

A Theory for Social Network Value

By Isabel Walcott Hilborn

July 2006

Abstract

The author argues that “Metcalf’s Law” for determining network value does not apply to social networks. Unlike machine networks, social networks depend heavily on the nature of the participation and attributes of each member. “Isabel’s Theory” proposes that the value of a social network will top out at a certain number of nodes. After this peak, the network is forced to calve or lose value if new members are added.

- Introduction
- History and background of network laws
- Examples of social networks declining with growth
- Discussion of calving? (not in place)
- Valuation factors in social networks
- Social science, not math
- Conclusion

Introduction

The arrival of Friendster in 2002 ushered in a new era for Internet users. “Web 2.0”, the second consumer Internet boom based on user-generated content and connections between people, was born . Within a few years, Yahoo bought Flickr and del.icio.us, Google bought Blogger, Sykpe and Dodgeball, Kleiner Perkins invested in Friendster, and Rupert Murdoch bought MySpace. Hundreds, if not thousands, of social network startups are now thriving in the new entrepreneur-friendly atmosphere, inspiring talk of another bubble. The tremendous valuations and the rush to grow the networks indicate that both investors and entrepreneurs believe in “Metcalf’s Law”: that the value of a network grows exponentially with the addition of each new node.

Without raining on the Web 2.0 parade, “Isabel’s Theory” argues that the network value law that applied so well to fax machines and PC’s no longer applies to social networks. While all fax machines share the same basic objective and ability, the same cannot be said of people. A fax is a fax is a fax, so the more in the network, the merrier. But adding the wrong person to a group can spell disaster.

Sociologists know that a tightly-knit clique, a private club, or a family offers important safety and support that the human race can’t live without. Beginning sociology textbooks stress the importance of “In-Groups” and “Out-Groups” in building social capital.¹ Parents tell their children, “Don’t talk to strangers” for good reason. Closely guarding entry into protective environments is not only immensely valuable but instinctive. A world of work exists already on the general topic of social networks; for a resource to some of this work, see the topic on Wikipedia at http://en.wikipedia.org/wiki/Social_network.

Given these well-known concepts, why hasn’t exclusivity been adequately valued among today’s Internet entrepreneurs? Perhaps because being exclusive is contrary to the dream of building a “Commons” which is shared by so many Internet idealists. It hardly needs mentioning that exclusionary groups are tremendously unpopular (especially among those they exclude), and justifiably so. Diversity adds great value to groups, often life-giving value. Democracy itself is built on the concept that all people are created equal, so why exclude anyone? Happily, countless “minority” individuals are now able to conquer prejudice and enter corporate and government settings that once unfairly tried to exclude them.

To all who agree that all people are created equal, then, to suggest that there’s a value to exclusivity could be viewed as positively undemocratic. American principles of social mobility and our historical resentment of elitism make exclusivity unpalatable.

¹ <http://www.wwnorton.com/giddens4/chapters/chapter6/welcome.htm>, as of March 20, 2006

Despite Web 2.0's seeming reluctance to see its importance, though, the fact remains that exclusivity protects power, safety, identity, and so many other important aspects of belonging to a group. This essay proposes assigning great value to exclusivity in online social networks. In short, "Isabel's Theory" sets forth the idea that a network's value begins to decline if the network gets "too big". That inflection point is based on multiple factors, and it's different for different networks.

Accepted Network Value "Laws"

Let's start with the basic rule of networking that many in the tech and venture communities are familiar with, **Metcalf's Law**, which states that the value of a network increases exponentially as each new node is added. The network's value is said to be worth approximately the number of nodes to the power of two, as illustrated by the common example of the humble fax machine:

"A single fax machine is useless, but the value of every fax machine increases with the total number of fax machines in the network, because the total number of people with whom you may send and receive documents increases." http://en.wikipedia.org/wiki/Metcalfes_Law, as of February 10, 2006.

The dramatic importance of this seeming truism may be missed by those who have spent their entire adult lives immersed in a networked culture. The revolutionary aspect of Metcalfe's Law only becomes clear when its theory of *exponential growth* is compared to the linear or *incremental growth* of a one-way or "broadcast" communications system, such as a television station that can only grow in increments of one as each new viewer is added. The many-to-many communication made possible by the Internet is utterly ordinary to some and completely alien to others.

Broadcasts have long been held to be as valuable as the number of people they reach, growing linearly as each new individual or group of viewers or listeners is added. This phenomenon is known as **Sarnoff's Law**. The underlying difference between a one-to-many broadcast and a many-to-many network is you can reach more people faster with the latter – assuming everyone does his or her job of spreading the word. The networked individual, like the networked computer, has an active role in the overall messaging mesh – hence the importance of building "users" as opposed to a passive "audience" in the digital age. The leverage networking tools offer the many is so immense that it is even changing the nature of marketing, as the Cluetrain Manifesto explains.

Metcalf's Law has been recently applied to social networks, inviting much comment. Specifically, David P. Reed noted that the potential value of the network is actually far greater than Metcalfe supposed, because an individual can belong to the entire group or any size subset of the group with any combination of other individuals. In **Reed's Law**, the equation for the exponential growth of a social network is written as $2^n - 1$, where n is the number of participants or "nodes".²

Clearly, in either case above we are discussing the potential number of contacts that could arise from these connections, and not looking at averages for how many contacts might be made or groups might be formed, which would in actuality be far smaller than the limit. Sociologists have examined this aspect of social networks as well.

In fact, Dunbar's number estimates that the mean natural limit of any social group is 150.³ What this suggests is that just because you can send a fax to anyone in the world, doesn't mean you will. Accordingly, in early 2005 a paper⁴ was published by Andrew Odlyzko and Benjamin Tilly out of the University of Minnesota pointing out that because all nodes in a social network are not equally valuable to all other nodes, it is inaccurate to value a network based on *potential* connections.

² http://en.wikipedia.org/wiki/Reed%27s_law, as of February 10, 2006

³ http://www.lifewithalacrity.com/2004/03/the_dunbar_num.html, as of March 20, 2006

⁴ <http://www.dtc.umn.edu/~odlyzko/doc/metcalf.pdf>, as of February 10, 2006

Oclyzko and Tilly asserted that it is more realistic to estimate how people are likely to actually connect with others, who are valuable specifically to them, for reasons such as common interests, geographical nearness, popularity, and so forth. Banking sensibly on what is realistic as opposed to what is possible, Odlyzko and Tilly propose a more modest valuation for networks: $n \log(n)$.

In brief, this predicts *faster than linear growth* for a social networking application, but not as exponentially large as either Metcalfe or Reed suggested.

Real Social Networks Don't Work Like That!

All the most well-known existing theories about network value agree that the more people join a network, the more valuable it becomes. Anecdotal examples, however, indicate a discrepancy. When it comes to people, quality is often more important than quantity. That is, a participant is happy to join a group when he is sure to meet cool people, and unlikely to join if he suspects that a bunch of losers will now have access to his attention. This is true even when the bunch of losers is much larger than the group of cool people. In fact, the larger the group, the more likely it is to be a bunch of losers.

At some inflection point in a group, then, each new member erodes the group's value, until it becomes worthless for its original purpose and must revise its objectives or die. This inflection point is necessarily different for each network based on the objectives of the participants, and hardly likely to be calculable.

Consider Orkut, Google's experimental social network, which began as a popular network for the "in" crowd in Silicon Valley. Individuals required an invitation to join, and the language of the interface was English. Before long, however, the "In Group" began to complain that Brazilian users (part of the "Out Group") had taken over the network. These newcomers approached other members they didn't already know (spamming) – a networking faux pas -- and peppered the site's pages with Portuguese text.

English-speaking users were put off by the change. An article in Government Enterprise magazine in July 2005 cited that Orkut only had 6% US users at that time, while 73% of users were Brazilian.⁵ Many US users found the Brazilian presence disturbing. Meanwhile, Brazilians were outraged that the small remaining minority of US users had the audacity to complain. The nature of Orkut changed completely.

Take the trajectory of a trendy Manhattan celebrity hotspot getting taken over by middle-class college kids from New Jersey and Long Island. How long before it becomes host to middle-aged married couples, before finally succumbing to market pressures and going out of business?

Trendy dance clubs need to be kept exclusive to stay trendy – hence the velvet ropes. The clubs that succumb to the desire to profit by admitting everyone in the queue, will soon learn that the queues disappear. Private country clubs with elaborate entry requirements and high fees will confirm the necessity of exclusivity. Otherwise, the club's nature is altered, which diminishes the value for the initial members, who will go elsewhere. In the case of Orkut, limiting membership to invitation by another member was apparently not exclusive enough.

Social networks in "meatspace" can die quick deaths as soon as they lose their exclusive cachet. The "Cybersuds" party put on by the New York New Media Association in the mid 1990's was at first a great place to meet other early-adopter Internet entrepreneurs. By the late 90's, however, as the Internet boom got into full swing, everybody and his brother had heard that Cybersuds was a great place to meet people and network one's way into the Internet industry.

The organizers appreciated the growth and accepted everybody. They successfully recruited lavish sponsors who were attracted to the large crowds. Before long, the attendees consisted mainly of people who were there to meet the early adopters: lawyers, consultants, PR people looking for new business, hangers-on from other industries, and singles hoping to get lucky. The early adopters stopped attending as the room filled with people who didn't add value, but were only looking to profit from those who did.

⁵ <http://www.governmententerprise.com/news/166401653>, as of February 10, 2006

Cybersuds died along with the Internet boom, just when the core group of Internet entrepreneurs most needed a support network to help them navigate the collapsing economy.

As these examples indicate, sometimes too much of a good thing is not so good anymore. This observation doesn't jive with Metcalfe's law. It doesn't jive with Reed's law, or even Odlyzko and Tilly's theory. Instead, it suggests that when we calculate social network value, we need to recognize that people aren't fax machines.

Valuation Factors in Social Networks

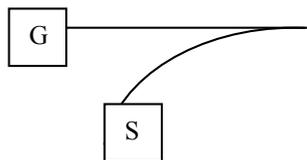
So if we can't value social networks using existing network laws, how can we value them? Clearly when it comes to people, it's not just about the number of people but what kind of people they are that builds value to the network.

Imagine a graph charting the real **Value (V)** of a social network, taking several factors besides the number of **Nodes (N)** into account:

- 1) **Status (S)**: The status of each individual participant, defined by a host of assets such as background (class, education, family); personal characteristics (beauty, industry knowledge), resources (finances, goods, expertise), location, and so forth
- 2) **Network Goal (G)**: The purpose of the network (hiring, organizing an activity like book club or soccer, meeting friends, dating, raising money, etc.)
- 3) **Access (A)**: The ability of each participant to reach others of value outside the network
- 4) **Exclusion sensitivity (X)**: The judgment of participant has to determine who belongs and who doesn't
- 5) **Recruiting (R)**: The ability of each participant to bring others into the network
- 6) **Participation (P)**: How active is each participant in the network? How much does each participant contribute?
- 7) **Trust (T)**: Are the participants honest and expert? Can you trust what you learn?
- 8) **Quibble factor (Q)**: Some of the above definitions could have exceptions that change the value of the variable.

Clearly, the value of the network to each participant increases if each participant has a high status within the purpose of that network. For example, in a dating network, the more each participant is attractive, smart, funny, employed, and meets other standard criteria ideal in a potential mate, the better that network is. The fewer people with high status, the less desirable it is to be a part of that network.

As the status of each participant (S) is accurately aligned with the network's purpose (or the other participant's goal) while networking (G), then, the network's value increases.



In a social network, value is added every time a new member is brought in who meets the standards. To bring in new people who add value, each participant must first of all know how to access the right kind of person (A), know how to tell the difference between a valuable member and a member who drags down the average (X) and be able to convince them to join (R). Once the new member joins, the information he or she provides must be trustworthy (T), or it takes too much filtering to be worth listening.

Finally, the network is no good if nobody uses it. So, the higher the participation level (P), the better... except this cannot approach infinity. People only have so much time, and they need to be meeting outsiders, if only for recruitment purposes. So, (P) must be limited: not so high that it approaches an unhealthy obsession or stalker level, at which point the value declines immediately to add negative impact.

It seems we must mention the quibble factor (Q): a participant need only participate once, and in that one time, he could meet a successful match and never need participate again. Or, he may not have the required status for membership, but still successfully connect with other members despite his deficiencies. This individual would be the exception, not the rule, yet we are uncomfortable crafting a formula that doesn't include him.

Sorry, No Formula

Is it even possible to create a formula to value social networks? A quick effort seems to indicate that it is a gargantuan task with an unreachable solution. Once people are involved, not just PCs, the question of a network's value becomes one of social science, not math. Of the eight variables, only one (number of nodes) is a natural numerical value. The rest would necessarily need to be subjectively assigned values, based on a set of rules that might be different for each network studied.

Fitting them all into a formula would be a fool's errand. If one admits that these social factors impact the value of a network, it simply becomes clear that a smaller network where the variables are high will be worth more than a bigger network where the variables are low.

For example, take **Status (S)**. We bet that Bob Metcalfe would rather join a network of a few hundred professionals at the top of their fields, like the top-shelf participants at a very expensive conference, than a larger network of people with lesser professional status, like Friendster. **Access (A)**? David Reed would likely give up his Orkut password to attend Davos next year, although Davos offers a much smaller network. And **Participation (P)**: if Odlyzko and Tilly played pick-up basketball, they'd surely rather join a group where the other participants actively met for regular games than one in which nobody on the list ever initiated or showed up for a game.

This is why, in real life, Esther Dyson charges over \$4,000 per participant to attend her annual PC Forum, a networking event for about four hundred people, grossing an estimated \$1.6 million from entry fees alone [unconfirmed figure]. Meanwhile, the Calgary Model Railway Society charges \$7 per participant for their Supertrain conference, which was attended by 12,500 participants in 2003, grossing an estimated \$88K (not counting discounts for children).

Conclusion

Theoretically, for each networking conference, like for each product or service, there is a point of highest profit, taking into account how many people will pay what price. After that, the profit begins to decline. Similarly, with a network funded by ad revenues, as long as the demographic fits the type that advertisers are trying to reach, the more participants it has the more valuable it will be. As soon as it strays from that demographic, however, advertisers will become less interested and the CPM rates will decline. We consequently propose that the value of a social network takes the shape of a peak, topping out at a certain number of participants and then starting to decline as members who don't add value join, and those who did add value exit.

It's the entrepreneur's job, or the venture capitalist's, to determine where that peak is and cap membership there. By creating rules defining what kind of person will be allowed to join the network, network founders can ensure that the nature of their network stays true to the purpose for which it has been created. They would have to take into account that this may limit their network's growth.

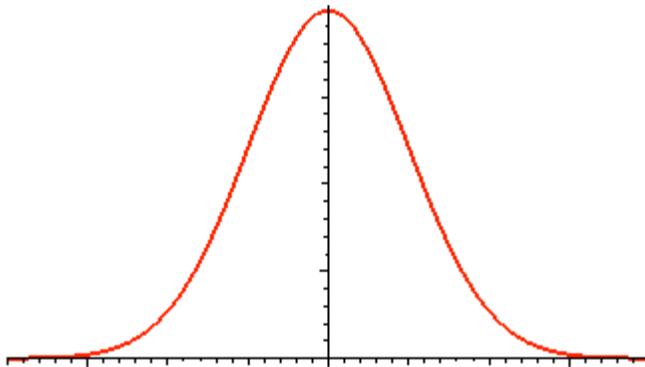
Alternatively, founders can change the goal of the network as the nature of the participants changes. In fact, large networks seem to calve when they get too big, because the shared group goal stops applying universally to every member. Witness Catholicism's many different branches as an example; members of this larger group formed themselves into smaller groups that better met their definition of how faithful parishioners should behave.

Whether membership-limited or calving, we place a social network's value along a peaked trajectory, with number of nodes or participants along the x axis and network value on the y axis of the graph. Value may peak at 25 participants or 2.5 million, depending on the network's goal and how many individuals would

make good participants. The object is to try to get just enough participants to hit the top value – no more, no less.

Because of the diversity of the variables, it seems reasonable to assume that this peak will take different forms. Some networks will increase in value more steeply, others may decline more slowly. A terrorist network infiltrated with a mole, a dating network hosting a murderer, or a house-sitting network hosting a burglary ring might lose all its value precipitously. Such a network might decline into negative valuation, where members and investors lose out tremendously by participating.

In conclusion, I maintain that exclusivity must not be underestimated when calculating network value; and that for each social network there is a peak number of participants, after which point the value of the group starts to decline. Because the suitability of the participants is no longer optimal, the integrity of the group has been compromised. For the original members, participating in the group is no longer worthwhile. The group must either change in nature and goal, calve, or die.



No. of Participants ----->