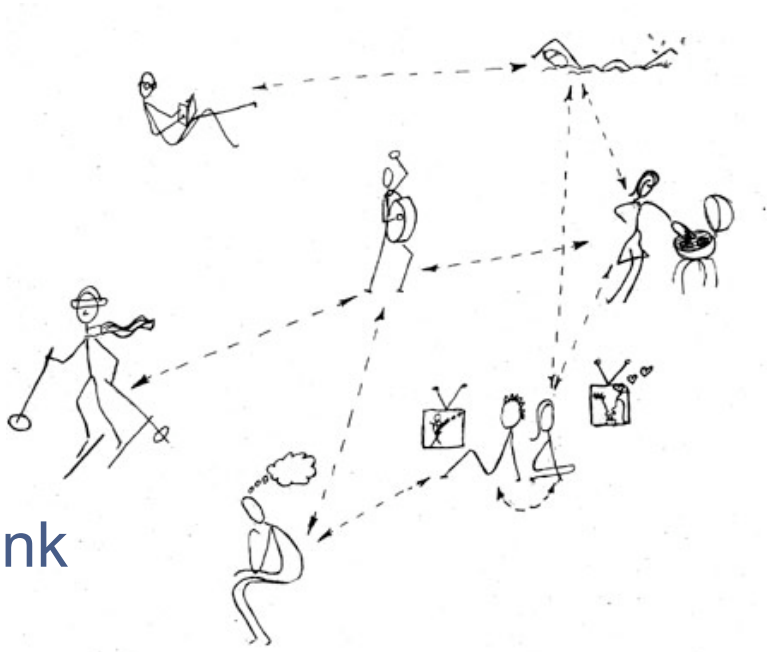
School of Information
University of Michigan



The Social Hyperlink

Lada Adamic
School of Information
Center for the study of complex systems
University of Michigan

Lada's Friends

http://web.archive.org/web/2007021509

Most Visited CTools DDish gReader Gdocs delicious PCiteULike CiteULike MBus

Google wayback machi Search Settings

Lada's Friends

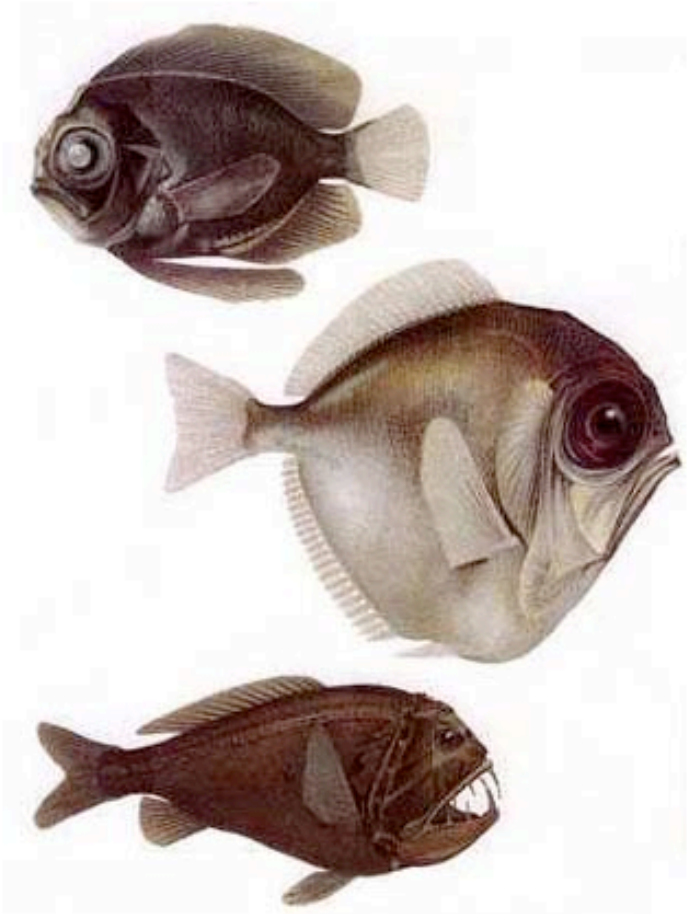
LADA ADAMIC

CURRENT
PAST
ALWAYS

ME
YOU
THEM

WORK
PLAY

ladamic@umich.edu



THEM

TJ
Stacy
Eytan
Orkut
Rajan
Ryan
Wendy
Sergio
Amy
Josh
Annie
Martin
Jen
Amnon

Julie

Becky

my roomie Becky

my best friend Julie

Hi, I'm Julie!

I'm studying...

I like ...

My friends are...

My favorite links:

Hey, I'm Becky.

I study...

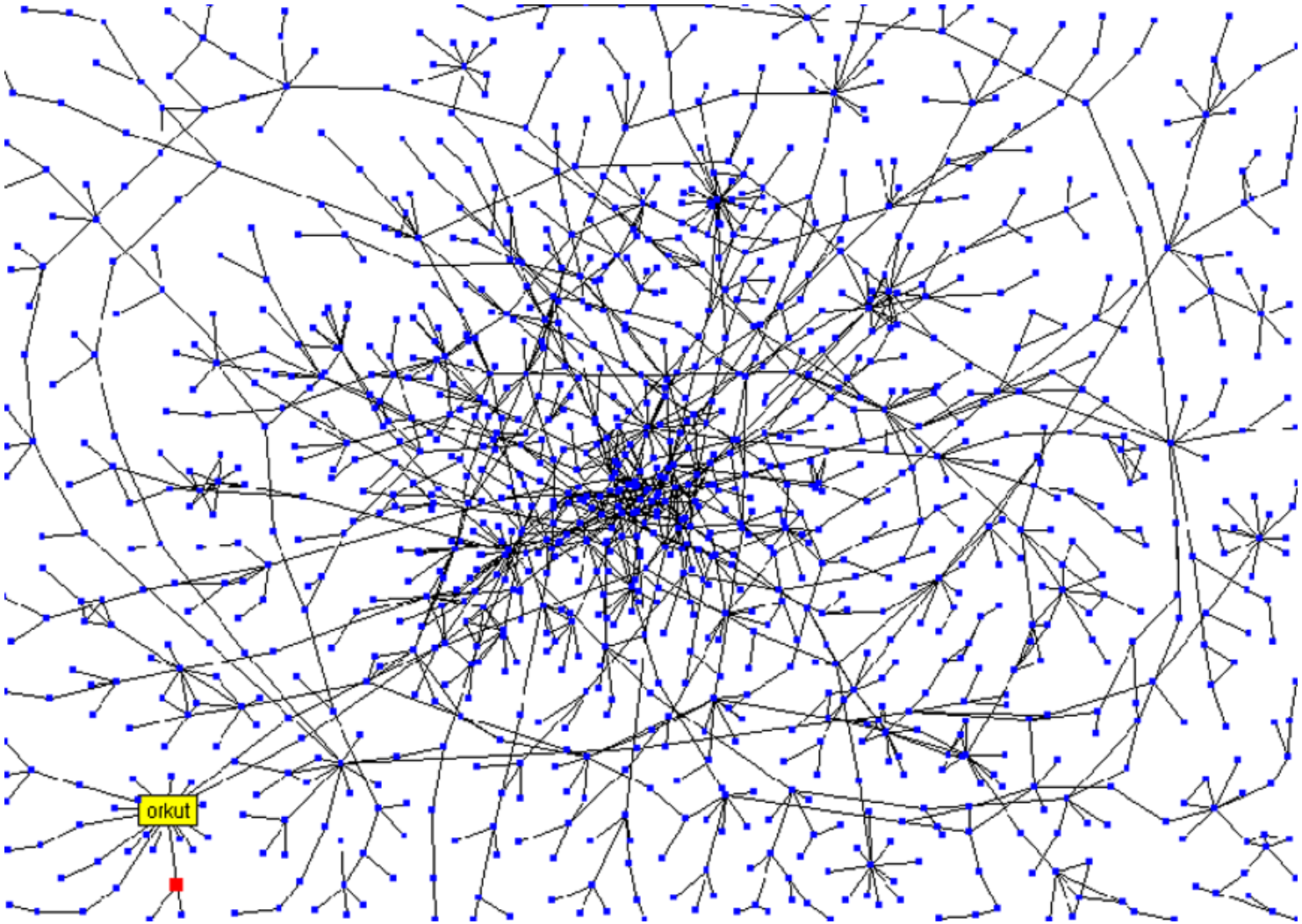
I live in ...

My favorite books are...

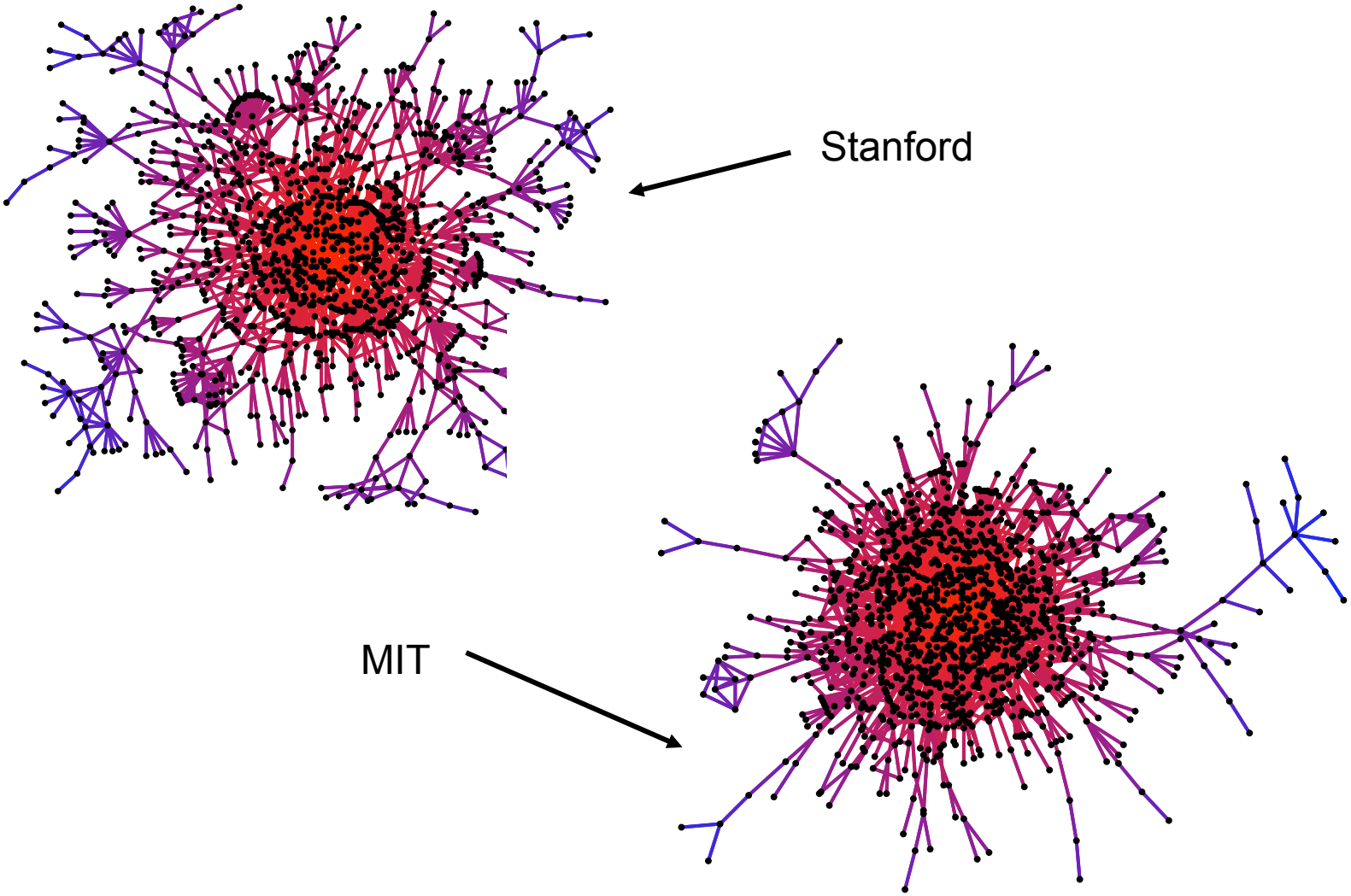
Here are some photos...

Becky and Julie aren't the only ones to link to each other

Stanford Social Web (ca. 1999)



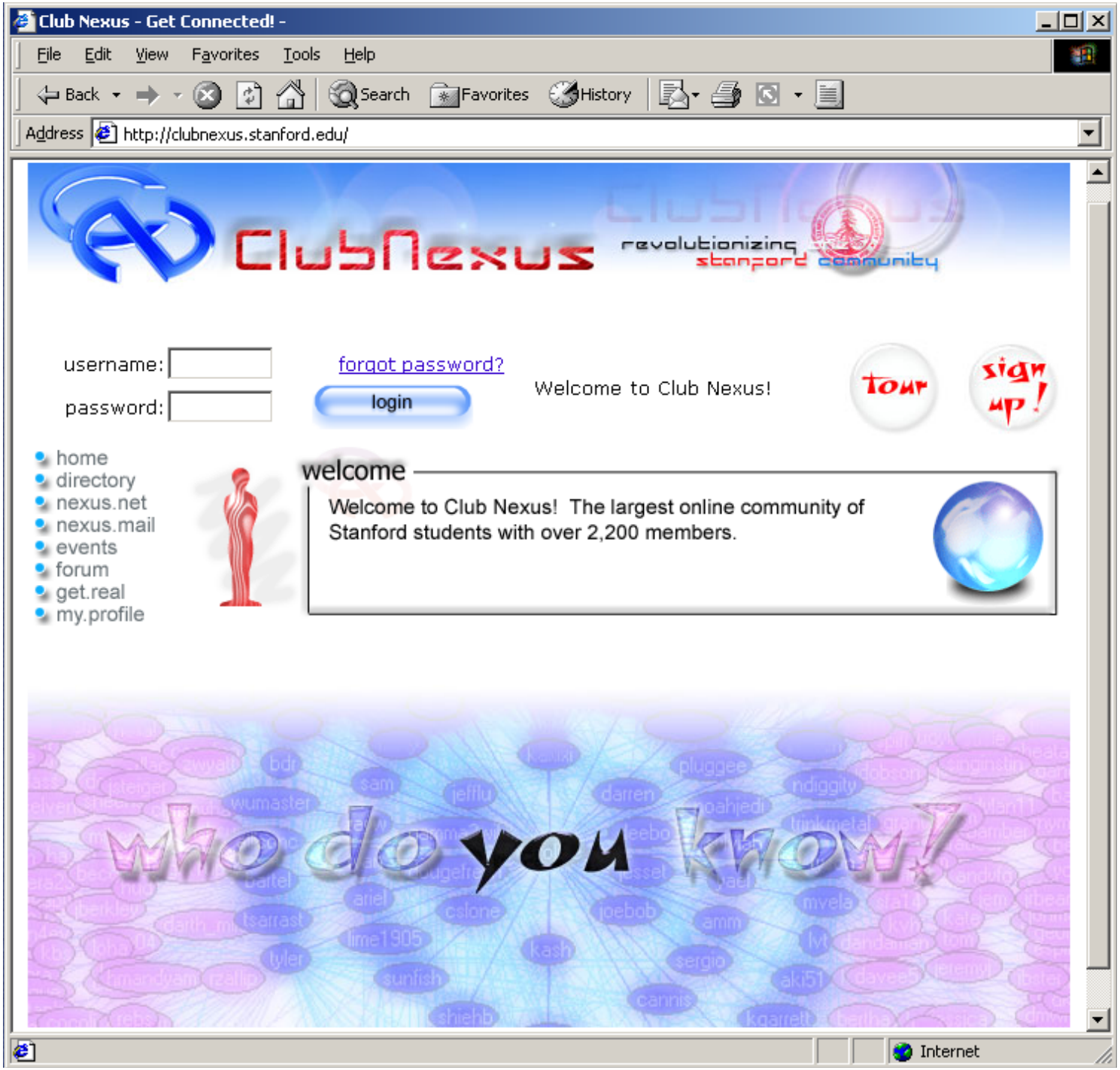
Differences in social networks



Adamic & Adar, Social Networks 2003

Link prediction reveals why individuals associate

MIT Top Things	Stanford Top Things
Union Chicana (student group)	NTUA (National Technical University of Athens)
Phi Beta Epsilon (**fraternity**)	Project Aiyme (mentoring Asian American 8th graders)
Bhangra (traditional dance, practiced within a club at MIT)	pearl tea (popular drink among members of a **sorority**)
neurosci (appears to be the journal Neuroscience)	clarpic (section of marching band)
Phi Sigma Kappa (**fraternity**)	KDPhi **(Sorority**)
PBE (**fraternity**)	technology systems (computer networking services)
Chi Phi (**fraternity**)	UCAA (Undergraduate Asian American Association)
Alpha Chi Omega (**sorority**)	infectious diseases (research interest)
Stuyvesant High School	viruses (research interest)
Russian House (**living group**)	home church (Religious phrase)


Club Nexus - Get Connected! -
File Edit View Favorites Tools Help
Back Search Favorites History
Address http://clubnexus.stanford.edu/
ClubNexus
revolutionizing stanford community
username:
password:
forgot password?
login
Welcome to Club Nexus!
tour
sign up!
home
directory
nexus.net
nexus.mail
events
forum
get.real
my.profile
welcome
Welcome to Club Nexus! The largest online community of Stanford students with over 2,200 members.
who do you know!
Internet

ClubNexus
define yourself
blog search buddylist help logout
profile
buddy list
buddy groups
settings
home
directory
nexus.net
nexus.mail
events
forum
get.real
media
my.profile
Your Buddy List forms the backbone of the Club Nexus system. From your list of friends, the system will construct your social network – a required step to enjoy any usage of Club Nexus.
add buddy
first name:
last name:
email:
add
Use Buddy Finder for easy one-click adding to your buddy list. Find friends from a database of over 21,400 Stanford students and faculty!
buddy finder
find
value:
search by:
first name
last name
sort by last
buddy list
name
username
email
Dragomir Anguelov drago drago@stanford.edu edit
Jian Silverstein jians liu@psych.stanford.edu edit
Orkut Buyukkokten orkut orkut@stanford.edu edit
Sergio Marti sergio smarti@stanford.edu edit
TJ Giuli tj giuli@stanford.edu edit
Wendy Morris wendy wendymorris@stanfordalumni.org edit
Internet

Major and personality

personality (% of total)	**major**
free time: learning (17%)	Physics (46%), Philosophy (37%), Math (31%), EE (26%), CS (24%)
free time: reading (26%)	English (55%)
free time: staying at home (8%)	History (24%)
free time: doing anything exciting (52%)	undecided/undeclared (62%)
you: weird (12%)	Physics (34%), Math (28%), EE (18%)
you: intelligent (32%)	Philosophy (59%), CS (42%)
you: successful (4%)	CS (7%)
you: attractive (16%)	Political Science (29%), International Relations (25%)
you: lovable (12%)	Political Science (24%)
you: kind (25%)	Public Policy (45%)
you: funny (25%)	Philosophy (6%)
you: creative (22%)	Product Design (62%), English (42%)
you: sexy (8%)	English (18%), EE (2%)

Adamic, Buyukkokten, Adar, First Monday, 2003

Nexus Karma

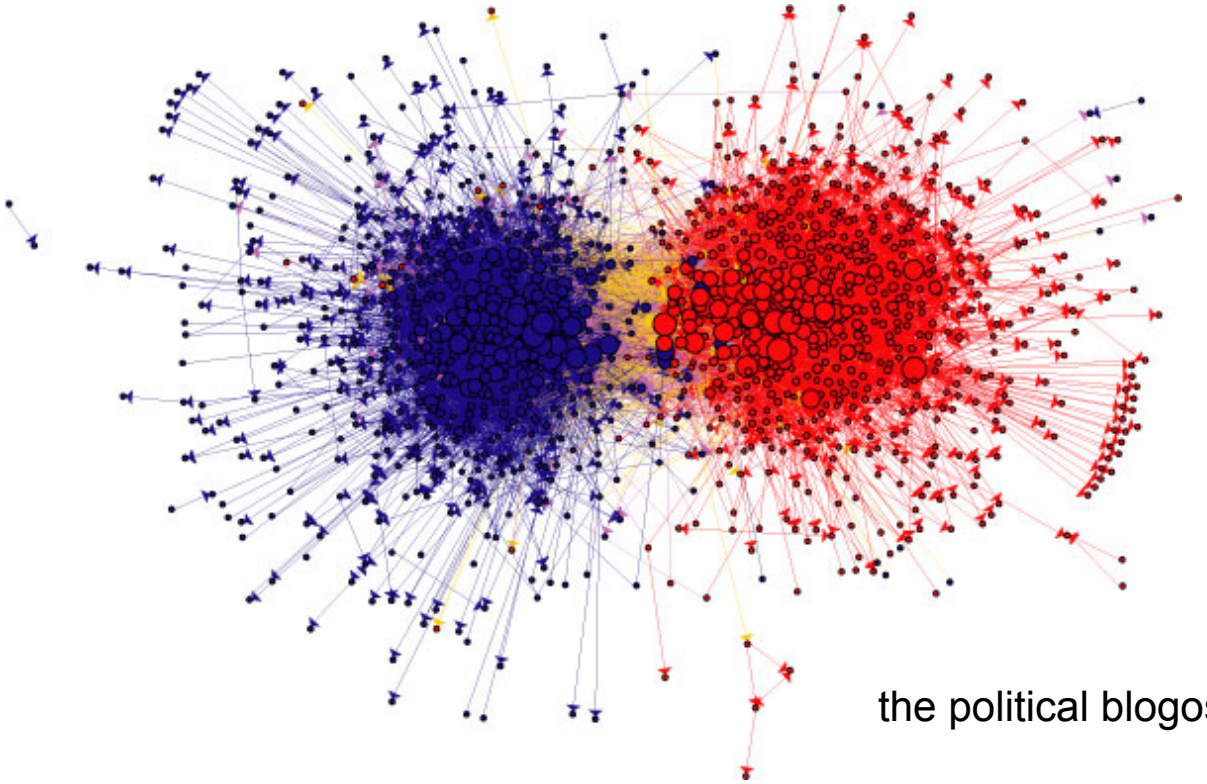
	trusty (3.22)	nice (3.37)	cool (3.13)	sexy (2.83)
responsible	↑ 3.36		↓ 3.02	↓ 2.67
sexy	↓ 3.10	↓ 3.23		↑ 3.03
attractive	↓ 3.09	↓ 3.25		↑ 2.93
kind	↑ 3.34	↑ 3.46		
friendly		↑ 3.44		
weird				↓ 2.67
funny		↓ 3.31		

Rank how ‘trusty’, ‘nice’, ‘cool’, and ‘sexy’ your buddies are on a scale of 1 to 4

Interests and association ratios

	high association	low association
book	gay & lesbian, professional & technical, computers, teen, sex, sports	history, fiction & literature, outdoor & nature
movie genres	gay & lesbian, performing arts, religion, erotic & softcore, sports	drama, mystery, documentary, comedy
music genres	gospel, jungle, bluegrass/rural, heavy metal, trance	pop, classical, rock
land sport	lacrosse, field hockey, wrestling, cricket	tennis, martial arts, bicycling, racquetball
water sport	synchronized swimming, diving, crew	swimming, fishing windsurfing
social	raving, ballroom dancing, Latin dancing	partying, camping

Can we understand community dynamics?

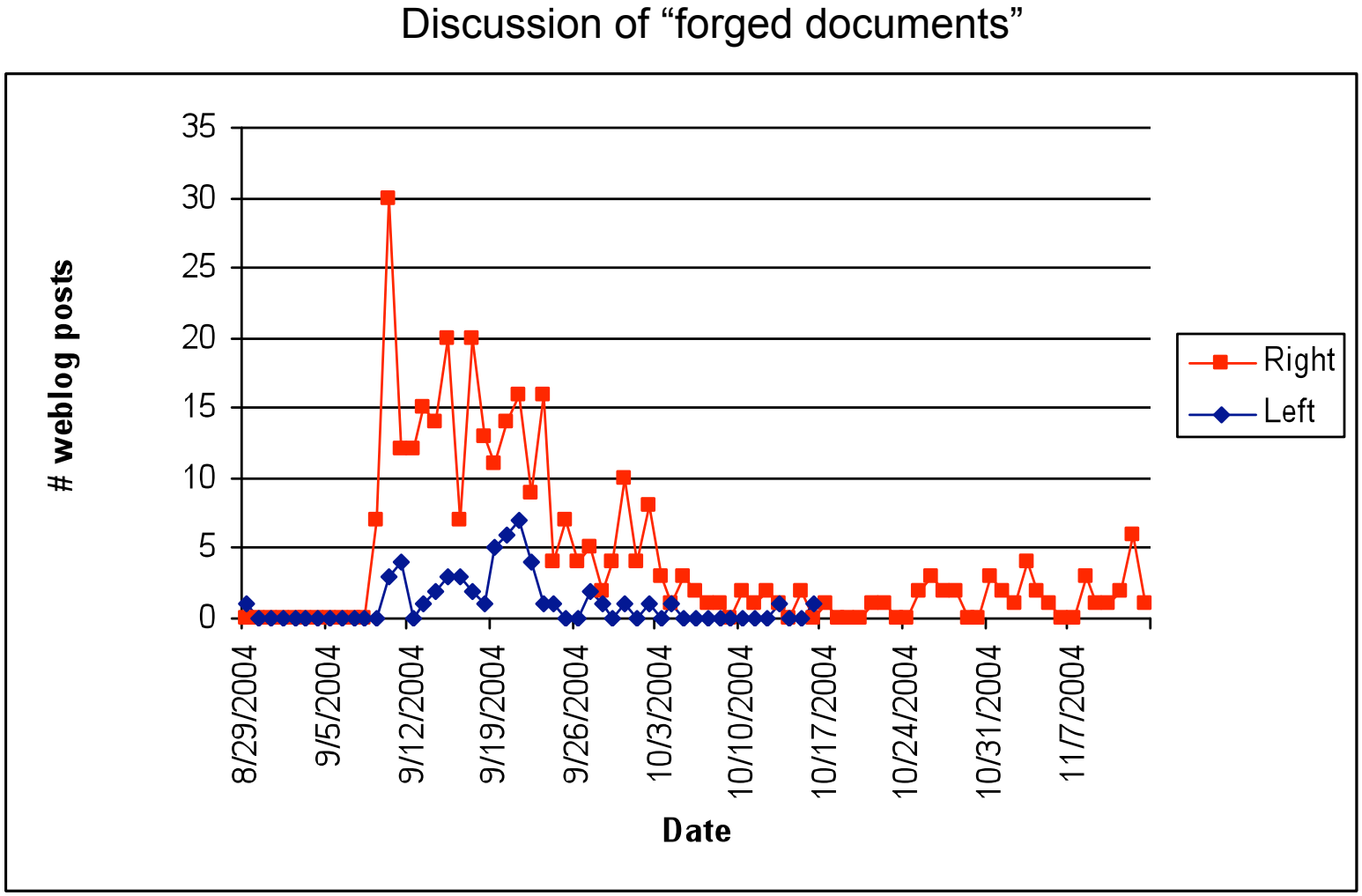


the political blogosphere, early 2005

- detecting polarization
- analyzing discourse

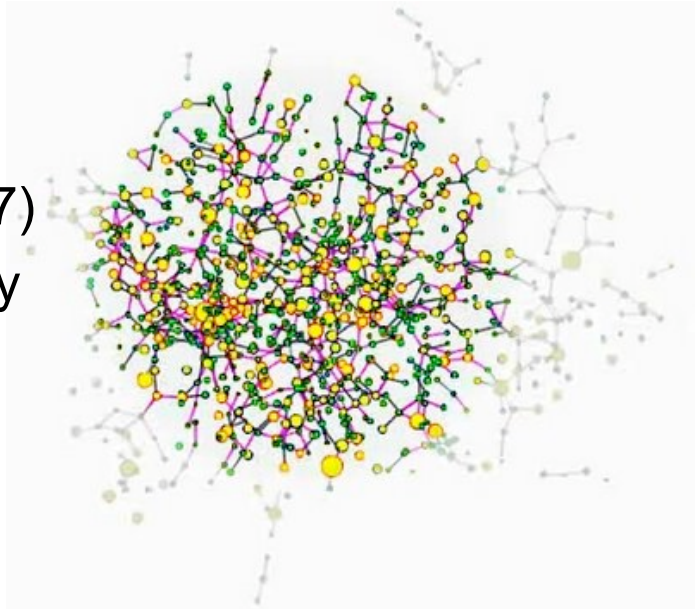
Adamic & Glance, LinkKDD 2005

Liberals and conservatives differ in the topics they discuss



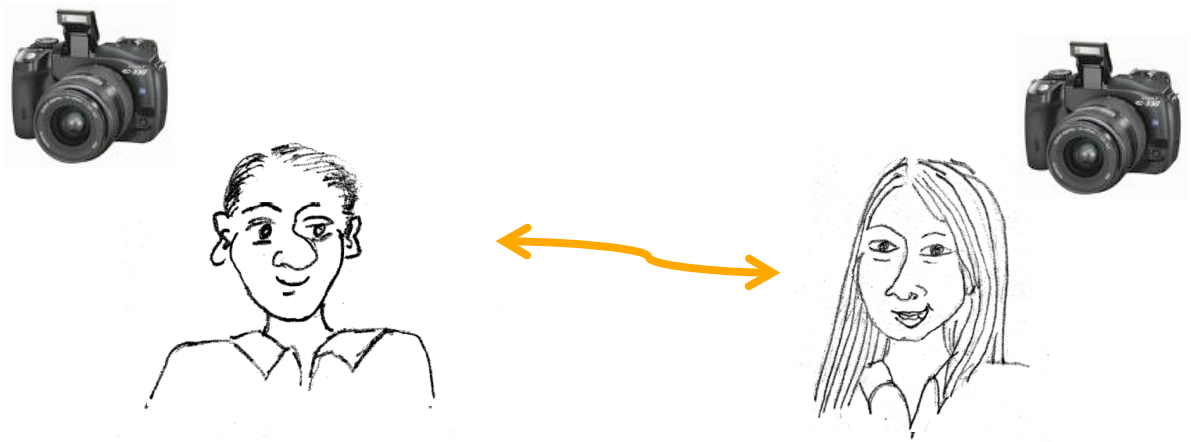
the social influence hyperlink

- Survey data:
  - Studies of innovation adoption
  - hybrid corn (Ryan and Gross, 1943)
  - prescription drugs (Coleman et al. 1957)
  - Christakis and Fowler (spread of obesity & happiness in social networks) 2008
- Online experiments
  - Salganik et al. 2006 (music)



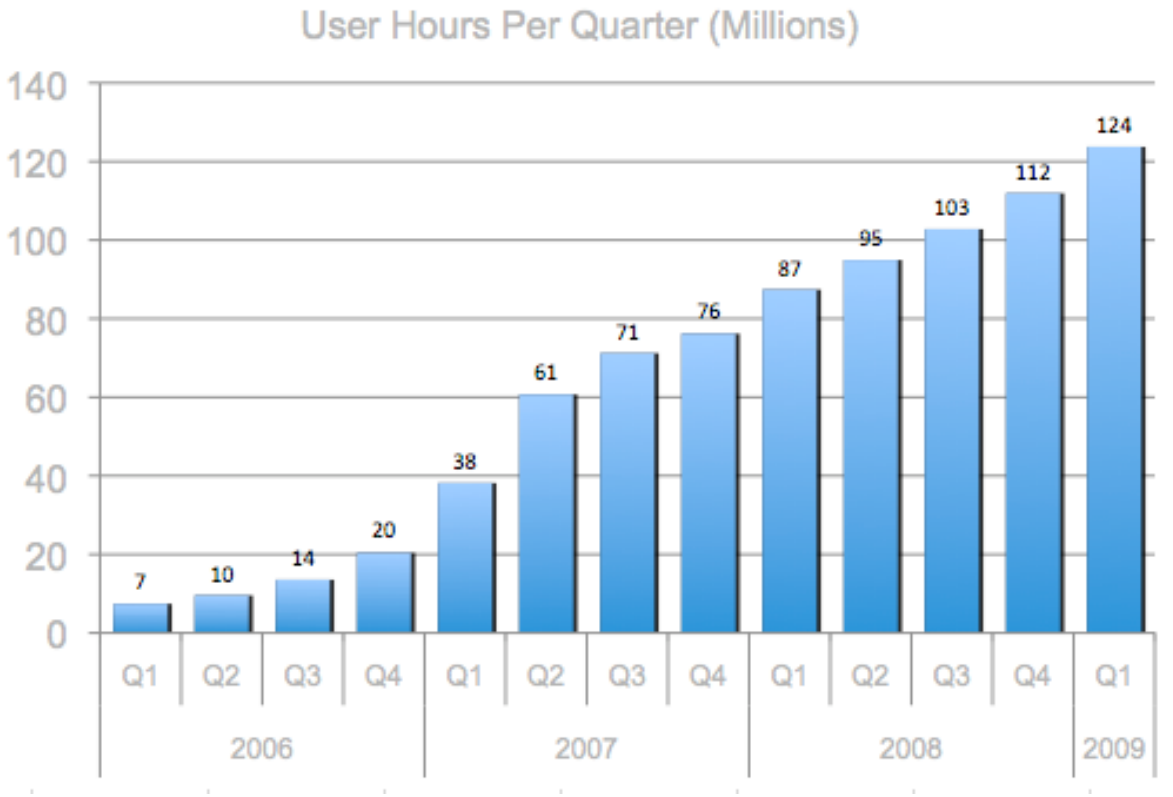
- Observational online data:
  - Lerman (spread of FlickR photos & Digg stories) 2007
  - Backstrom et al. (joining LiveJournal groups & CS conferences) 2006

social networks: influence or correlation?



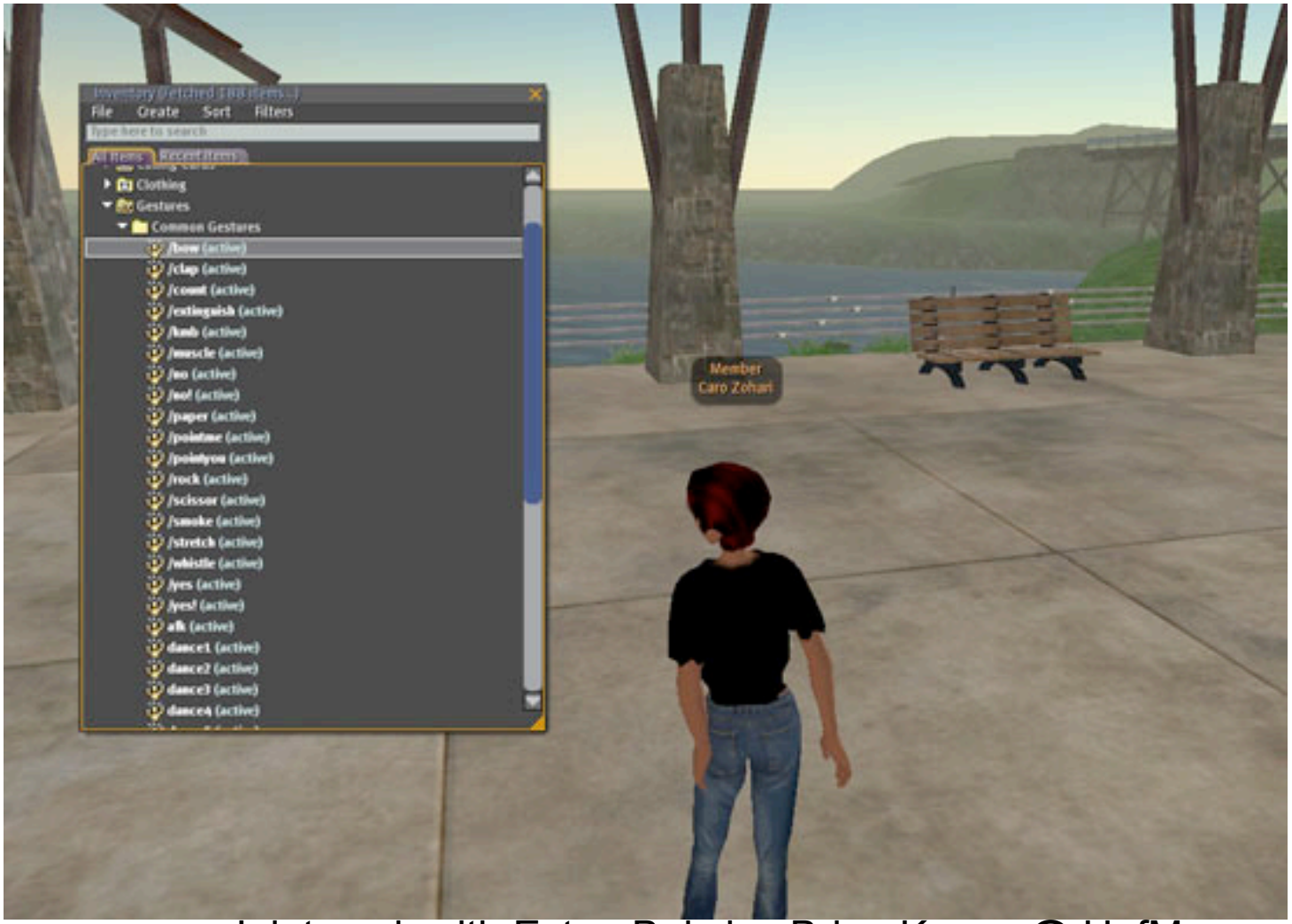
Why study second life?

- digital traces!
- content is user-created
- content is shared and traded



https://blogs.secondlife.com/community/features/blog/2009/04/16/the-second-life-economy--first-quarter-2009-in-detail

gestures in second life

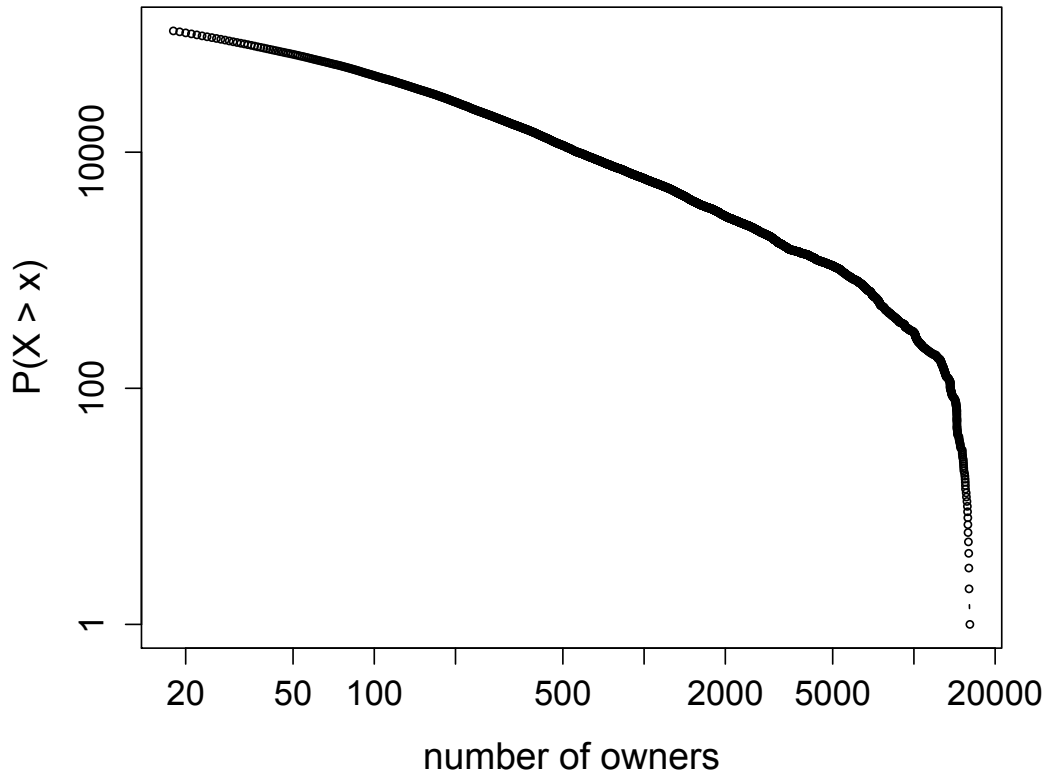


Joint work with Eytan Bakshy, Brian Karrer @ UofM

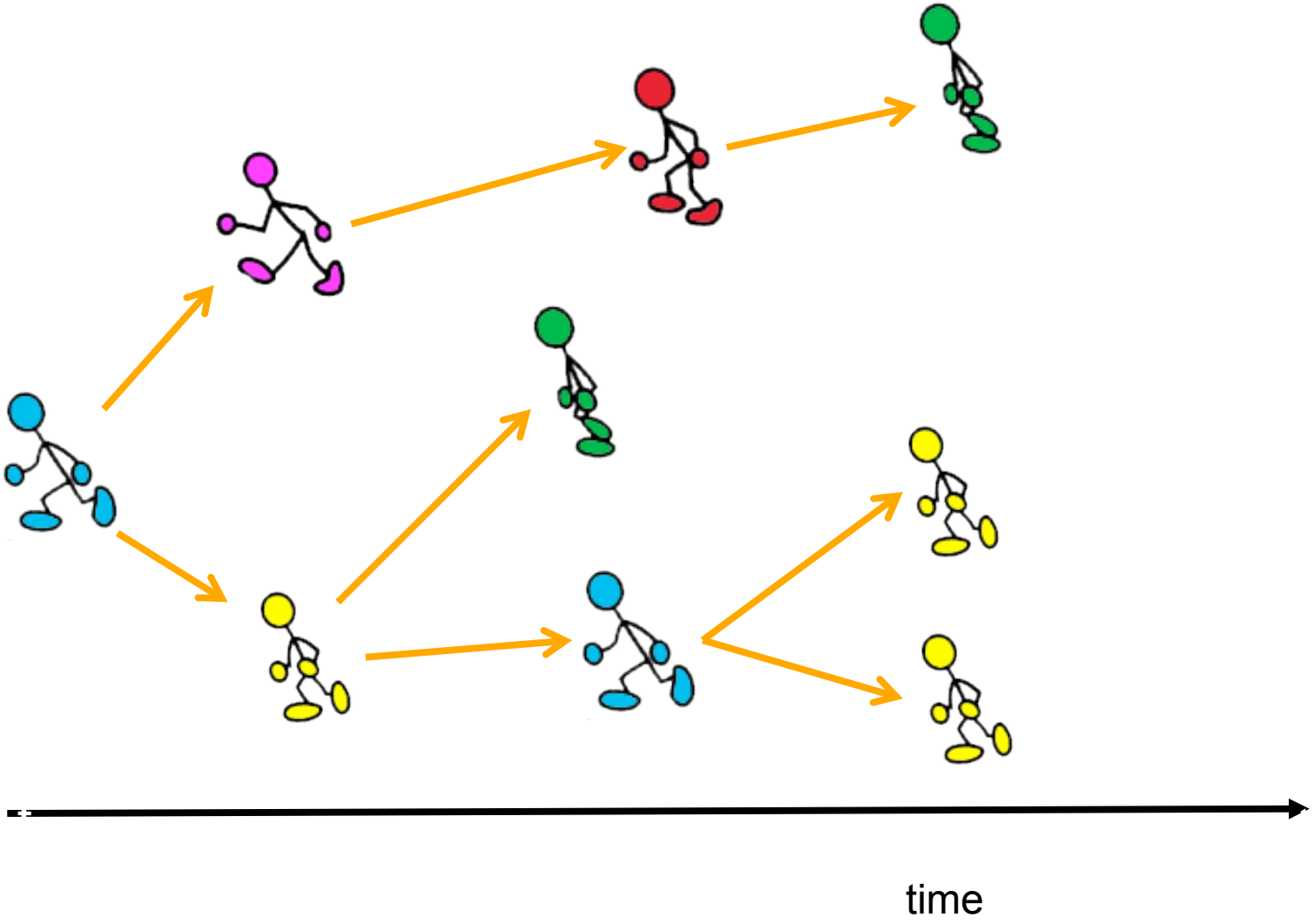
accepted at EC (Electronic Commerce Conference) ‘09

how does on discover content in the long tail?

(heavy tail: there are > 5 million different gestures)



How do gestures spread?

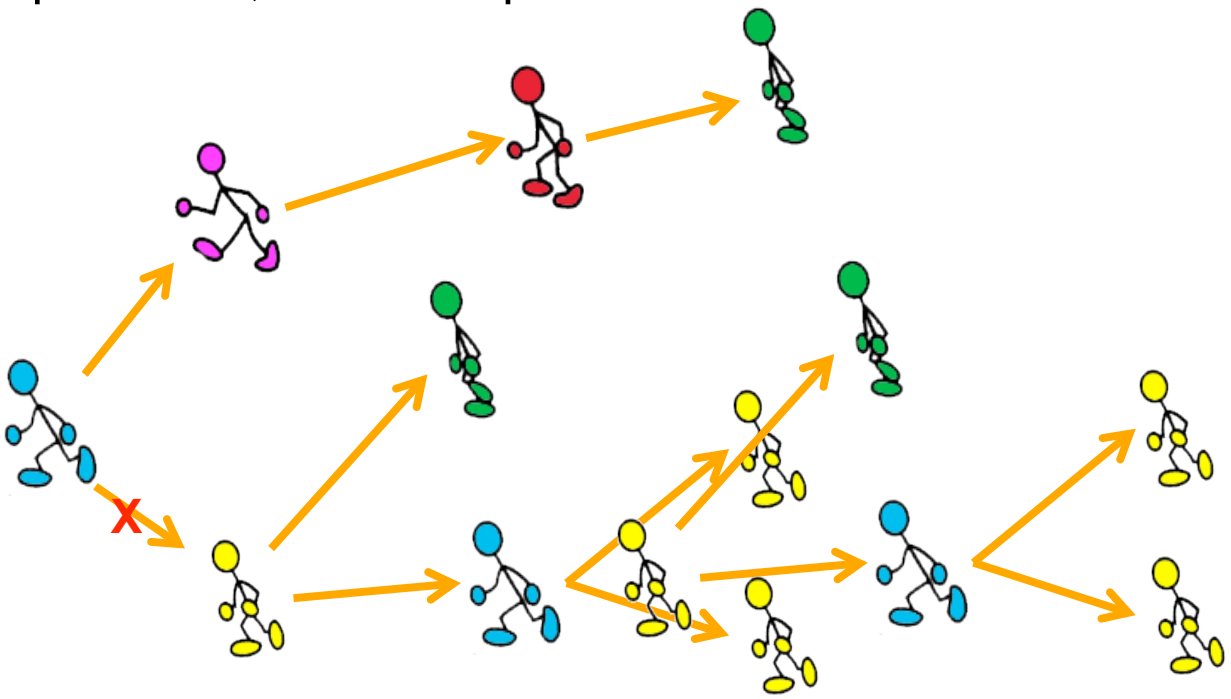


Dataset

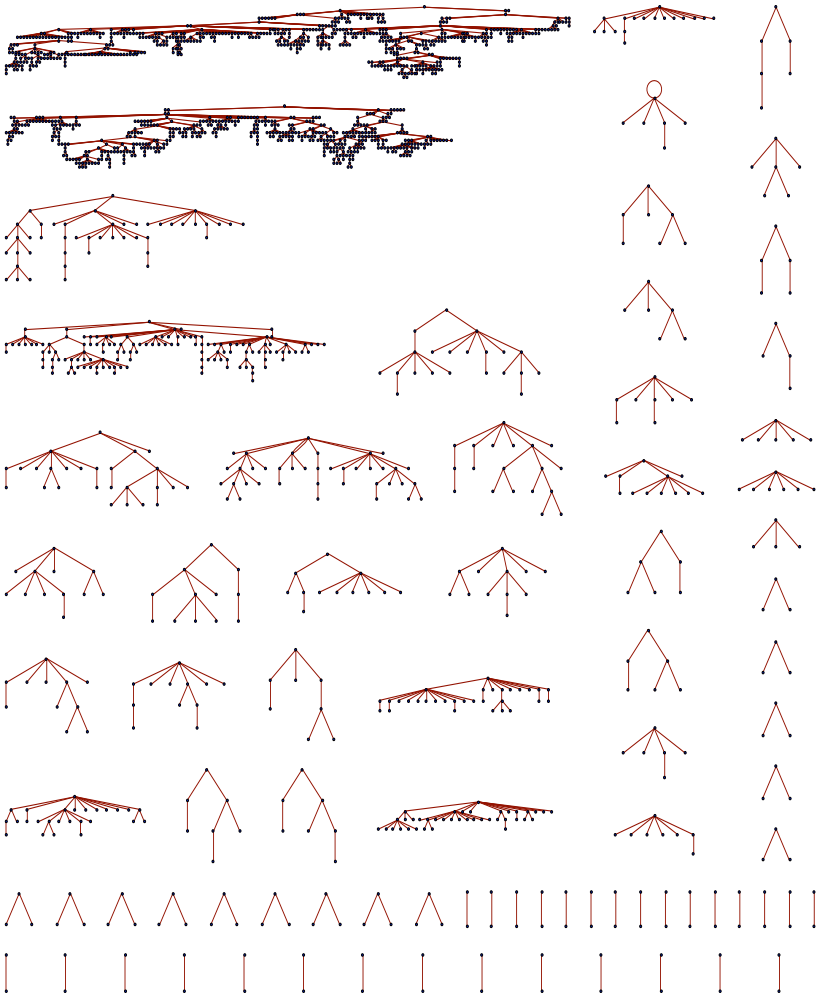
- gesture transfers 9/2008-1/2009
- 100,229 users who exchanged at least 1 object
- 106,499 assets with at least 16 unique owners & not distributed by Linden Lab

missing links

- 12.6 million asset transfers
- 3.4 million (23%) have accurate previous owner info
  - per asset, ~ 43% of previous owner info available

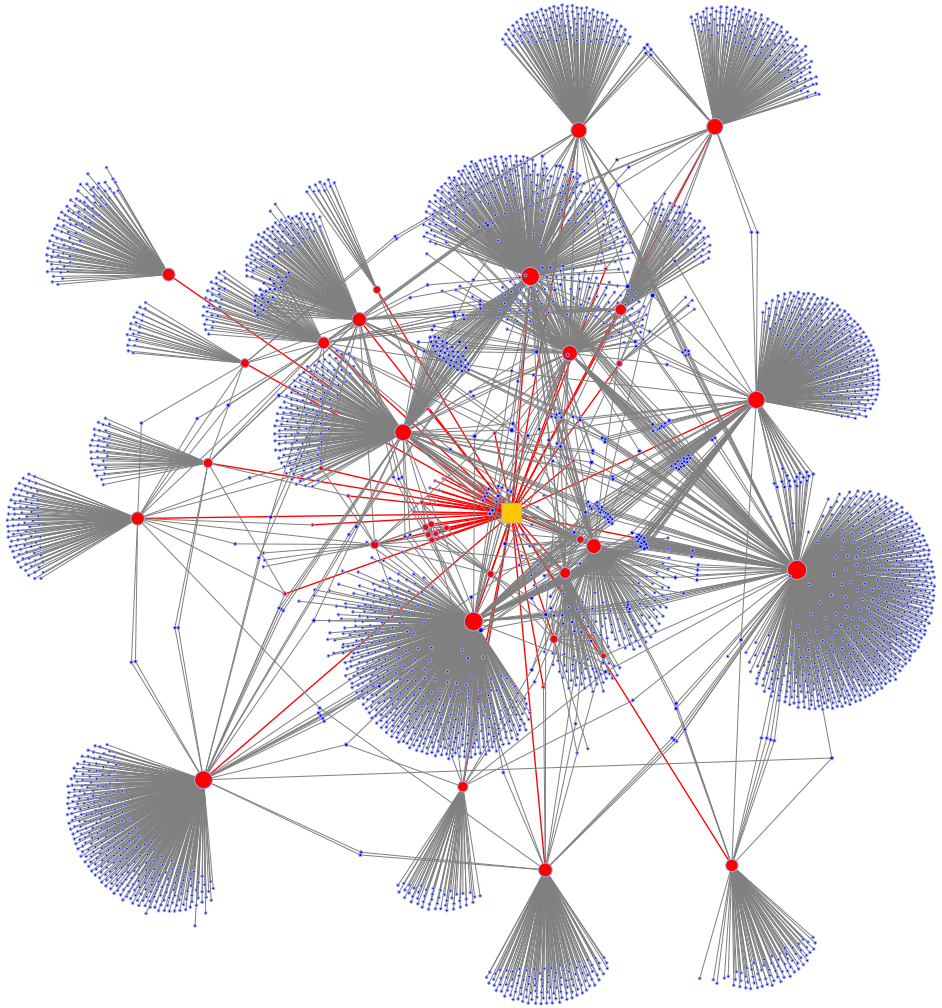


spread of an aerosmith gesture



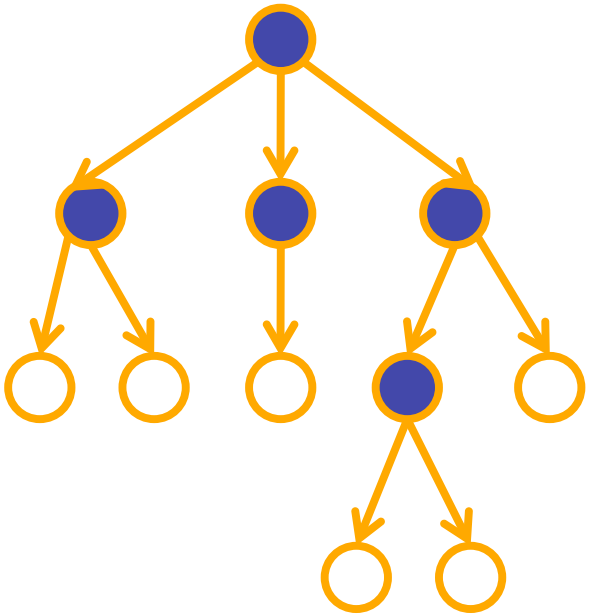
the role of the social network

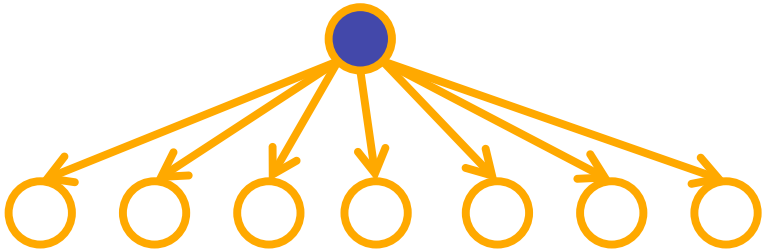
- weekly snapshots
- direct influence:
  - 48% of transfers occur between friends
- indirect influence:
  - of the remainder 38% occur after at least one friend has adopted



spread through the social network: boost or brake?

- cascades spreading through the social network are deeper (higher percentage of non-leaf nodes) (ρ = 0.42)



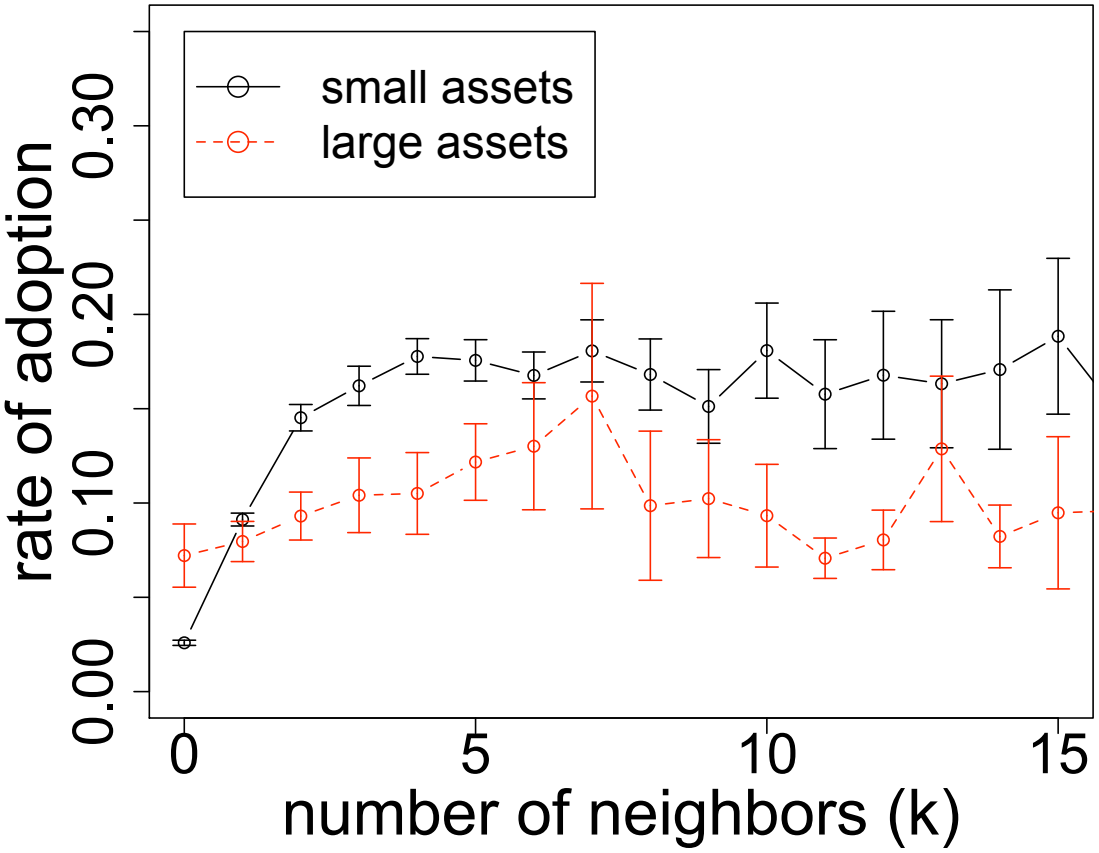


spread through the social network associated with limited reach

- observe adoptions over first 30 days of assets' existence
- predict adoptions over next 60

	model 1	model 2
log (initial adoptions)	0.508	0.476
% direct or indirect social		**-0.897**
R^2	0.164	0.196

new assets and eventual adopters

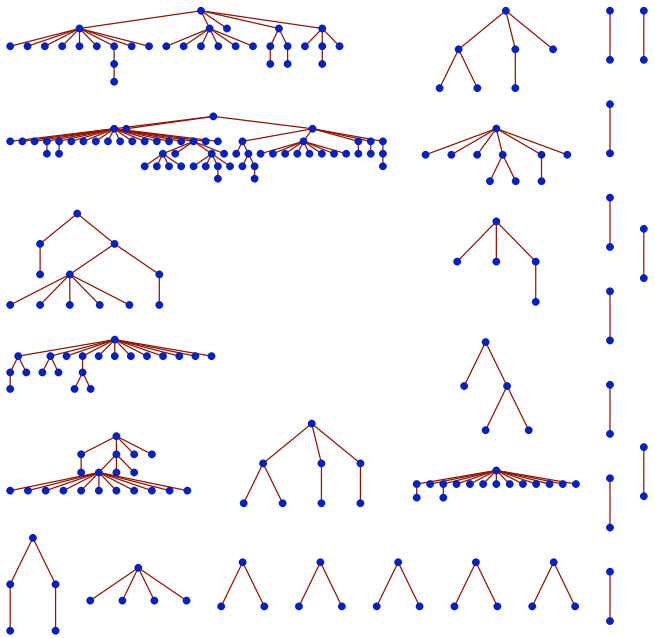


-> small difference in λ_0 accounts for large difference in asset size

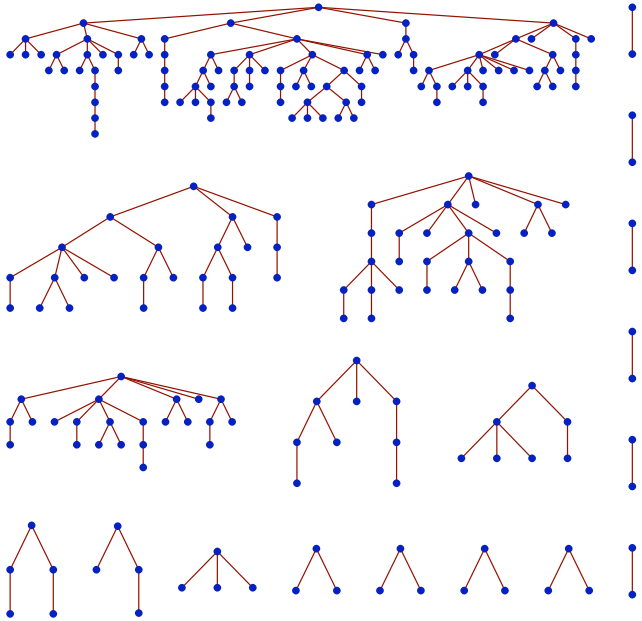
influencers (connectors?)

- heavy tailed distribution in number of times each user shares an asset
- users who have more friends share assets more often (ρ = 0.15)

actual vs. random cascade



actual



random

early adopters (mavens?)

- characterize ~800 users who have >=20 assets, but were among the first 5% to adopt each one
- compare to laggards (among the last 50% in adopting all their gestures)

what early adopters are not particularly

- early in joining Second Life (only 2 months older than laggards)

- gregarious (8 friends fewer on average out of ~ a mean of 60)

early adopters are not influencers…

- lower γ ($\rho = -0.015$, $p < 0.001$)
- number of transfers the user makes ($\rho = -0.02$, $p < 10^{-7}$)

  - Malcom Gladwell distinguished mavens from connectors in the ‘Tipping Point’

The social influence hyperlink: wrap up

- social network influences adoption
- niche items get a bigger boost
- some individuals more influential than others
- but early adopters not necessarily connectors

The knowledge exchange hyperlink

Developer Forums

Sun Forums

Google Groups

SOURCEFORGE.net

Taskcn 威客任务

多人完成,多个结果中挑最棒的

WikiAnswers The Q&A Community

Ask MetaFilter

querying the hive mind

PC ADVISOR

answerbag

YAHOO! ANSWERS

Baidu 知道

Knows

NAVER

지식iN 지식과 내가 함께 커가는 곳

Knowledge iN

LinkedIn Answers NEW!

illumio BETA

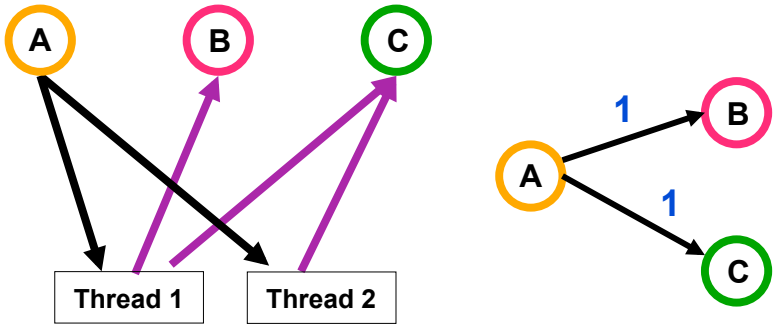
Related work

- Analysis of online communities
  - NetScan (Smith, Fisher, et al. at Microsoft)
  - Motivations of online participation (Lakhani & Hippel, Kraut)
- Expertise sharing studies
  - Expertise recommenders
    - ContactFinder (Krulwich et al.), Answer Garden (Ackerman)
    - Small Blue (Lin)
  - Automatic evaluation of expertise levels
    - Using different text resources (Kautz, et al, and a lot of others)
    - Using email networks (Campbell et al.)

Related work: Q&A sites

- Harper et al. how can one obtain good answers?
  - Harper et al. CHI 2008: paying for (Google) Answers lead to higher answer quality than not (Yahoo! Answers), but inconsistent with Chen et al…
  - Harper et al. CHI 2009: automatically identify question types, predict answer quality
- Agichtein et al.: Identifying good answers, facts, experts (CIKM2007, WSDM 2008, WWW 2008, SIGIR 2008, WWW2009..)
  - use text & link analysis, clicks, and community ratings

Constructing a community expertise network



Thread 1*:* Large Data, binary search or hashtable? *user A*

Re: Large... *user B*

Re: Large... *user C*

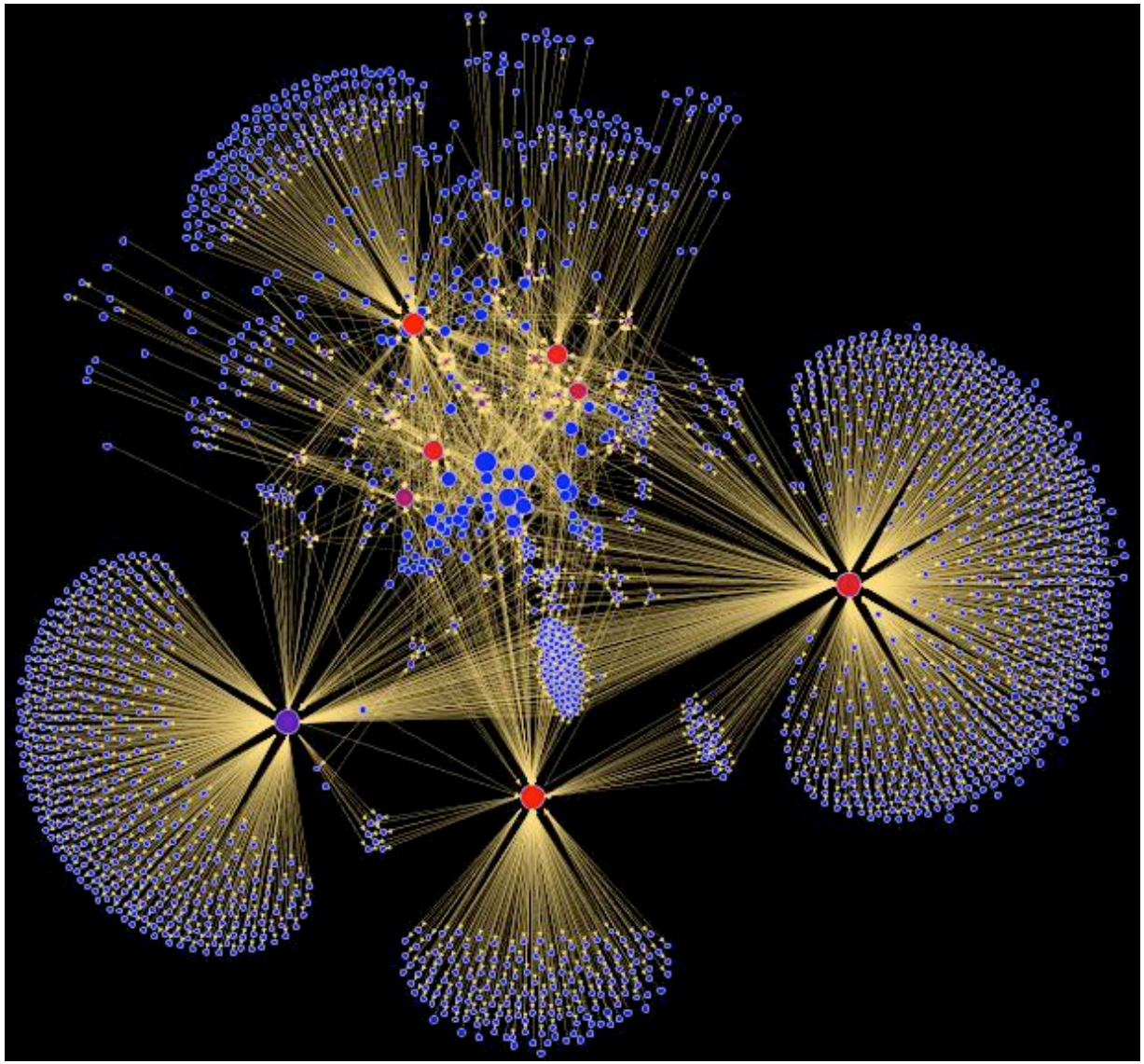
Thread 2*:* Binary file with ASCII data *user A*

Re: File with... *user C*

Java Forum

Zhang, Ackerman, Adamic WWW'07

fragment of the Java Forum

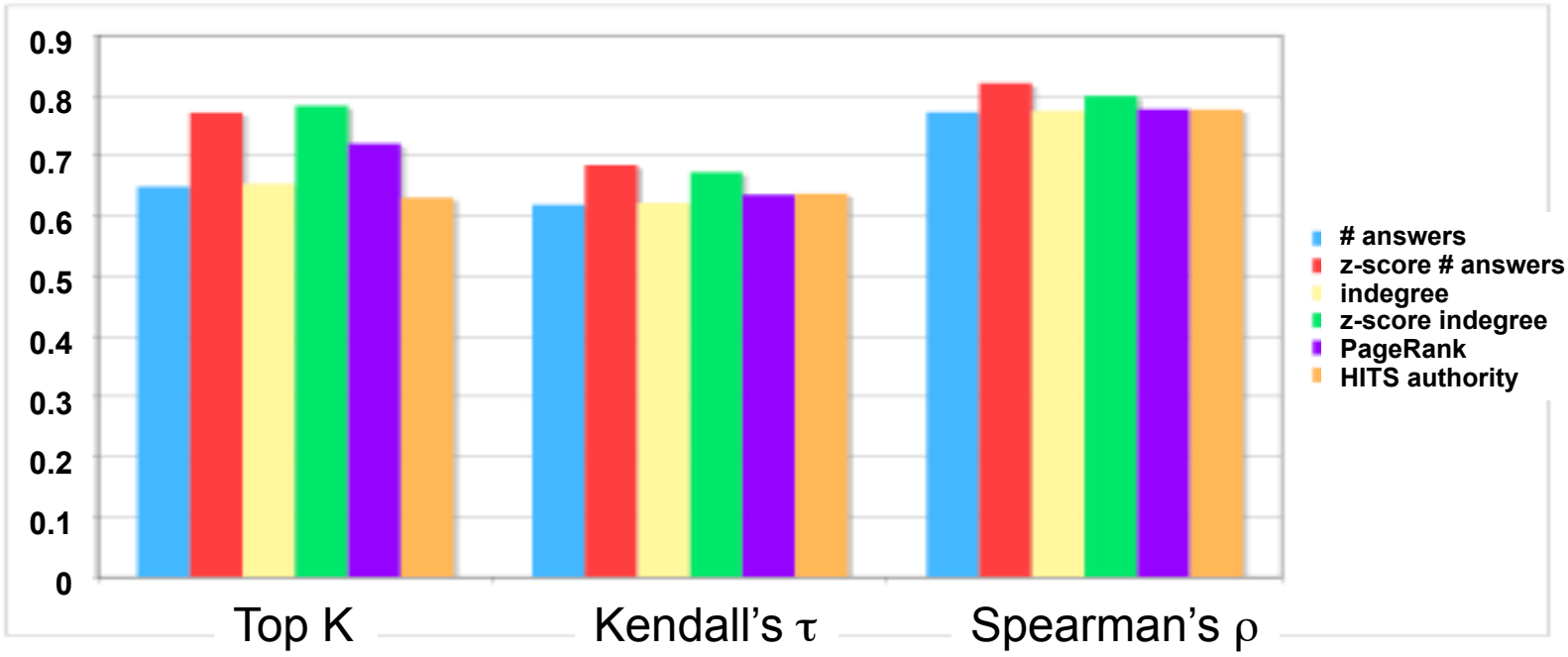


Relating network structure to Java expertise

- Human-rated expertise levels
  - 2 raters
  - 135 JavaForum users with >= 10 posts
  - inter-rater agreement (τ = 0.74, ρ = 0.83)
  - for evaluation of algorithms, omit users where raters disagreed by more than 1 level (τ = 0.80, ρ = 0.83)

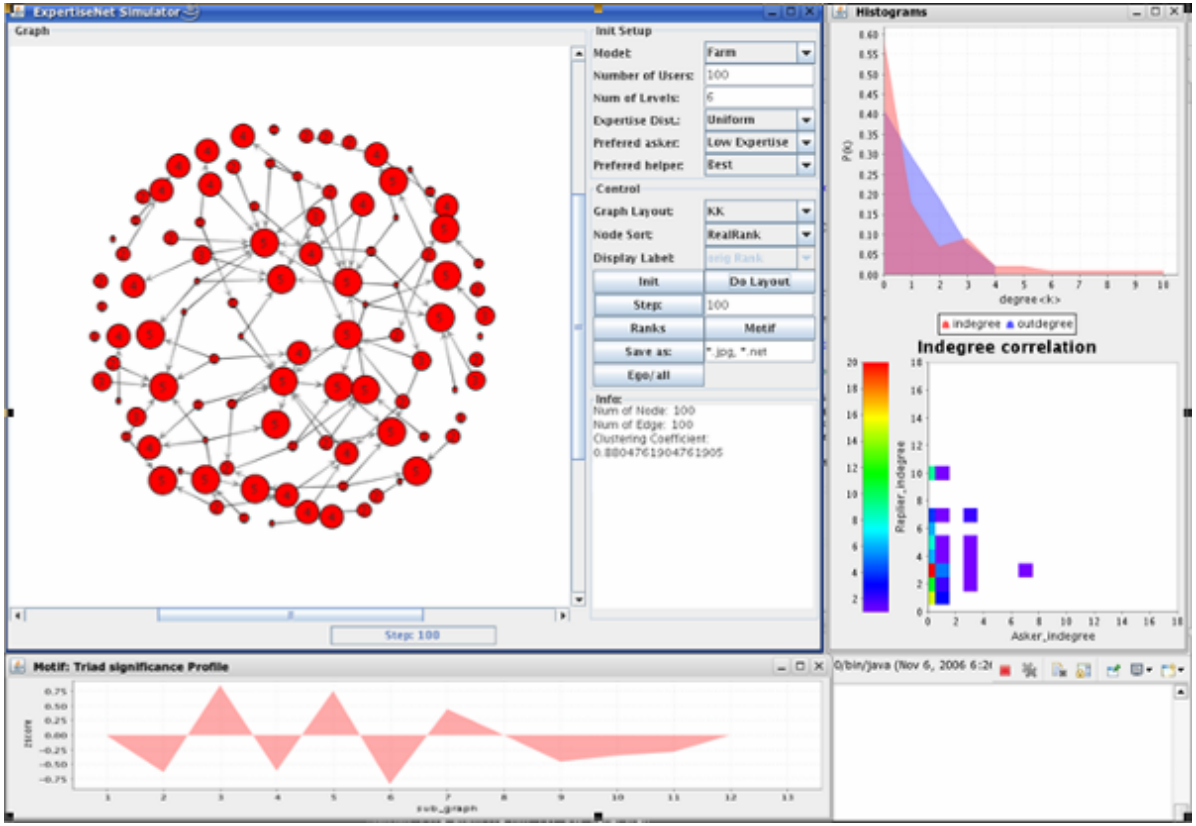
L	Category	Description
5	Top Java expert	Knows the core Java theory and related advanced topics deeply.
4	Java professional	Can answer all or most of Java concept questions. Also knows one or some sub topics very well,
3	Java user	Knows advanced Java concepts. Can program relatively well.
2	Java learner	Knows basic concepts and can program, but is not good at advanced topics of Java.
1	Newbie	Just starting to learn java.

Algorithm Rankings vs. Human Ratings



simple local measures do as well (and better) than measures incorporating the wider network topology

Modeling community structure to explain algorithm performance

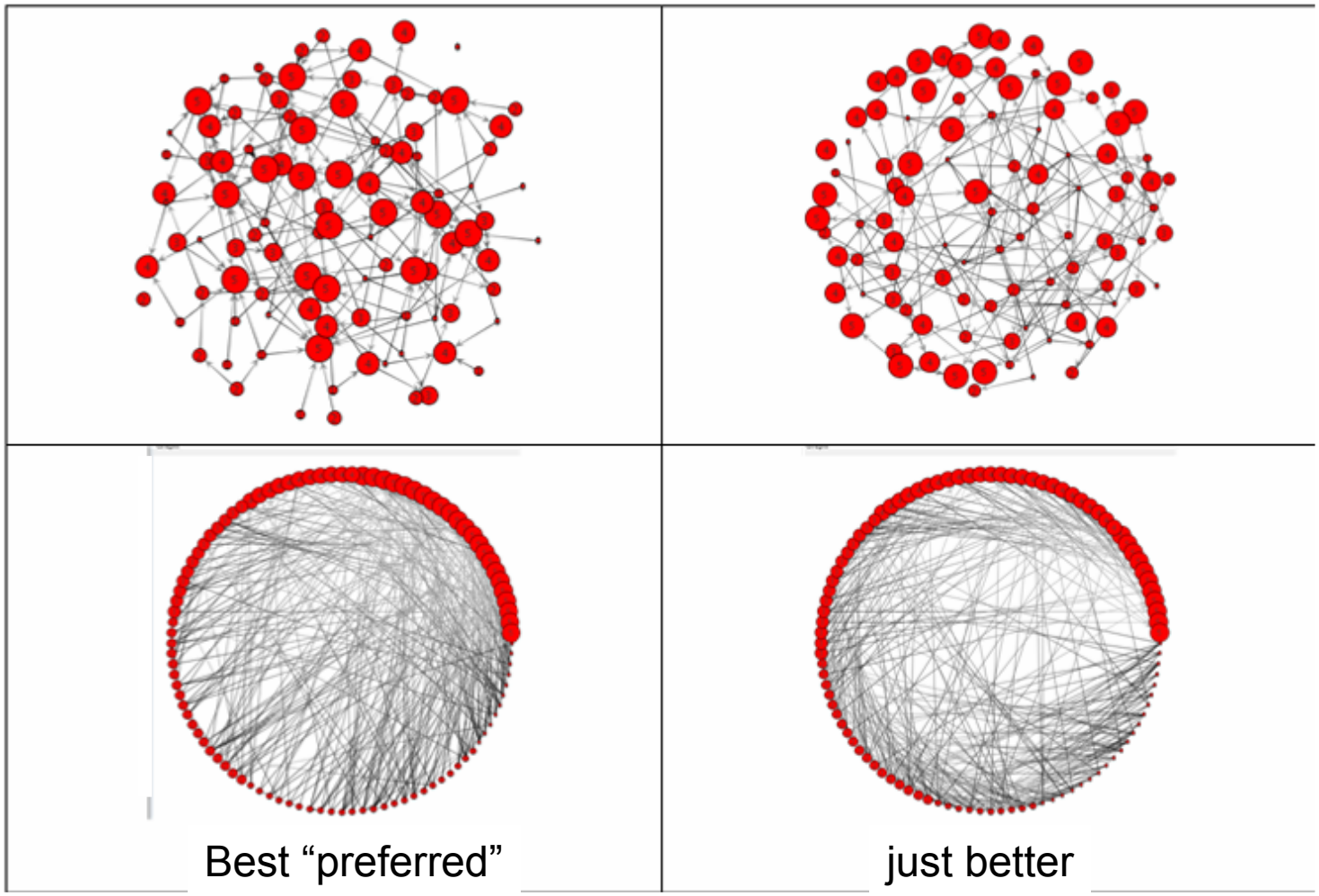


ExpertiseNet Simulator

Control Parameters:

- Distribution of expertise
- Who asks questions most often?
- Who answers questions most often?
  - best expert most likely
  - someone a bit more expert

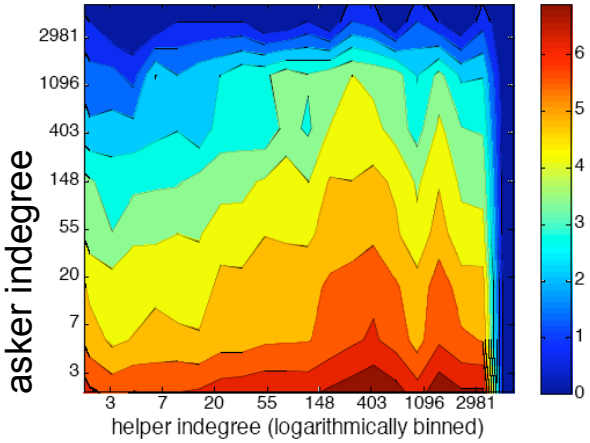
Visualization



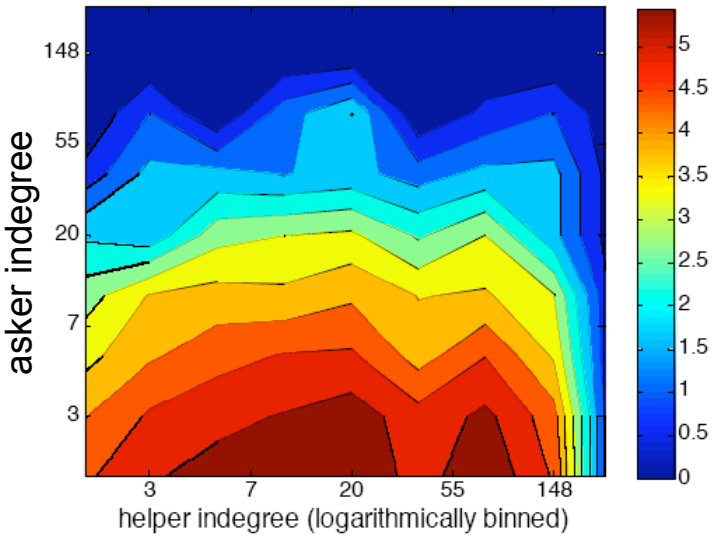
Best “preferred”

just better

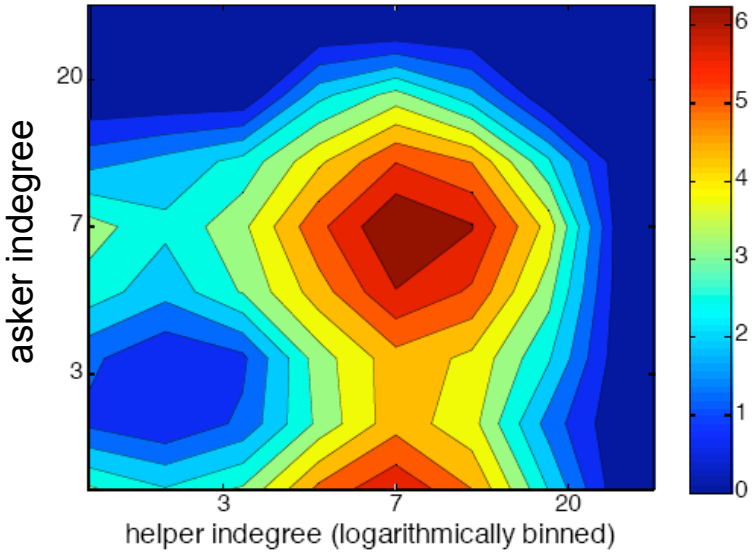
Degree correlation profiles



Java Forum Network

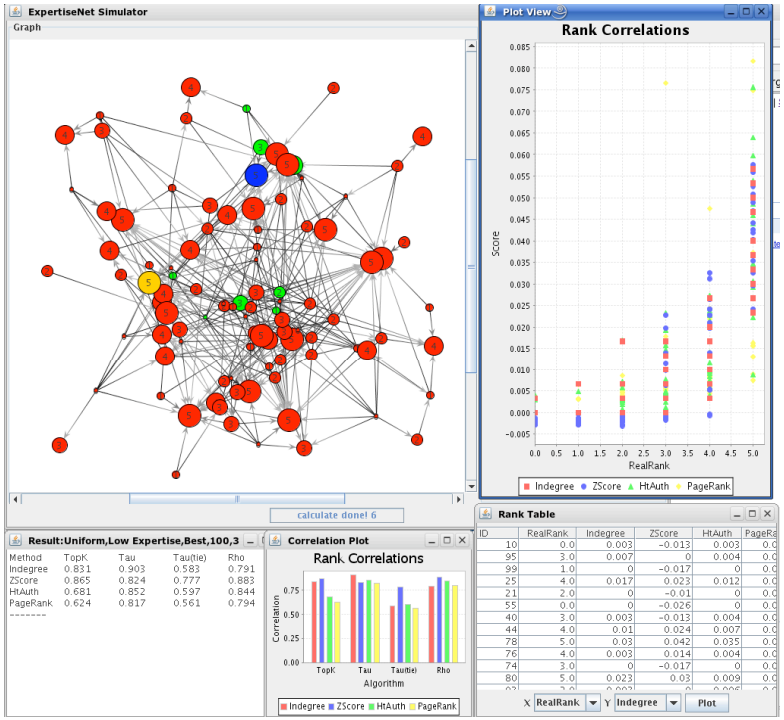


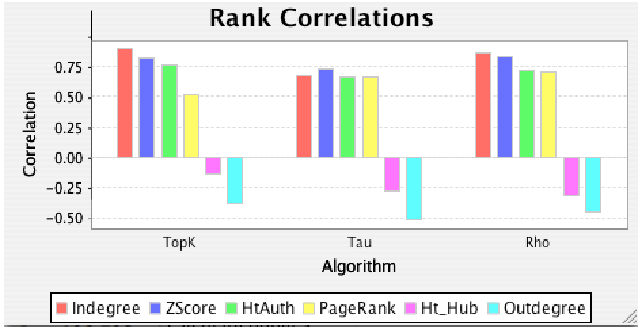
best preferred (simulation)



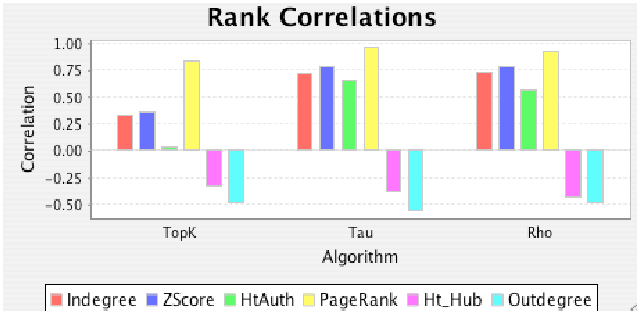
just better (simulation)

It can tell us when to use which algorithms



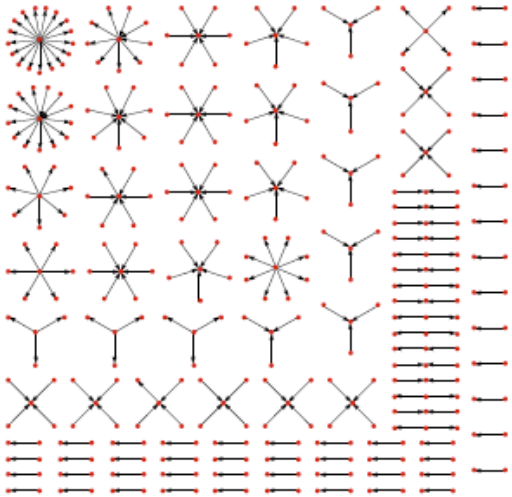


Preferred Helper: ‘best available’

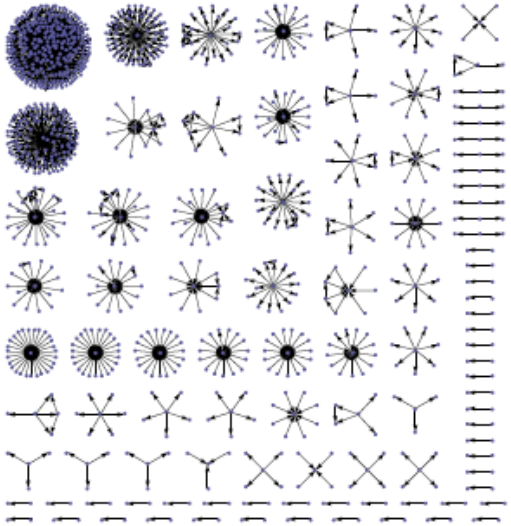


Preferred Helper: ‘just better’

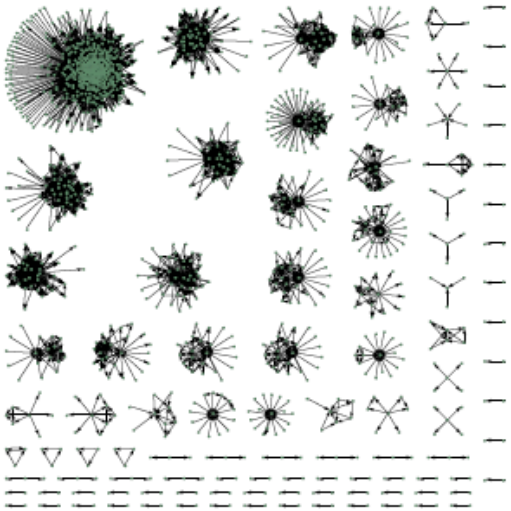
Knowledge sharing across topics: Y! Answers



(a) Programming



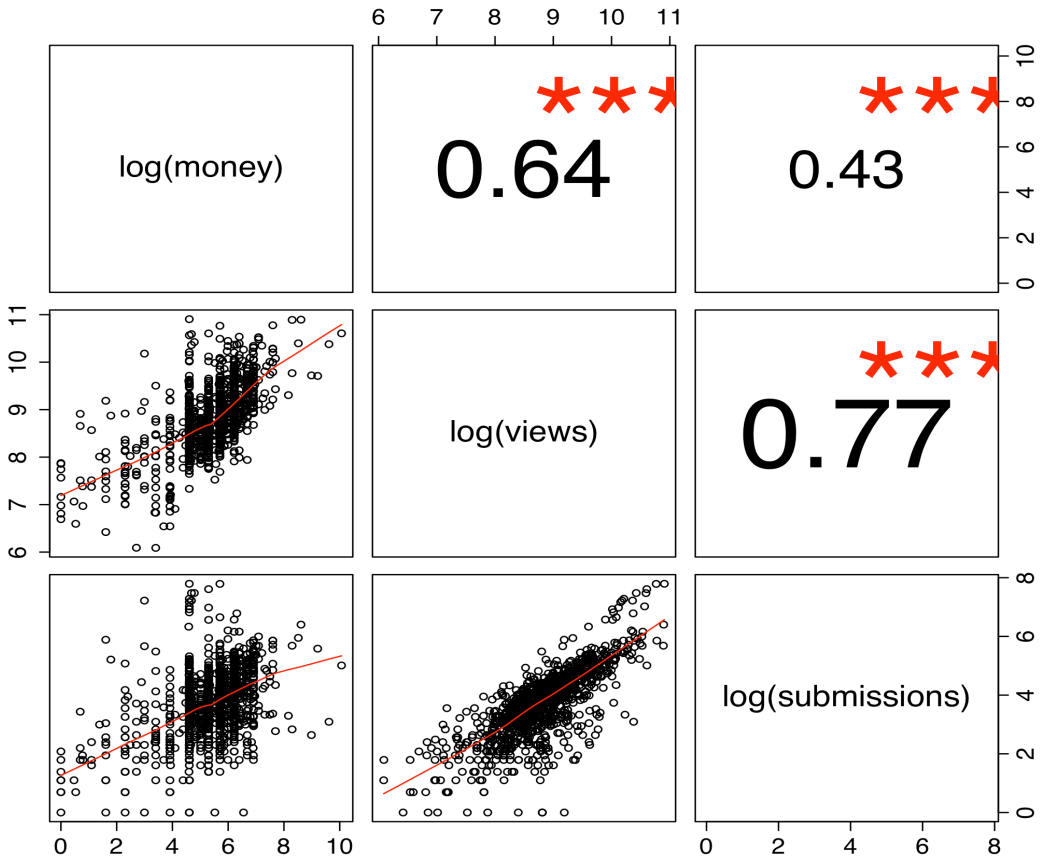
(b) Marriage



(c) Wrestling

Adamic, Zhang, Bakshy, Ackerman WWW'08

Does money matter?



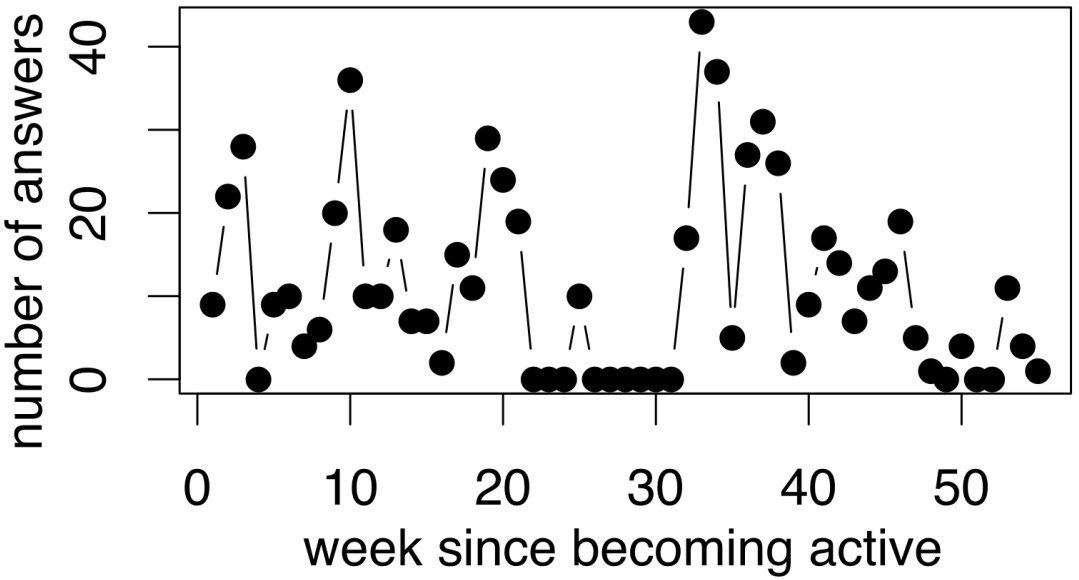
Taskcn 威客任务
多人完成,多个结果中挑最棒的

best answers are financially rewarded

Yang, Adamic, Ackerman EC'09

Is there a stable core of participants?

- even the most active users have intermittent activity
- intermittency negatively correlated with quality



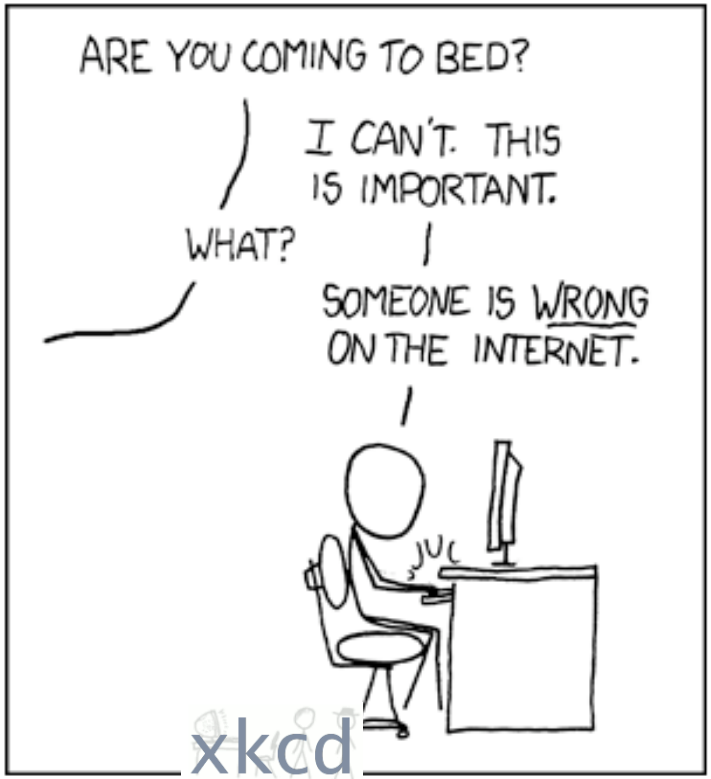
Nam, Ackerman, Adamic, CHI 2009

Why?

- What motivates users to answer hundreds to thousands of questions?
- From interviews of Naver (Korean Q&A site) participants
  - Altruism
  - Learning
  - Hobby
  - Business
  - Points

what to answer?

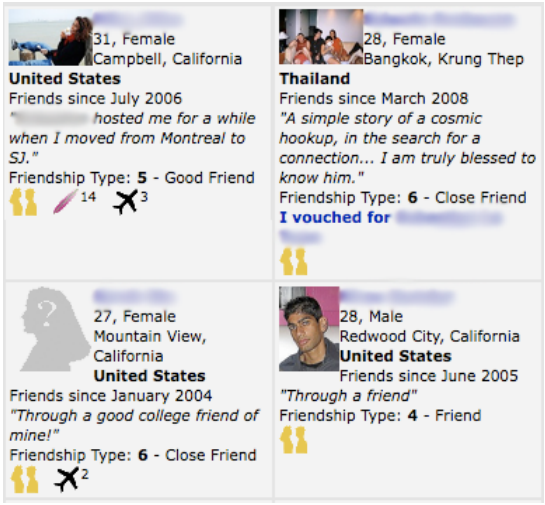
- filling in the blanks: users select unanswered questions
- correcting others: last answer picked as best most often



The knowledge sharing hyperlink

- hyperlinks in Q&A reflect information exchange between individuals
- they are keys to identifying expertise and experts

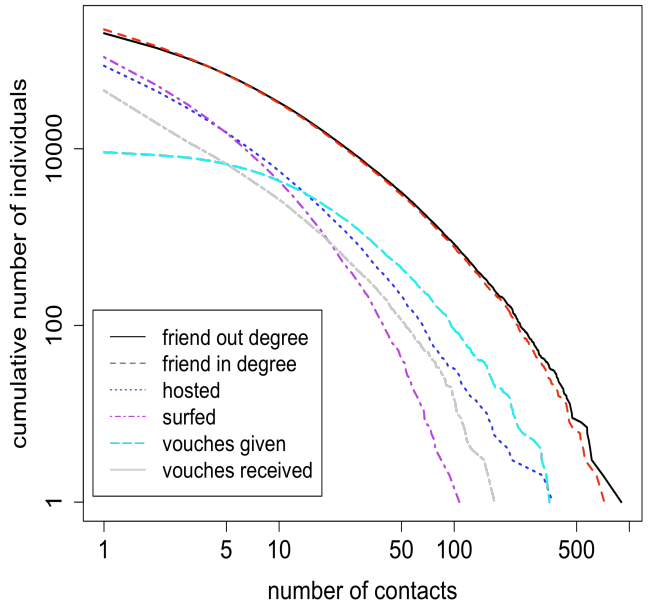
the trust hyperlink: whose couch would you sleep on?

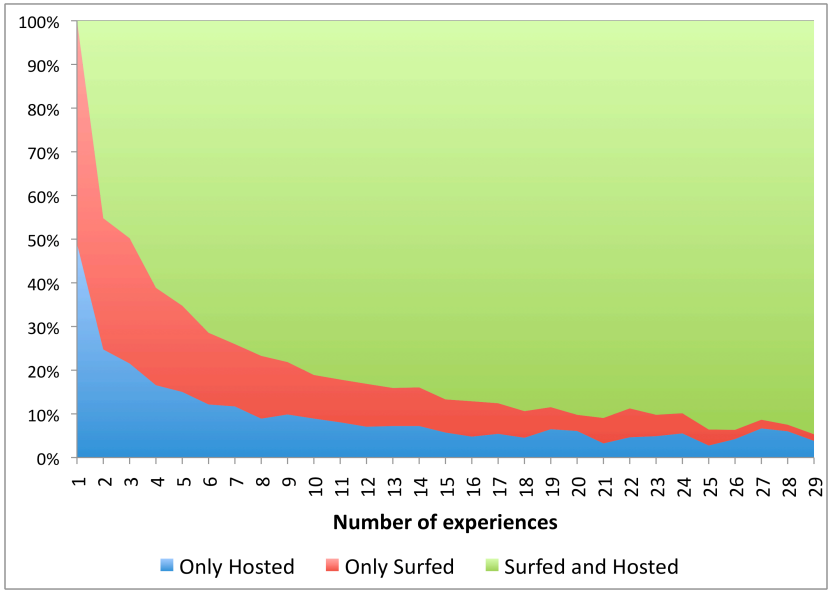


- Lauterbach et al., 'Surfing a web of trust, Reputation and Reciprocity on CouchSurfing.com', SIN 2009

the web of trust

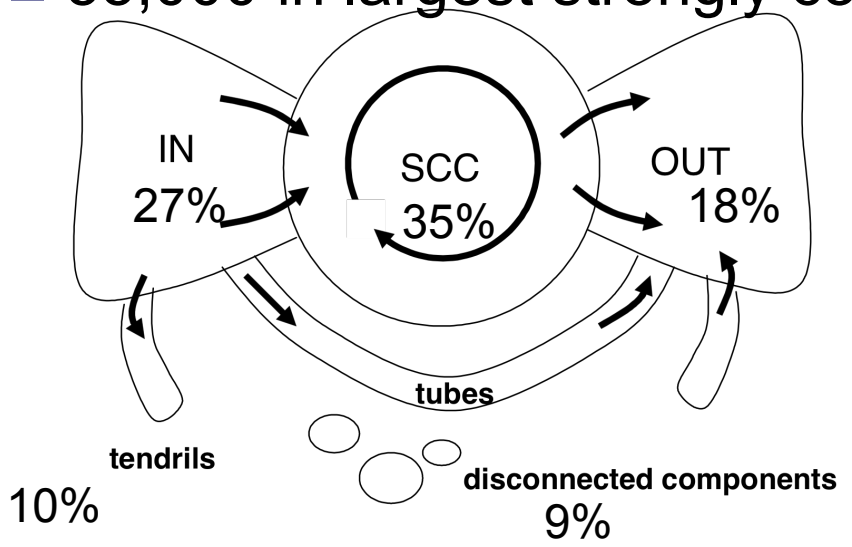
- 600,000 users, 156,000 surfed or hosted

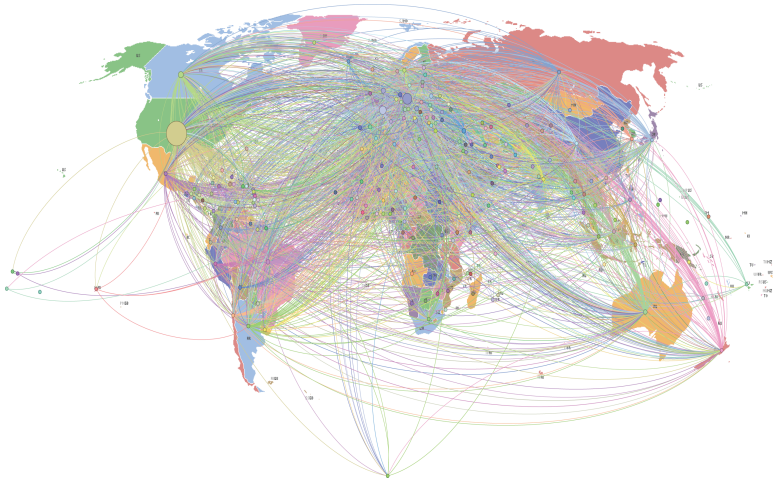




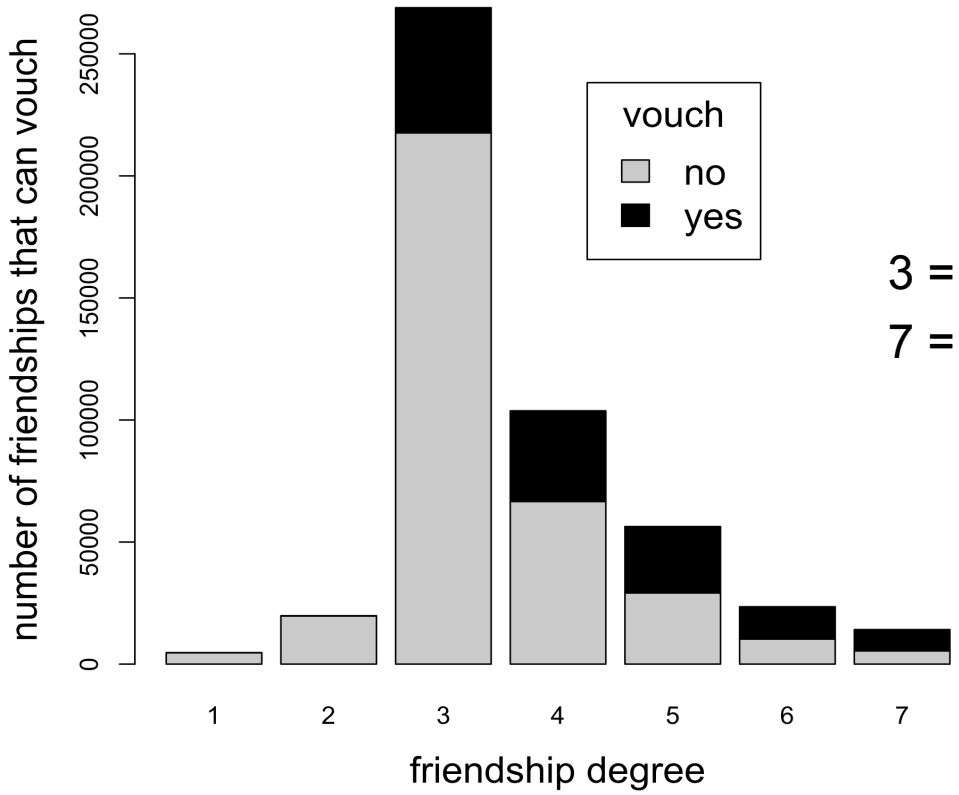
reciprocity and the web of trust

- direct reciprocity: 12-18%
- generalized reciprocity
  - 55,000 in largest strongly connected component





Can you trust web-based social hyperlinks?



3 = couch surfing friend

7 = best friend

Conclusion

- Social hyperlinks permeate the web
- Contribute to understanding of social phenomena
  - homophily
  - information diffusion
  - social influence
  - knowledge exchange
  - trust & reciprocity
- **more info: http://www-personal.umich.edu/~ladamic**