productivity. Don't listen to the Man."*
- *"The network is mostly connections. The connections matter, give it value, not the nodes."*
- *"Time is a shared space - your time is truly not your own"*
- *"Productivity is second to Connection: network productivity trumps personal productivity."*

This belief in the power of the network - and his willingness to subsume personal focus to it is based on the simple notion that: *"I am made greater by the sum of my connections - so are my connections."*

4 Don't Just Network for Networking's Sake

When a network is for simple one-to-one communication, there is little potential for collaboration (other than between one and another). There is no potential for unleashing the wisdom of crowds [8], for tapping into the notion that none of us is as clever as all of us. Ross Mayfield, CEO of Socialtext, offered his own equation for the value created by collaboration [5]. In his “Ecosystem of Networks” diagram (Figure 2, Table 1), he argues that the growth and potential value of a network is not only defined by its freedom to self-form into groups, but crucially by what those groups do.

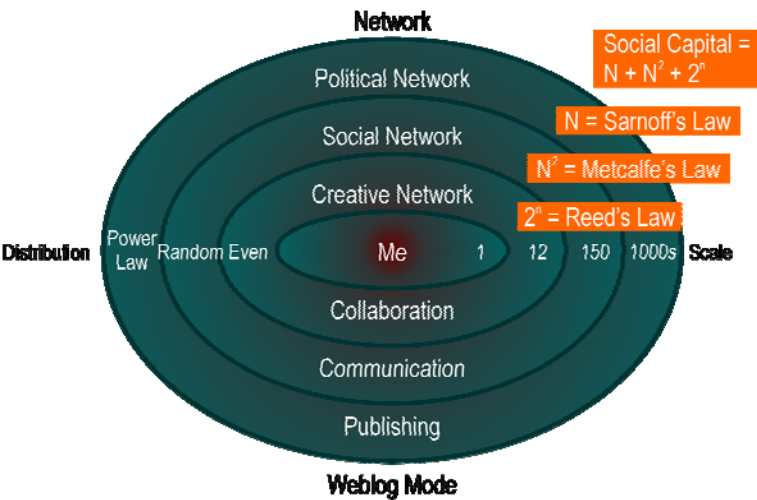


Fig. 2. “Ecosystem of Networks” by Ross Mayfield

Table 1. “Ecosystem of Networks” by Ross Mayfield

Network Layer	Unit Size	Distribution of Links	Social Capital	Weblog Mode
Political Network	1000s	Power Law/Scale-Free	Sarnoff's Law (N)	Publishing
Social Network	150	Random/Bell Curve	Metcalfe's Law (N ²)	Communication
Creative Network	12	Even/Flat	Reed's Law (2 ⁿ)	Collaboration

For example, if your blog (your place in the network) is simply about publishing information, its value to you and your readers follows Sarnoff's Law. If you use Facebook to communicate with your friends, then the value derived follows Metcalfe's Law. If your node, your place in the network, is used to collaborate with others - to share information, mash-up images, create new ideas, services and products, then the value growth can follow Reed's Law.

In other words, Reed's Law reveals the potential value growth in collaborative networks of shared interest and purpose. It is in this that the runaway value Reed's Law describes is found. It is this which answers [1]'s concern: how is a network with ten more people worth 1000 times more? Imagine a collaborative network of 1000 scientists who have been seeking the cure for cancer. If ten more join there are now 1000 more potential subgroups. If just one of the new juxtapositions/mergers/mashings of ideas results in that cure for cancer few would argue that the network had delivered a value 1000 times greater value than the network's previous state.

Of course, not every single potential group will form. Not every new idea will deliver cancer-curing value. This much we know. It is why simply enabling collaborative networks will never deliver a 100% replica of the Reed's Law value curve. For each potential group that does not form, a big chunk of subsequent value is lost. What we find harder to know, or even imagine, is the value emerging from those collaborative groups which do form.

5 Self-forming Communities and Multi-fac(et)ed Identities

It seems to me that the pursuit of that emerging value is the best indicator to where our development and investment efforts should be focused if we wish to create sustainable value. Networks which allow self-forming collaborative communities of shared interest and purpose will create value. This is the reason networks of collaboration have real power, create value you could not predict and are fast becoming the model for a new way of socioeconomic life. Also, as networks gain increasing influence on the macroeconomics of life, they are also having greater and greater influence on our microlife - on the creation of our own individual identities.

Our identities become increasingly complex. The more I collaborate in self-forming groups - the more complex 'I' become. It is a question of psychological self-determinism: "who do I think I am?" Our identity - whether it carries the label of a name or a number - is a work in progress. Ever-shifting, responding to communities it is part of, your identity is as much (perhaps more) created by those around you as by yourself.

The desire and need for psychological self-determinism is working as a powerful adjunct to the growing influence of global, digital networks. When communities were fixed in location, your identity was created by your relationships within that fixed community. Your identity was equally fixed. In terms of Group Forming Network Theory you belonged to just one group, and it was pretty much fixed in size.

In a socially-networked world, the creation of your identity becomes a process which is contributed to by more people, more often, and from very varied backgrounds. The community you exist in shapes your identity from its perspective and from your own. Your identity varies from community to community. If once you were the blacksmith's son and village blacksmith-in-waiting, now you are a huge variety of identities - depending on the community you are interacting with at any one time.

Our identities become increasingly multi-faceted. For example, on my blog, my identity is relatively serious, thoughtful. On Facebook, it is more playful. I am displaying a different facet of a complex identity. The community I feel I am part of

when writing my blog joins in the construction of my serious and thoughtful persona (by their comments and expectations) [6]. The community I feel part of on Facebook also joins in the construction of my persona there - by the way it acts, by its response to what I do, by the tools it offers me. The push and pull of the forces forging my identity in all elements of my life are communal. I interact with a community, therefore I am. Each community creates a different facet of that identity - and in doing so makes a contribution to subtly reshaping the core.

As a simple example, becoming a parent changes your personality. You have a new role to play and a new set of relationships - with your child, with your partner (now a parent, too) with other parents, grandparents, etc. Each interaction changes you in small but important ways, and these result in changes at your core. This may be an extreme and emotionally-loaded example, but the co-creation of facets of your personality has more than a superficial impact. This may be why ‘the edglings’ that Stowe Boyd describes or Generation-C that [4] describes, have a different set of wants, and are not satisfied by the norms of mass production/media. It is through new mobile, fluid, co-creating communities they find themselves. They find they want to share in, to be part of, and to engage with these communities. They are people for whom collaboration and participation is the norm - for whom Reed’s Law is right.

Understanding which facets of personalities you seek to engage with, understanding that you are dealing with personalities created from converged facets: these are real challenges for those marketing and/or creating social media today. Furthermore, the notion that we want just one digital identity is challenged by the emerging value multiple identities offer.

6 An Adjustment to Reed’s Law: A Longer Tail

There is an adjustment required for Reed’s Law. If each of us is a node on the network, each time one new node is added the value of the network (assuming the caveats described above) doubles. However, if each node has multiple identities then the potential value must be multiplied by X , where X = the number of identities per node. This clearly can only add to the value in an “uber” network - one in which multiple identities apply, with the Internet itself being the biggest of them all.

What is the value of X ? The average number of social networks regularly used by the average social networker is greater than one. For example, I am a user of five, but a regular user of three. Plenty of people who use them will use just one. Those who use none are not part of any network and are therefore not part of the Reed’s Law value curve creation of the Internet. X must equal a factor somewhat larger than 1. Some estimate the average at 2.5. This then goes some way to restoring some of the value lost to the Reed’s Law calculation when potential groups do not form. This suggests that the actual ‘real’ curve may be somewhere between Metcalfe’s and Reed’s curves.

Of course, if the potential of every group were fulfilled and we apply the multiple identities factor, then the result must be an even steeper curve than even Reed predicted. The number of possible sub-groups of network participants becomes 2 to the power of $N(x) - N - 1$, where N is the number of participants and (x) is the average number of identities of each participating node. The theoretical growth of value in

participatory and collaborative networks of multiple identity nodes is greater even than Reed predicts. It seems reasonable to challenge this identity complication. Why should not N simply be the value which encompasses the total of $N(x)$?

It is worth making the distinction because the N value does not reflect the diversity of thought the multiple identities of one individual node (person) can offer. The thoughts of my Facebook identity may differ from those of my Blogger.com one. That is because my modes of thought, my openness, my willingness to think differently in different contexts/communities does vary. Environment/community counts. For example, Twitter thoughts may kick the whole long-winded reasoned argument out of the window – resulting in a different set of problem solving thinking, that short-cuts the logical and makes leaps using instinct.

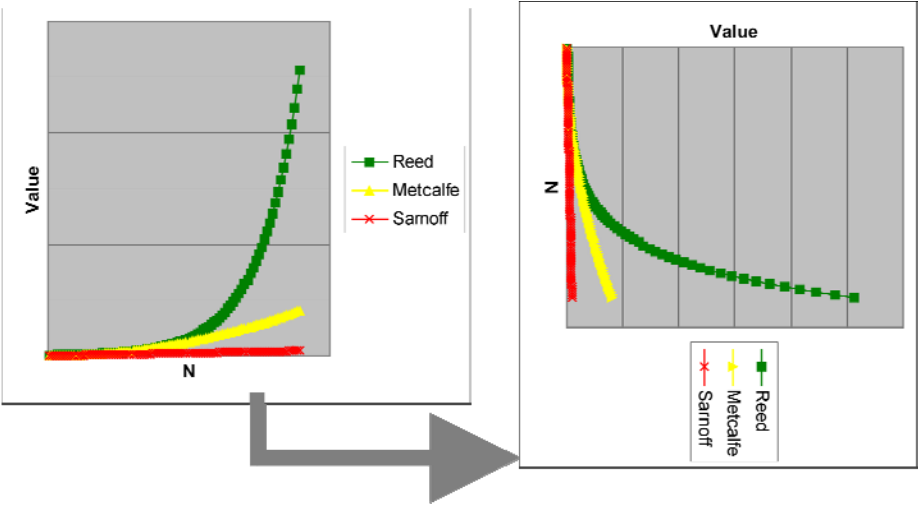


Fig. 3. The long tail in Reed's Law

Given the notion that the converged identities that make up the network are collaborating to create, it is reasonable to suggest that the supply of what they create should match the demand for what is created. If the network works unfettered, it should make only that which there is a demand for. To discover the demand curve, all we need do is tip Reed's Law on its side (Figure 3).

7 Conclusions

In this paper, we presented an overview of Reed's Law and various related theories for describing the collaborative power of a network. We examined these laws and suggested that the multiple complex identities we are adopting in various online communities are not necessarily a negative development. We contend that the different modes of thought these actively encourage are to be welcomed when viewed

in the context of unleashing the power of self-forming collaborative communities of interest. Adding our identity multiple to Reed's equation makes the long tail just that little bit longer still: the more identities, the longer the tail.

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