

Computing with Social Networks on the Web

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Web-Based Social Networks

- What are they?
- How do they grow and change?
- Challenges
- Applications



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- **What are they?**
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What are Web-based Social Networks

- Websites where users set up accounts and list friends
- Users can browse through friend links to explore the network
- Some are just for entertainment, others have business/religious/political purposes
- E.g. MySpace, Friendster, Orkut, LinkedIn



Growth of Social Nets

- ***The*** big web phenomenon
- About 230 different social networking websites
- Over 675,000,000 user accounts among the networks
- Number of users has more than doubled in the last 18 months
- Full list at <http://trust.mindswap.org>



Biggest Networks

1.	MySpace	250,000,000
2.	ChinaRen Xiaonei	60,000,000
3.	Orkut	60,000,000
4.	Friendster	53,000,000
5.	zoominfo	35,000,000
6.	Adult Friend Finder	26,000,000
7.	Bebo	25,000,000
8.	Facebook	24,000,000
9.	Cyworld	21,000,000
10.	Tickle	20,000,000



Structure of Social Nets

- Small World Networks
 - AKA Six degrees of separation (or six degrees of Kevin Bacon)
 - Term coined by Stanley Milgram, 1967
- Math of Small Worlds
 - Average shortest path length grows logarithmically with the size of the network
 - Short average path length
 - High clustering coefficient (friends of mine who are friends with other friends of mine)



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Behavior and Dynamics

- Social networks are not static.
 - Relationships constantly change, are formed, and are dropped.
 - New people enter the network and others leave
- Do people behave the same way in social networks on the *Web*?



Questions

- How do these networks grow (and shrink)?
- How are relationships added (and removed)?
- What affects social disconnect?
- What affects centrality?



Methodology

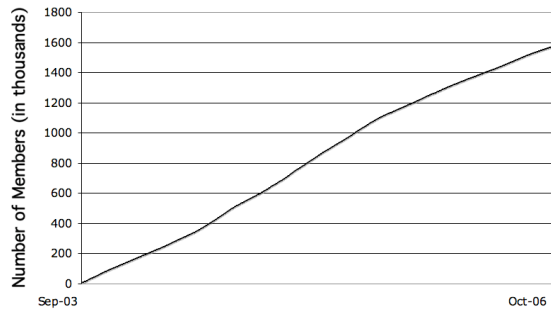
- 24 month study
- Automatically collected adjacency lists (everyone and who they know), join dates, and last active dates for all members.
 - December 2004
 - December 2006
- For 7 networks, I collected adjacency lists every day for 7 weeks.
 - Who joined or left
 - What relationships were added or removed



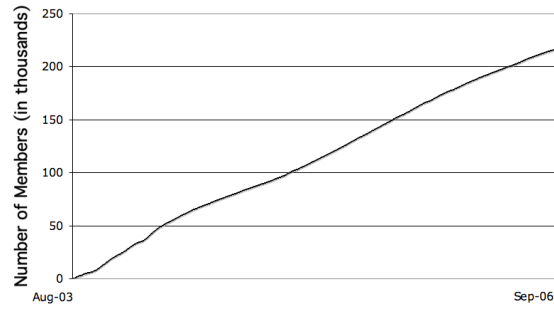
Network Growth

- People do not leave social networks
 - On sites with a clear simple process, less than a dozen members leave per day
 - In some networks, essentially no one has ever left
- Lots of people join social networks
 - For ten networks we knew the date that every member joined the network
 - Networks tend to show linear growth
 - The slope can shift
 - Usually occurs suddenly
 - Explained by some event

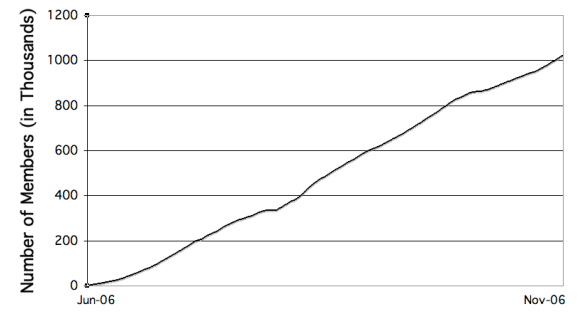
GreatestJournal Membership Growth



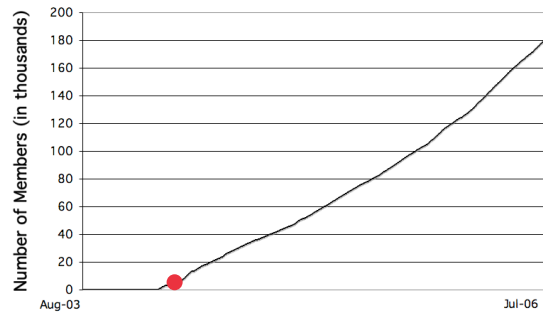
Tribe Membership Growth



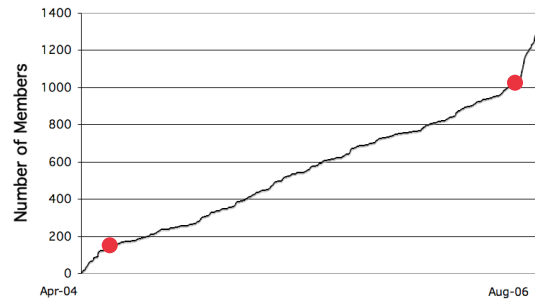
Mobango Membership Growth



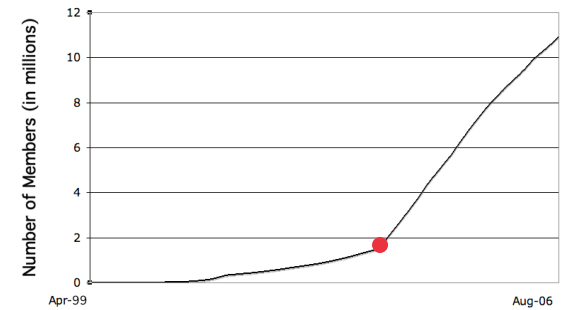
Dogster Membership Growth



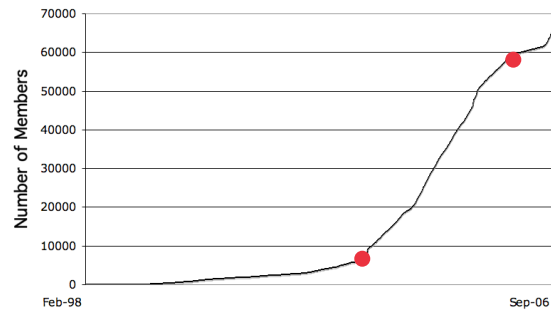
Hamsterster Membership Growth



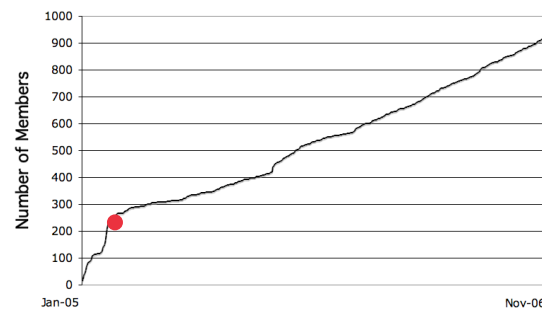
LiveJournal Membership Growth



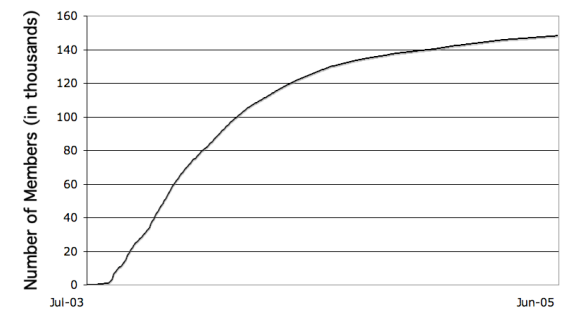
Ecademy Membership Growth



FilmTrust Membership Growth



Hipstir Membership Growth

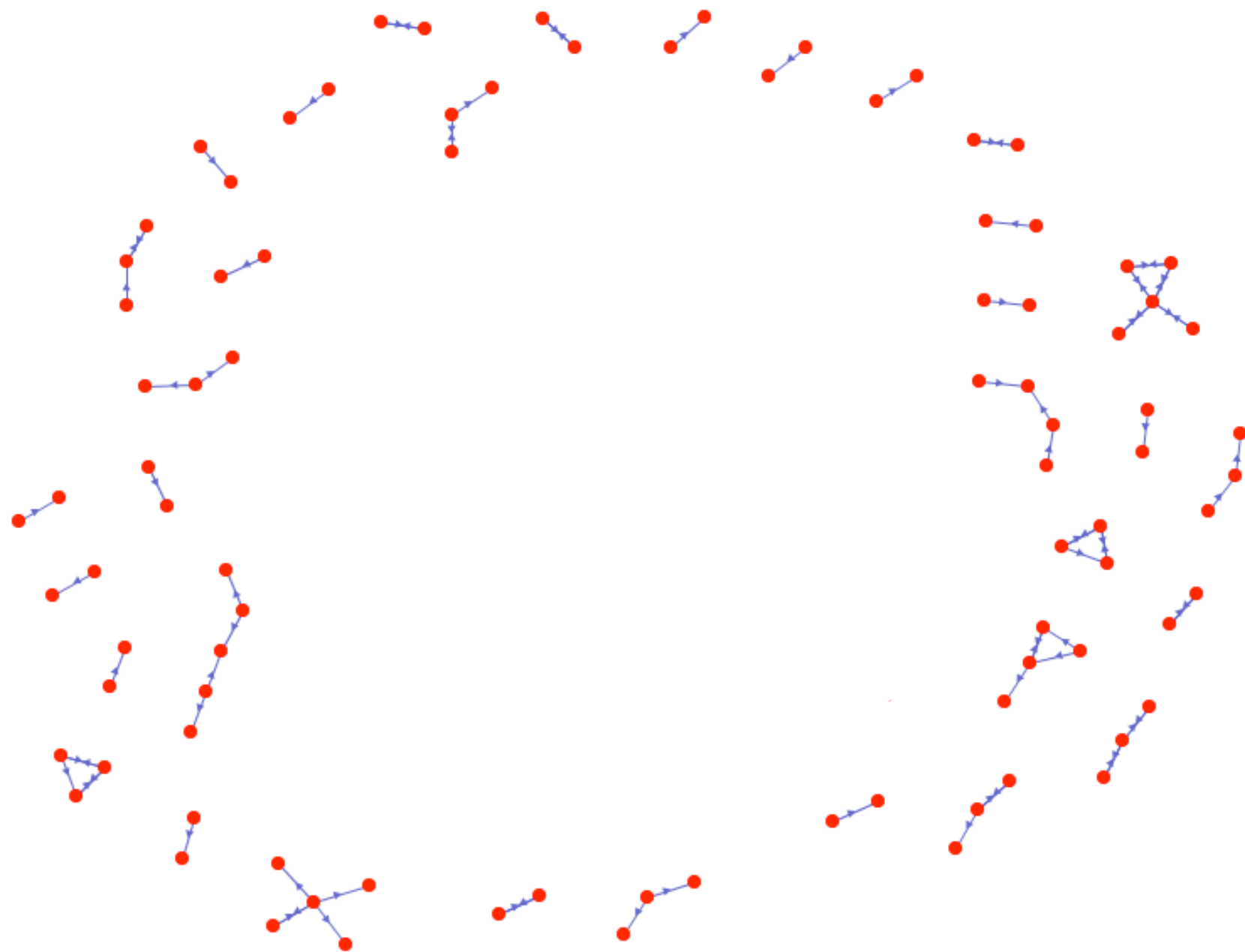




Relationships

- Forming relationships is the basis for social networking
- Almost all networks are growing denser
 - Relationships grow at approximately 1.7 - 2.7 times the rate of membership
- There is a strong social disincentive to remove relationships

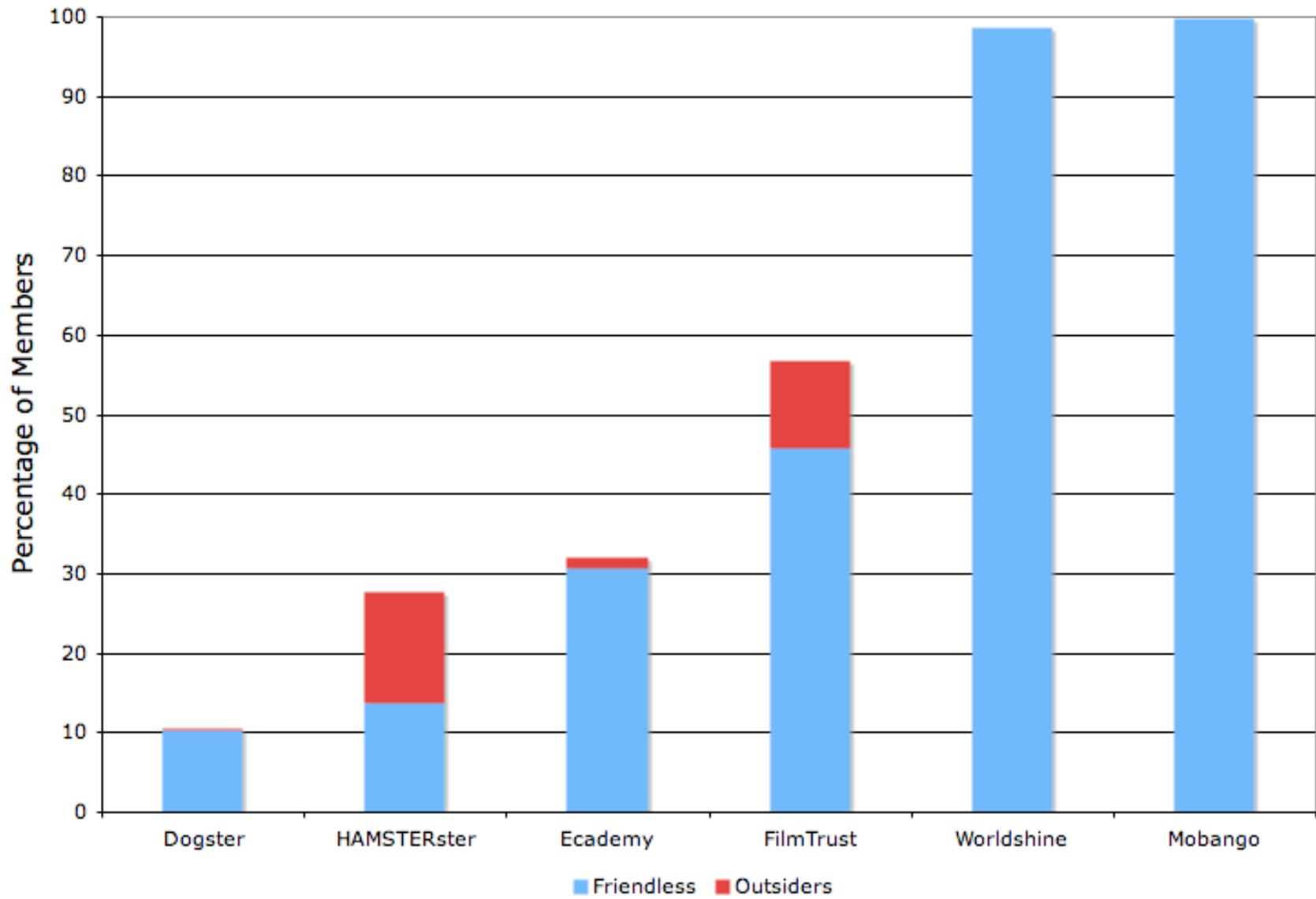
<i>Network</i>	<i>Removed</i>		<i>Added</i>		<i>Net Growth</i>	
Buzznet	6,418	(1.82%)	135,158	(38.38%)	128,740	(36.56%)
Ecademy	1,774	(0.66%)	26,751	(9.92%)	24,977	(9.26%)
Fotothing	2,059	(2.73%)	11,314	(14.98%)	9,255	(12.26%)
Tribe	11,211	(0.50%)	180,936	(8.08%)	169,725	(7.58%)
FilmTrust	1	(0.001%)	399	(31.7%)	398	(31.6%)





Friendless and the Outsiders

- Friendless have no social connections
- Outsiders have social connections but are independent from the major connected component of the network
- Important because if we are using the social network for information access, these people will get little benefit.





Centrality

- Other than having lots of friends, what makes people more central?
 - Average shortest path length as centrality measure
- Activity
 - Consider join date, last active date, and length of activity (last active date - join date)
 - Compute rank correlation with centrality
 - Medium strength correlation (~ 0.5) between duration and centrality



Results

- Networks follow a linear growth pattern, where the slope shifts in response to events
 - People rarely leave networks
- Networks grow denser, with relationships added more frequently than members
 - People will delete relationships, but orders of magnitude less frequently than they add them
- Websites with more non-social features tend to have more friendless and disconnected users
- Users with longer periods of activity tend to be more central to the network



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Challenges

- Aggregation
 - People have accounts in multiple places
 - What if we want to see all that data together
- Size
 - Scalability of algorithms is important when working with hundreds of millions of nodes in a graph



Social Networks on the Semantic Web

- FOAF (Friend Of A Friend)
 - A simple ontology for representing information about people and who they know
- About 20,000,000 social network profiles are available in FOAF format
- Approximately 60% of all semantic web data is FOAF data



FOAF for Aggregation

- Semantic Web Vocabulary for describing people and social networks
- Automatically generated by many social networking websites
 - Advogato
 - Buzznet
 - DeadJournal
 - eCademy
 - FilmTrust
 - GreatestJournal
 - InsaneJournal
 - LiveJournal
 - LJ.Rossia.org
 - Minilog.com
 - Tribe



```
<foaf:Person>
  <foaf:nick>golbeck</foaf:nick>
  <foaf:name>golbeck</foaf:name>
  <foaf:mbox>4d14fc9da1d0929dae3cde648ae4a7195d120bae</foaf:mbox>
  <foaf:openid rdf:resource="http://golbeck.livejournal.com/" />
  <foaf:page>
    <foaf:Document rdf:about="http://golbeck.livejournal.com/profile">
      <dc:title>LiveJournal.com Profile</dc:title>

      <dc:description>Full LiveJournal.com profile, including information such
as interests and bio.</dc:description>
    </foaf:Document>
  </foaf:page>

  <foaf:weblog rdf:resource="http://golbeck.livejournal.com/" />
</foaf:Person>
```


Semantics of FOAF



- Inverse Functional Properties
 - foaf:aimChatID
 - foaf:homepage
 - foaf:icqChatID
 - foaf:jabberID
 - foaf:mbox
 - **foaf:mbox_sha1sum**
 - foaf:msnChatID
 - foaf:weblog
 - foaf:yahooChatID
- Two people who share a common value for one of these properties are inferred to be the SAME person



Do People Have Multiple Accounts?

- FOAF is fine and good, but can we take advantage of the reasoning to merge networks?
- Yes!

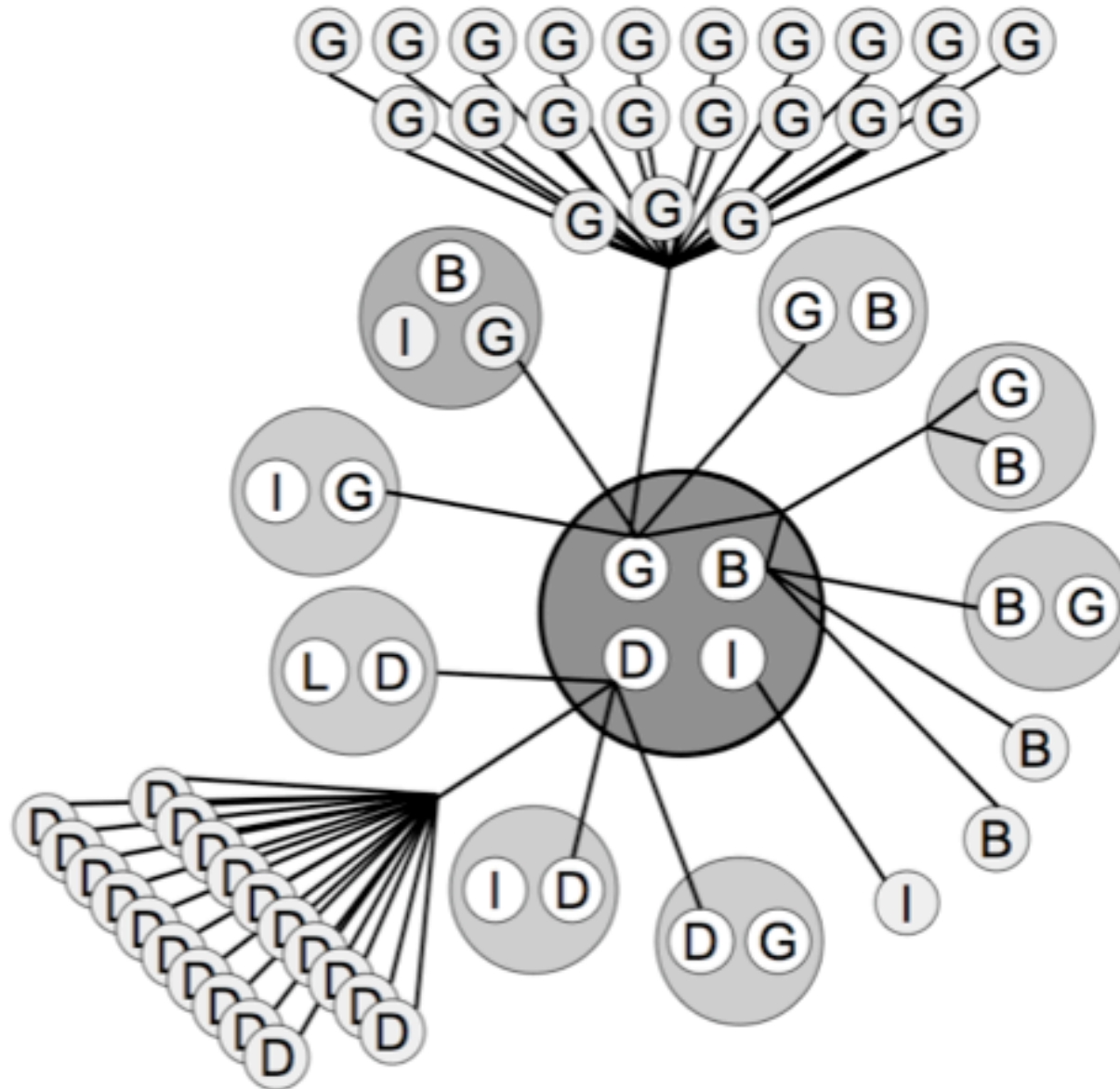


Table 1: The social networks used in this study, including the average shortest path length pre and post-reasoning.

Network	Purpose	Members Studied	Avg. Degree	APL (Pre)	APL(Post)
Advogato	Business	2,778	13.51	2.17	2.15
Buzznet	Photos	208,324	1.00	4.43	2.76
DeadJournal	Blogging	9,801	3.74	3.19	3.23
eCademy	Business	61,242	3.08	2.20	2.19
FilmTrust	Social/Entertainment	1,250	1.06	3.75	3.84
GreatestJournal	Blogging	36,862	33.36	2.25	2.31
InsaneJournal	Blogging	1,410	13.36	3.19	3.26
LiveJournal	Blogging	3,563,267	8.38	2.85	2.83
Minilog.com	Blogging	119	1.63	3.66	3.66
Rossia.org	Blogging	4,180	9.65	2.33	2.36
Tribe	Social/Entertainment	218,694	9.93	2.74	2.69



Networks	Advogato	Buzznet	DeadJournal	eCademy	FilmTrust	GreatestJournal	InsaneJournal	LiveJournal	Rossia.org	Minilog.com	Tribe
Advogato	x	2	1	1	6			58	1		53
Buzznet		x	53	89	13	929	75	1967	5		793
DeadJournal			x			85	19	387			28
eCademy				x	8	1		22	1		161
FilmTrust					x			8			17
GreatestJournal						x	320	702	16	4	15
InsaneJournal							x	32	5	1	
LiveJournal								x	208	10	2357
Rossia.org									x		8
Minilog.com										x	3
Tribe											x





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Information Access

- Aggregate, Sort, Filter information
- A user's social relationships inform what they want to see and how important it is
- Use data from web-based social networks to build intelligent applications
- My focus is specifically on *trust*

Example: Filtering

The screenshot shows the TrustMail email client interface. The main window displays the 'INBOX' for the account 'trust@danandjen.org'. The inbox contains 16 messages, with the following details:

Ms...	A ...	Date	From	Subject	Trust
1		06/15/04 15:37	Jennifer Golbeck <golbeck@...>	test	9.0
2		06/16/04 02:22	Jennifer Golbeck <golbeck@...>	mail2	9.0
3		06/16/04 17:11	Jennifer Golbeck <golbeck@...>	CfP Distribution ISWC'04 Trust W...	9.0
4		15:24	Bijan Parsia <bparsia@isr...>	Lightbulbs and inference	8.5
5		06/16/04 14:44	Dan Golbeck <dan@danand...>	Yo	8.0
6		15:11	nfnti <me@nfnti.com>	And another one	7.8
7		15:09	Kendall Clark <kendall@mo...>	[golbeck@cs.umd.edu: [Semweb] ...	7.8
8		15:14	Denise Cross <dcross@um...>	The secret to a happy life	7.8
9		15:19	awmannes@comcast.net	Hope everything is going well	7.8
10		15:28	Yarden Katz <yarden@umd...>	Stalnaker's Probability and Condi...	6.9
11		15:27	Taowei David Wang <tw7@...>	This is not a chain letter... yet (fwd)	6.475
12		09/21/04 16:41	Debbie Heisler <heisler@cs...>	hi	6.399999...
13		15:13	Aditya Kalyanpur <aditkal@...>	rafactoring ontologies using Swo...	6.0
14		15:09	Anant <anant@cs.umd.edu>	TrustMail	
15		15:49	"Kolovski, Vladimir" <kolov...>	Greetings from Macedonia!	
16		15:11	Nfnti <beyond.nfnti@gmail...>	Last One	

The interface also shows a sidebar with folders: 'trust@danandjen.org', 'outbox', 'sent', and 'INBOX'. The status bar at the bottom indicates 'INBOX 10 Unread / 16 Total' and 'Goto Msg' with a search field. The bottom right corner shows a 'default' dropdown menu.



Example: Aggregating

- If we have numeric data, a simple average only shows what the overall population thinks
 - Not so useful, e.g. politics
- What if we weight the values in the average by how much we trust the people who created them?
- FilmTrust
 - <http://trust.mindswap.org/FilmTrust>

A Clockwork Orange (1971)

User Options

Your Rating:

0.5 stars

You have reviewed this film:
I read the book before seeing the movie, and the book had a poin ...
[Edit Review](#) - [Delete Review](#)

Movie details for A Clockwork Orange (1971) from IMDB. [Click Here.](#)

Search
Film Title:
 Search only movies with ratings or reviews

RDF 1.0

Ratings of A Clockwork Orange (1971)

Number of Ratings	266
Average User Rating	<input type="text" value="★★★"/>
Your Recommended Rating	<input type="text" value="★"/>
Your Rating	<input type="text" value="★"/>

Reviews of A Clockwork Orange (1971)

I read the book before seeing the movie, and the book had a point. There was a deep social commentary there, amidst the violence and torture. The movie, however, lost much of the meaning of the book. The violence was not justified by the plot, and the message was left very shallow.

A lot of people who love this movie love it because they know it is supposed

Rated By

- (All Users)
- ★★★★ Steven Hopkinson
 - ★★★★ Robert Sherwood
 - ★★★★ Tim Finin
 - ★★★★ Bill Krauss
 - ★★★★ Phil Wilson
 - ★★★★ Leigh Dodds
 - ★★★★ Steve Pomeroy
 - ★★★★ Ryan Shaw
 - ★★★★ Bijan Parsia
 - ★★★★ Geoffrey Bilder
 - ★★★★ Jason Harris
 - ★★★★ Owen Astrachan
 - ★★★★ hobvias sudoneighm



Example: Sorting

- When many users create information, we want to see the data from people like us first

Reviews of **A Clockwork Orange (1971)**

I read the book before seeing the movie, and the book had a point. There was a deep social commentary there, amidst the violence and torture. The movie, however, lost much of the meaning of the book. The violence was not justified by the plot, and the message was left very shallow.

A lot of people who love this movie love it because they know it is supposed to be deep and important, not because there is actually a lot to love here. Read the book instead.

- by **Jen Golbeck**



This movie sucked! It was probably the worst movie I have ever seen. As I left the theatre, I remember thinking, "what was that all about?"

- by **john golbeck**



Absolutely the worst movie ever. Very weird, hard to follow and disturbing. Perhaps if the book had been followed better it would have been more tolerable to sit through

- by **irene golbeck**



One of Stanley Kubricks science fiction classics. Staring Malcolm McDowell as "Alex", a young man whose principle interests are rape, ultra-violence, and Beethoven.

The first half of this film is a disturbing no-holds-barred look at the life of Alex. Kubrick seems to want to make the audience dislike the principle character, with little sympathy for what will ultimately happen to him.

When Alex goes to jail, he appears unrepentent and determined to subvert the system. Instead, he is subjected to a treatment to "cure" him of his ways. After his cure and subsequent release, his past revisits him, causing the audience to

- ★★★★ Ryan Suaw
- ★★★★ Bijan Parsia
- ★★★★ Geoffrey Bilder
- ★★★★ Jason Harris
- ★★★★ Owen Astrachan
- ★★★★ hobvias sudoneighm
- ★★★★ Valentina Tamma
- ★★★★ Bernardo Cuenca
- ★★★★ fox mulder
- ★★★★ Winnie Kessler
- ★★★★ Kaan Ege
- ★★★★ Paulo Pinheiro da Silva
- ★★★★ Chris Craun
- ★★★★ Øystein Holm-Olsen
- ★★★★ Stephen Harris
- ★★★★ Chris Walton
- ★★★★ Hermann Keldenich
- ★★★★ Duy Vu
- ★★★★ nivas gallo
- ★★★★ Jenneke Fokker
- ★★★★ Faith Piper
- ★★★★ Eric Prud'hommeaux
- ★★★★ Paul Gearon
- ★★★★ Michael Rueger
- ★★★★ Suzan Foster
- ★★★★ Dietrich Ayala
- ★★★★ Sean Cier
- ★★★★ Jochen Notholt
- ★★★★ michael diamond
- ★★★★ Davide Eynard

tolerable to sit through

- by irene



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When Alex goes to jail, he appears unrepentent and determined to subvert the system. Instead, he is subjected to a treatment to "cure" him of his ways. After his cure and subsequent release, his past revisits him, causing the audience to question the attitudes they have formed about this character.

This is a dark and cynical film about the way society treats its fringe elements. It contains numerous dichotomies, including an incredibly funny sex scene, as well as the most disturbing rape scene I've ever witnessed. The violence is stylized rather than authentic, but Kubrick makes great use of psychological elements with a much greater effect than the highly explicit elements used in more modern films.

- by Paul Gearon



Notwithstanding the movie's poor showing in the Golbeck demographic, this is actually an interesting --- if at times difficult to watch --- film. Kubrick does a pretty amazing job of making the audience feel compassion for a sociopath. That said, the film is not 100% faithful to the book. Most notably, the final (redemptive) chapter is omitted. But Kubrick never seemed all that much into redemption anyway, and so the ending is not necessarily what we'd hope for, but since when have Kubrick's films been described as 'life-affirming'? Worth watching, even through hands over your eyes in parts...

- by Brian Shields



- ★★★★ nivas gallo
- ★★★★ Jenneke Fokker
- ★★★★ Faith Piper
- ★★★★ Eric Prud'hommeaux
- ★★★★ Paul Gearon
- ★★★★ Michael Rueger
- ★★★★ Suzan Foster
- ★★★★ Dietrich Ayala
- ★★★★ Sean Cier
- ★★★★ Jochen Notholt
- ★★★★ michael diamond
- ★★★★ Davide Eynard
- ★★★★ Lorie Huertas
- ★★★★ karsten schmidt
- ★★★★ Sebastian Rodriguez
- ★★★★ theo takiri
- ★★★★ Mónica Rojas
- ★★★★ Brad Bebee
- ★★★★ Santiago Molina
- ★★★★ Rachel Rein
- ★★★★ Al Gray
- ★★★★ Maria Leonard
- ★★★★ jennifer lee
- ★★★★ Darin Marshall
- ★★★★ Eric Miller
- ★★★★ Bill McDaniel
- ★★★★ Ron Craswell
- ★★★★ Greg Tyrelle
- ★★★★ Caz Ksiazek
- ★★★★ John Smart
- ★★★★ Jim McManus
- ★★★★ Lyndsay Burtonshaw
- ★★★★ Simon Jacquier



Conclusions

- Social networks are growing exponentially in number and size
- Web standards and technologies are available that let us access them easily and aggregate them
- There is a wide range of applications that could benefit from taking users' social relationships into consideration.



Ongoing Work

- Social Networks and trust for disaster response and recovery
 - Alerting people of emergencies taking place
 - Helping people find information in the aftermath of disasters



Info

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