understanding social dynamics

techniques & applications

Interaction & behavior in Massively Multiplayer Online Games

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Social Computing @ QCRI

- 21 people
  - 13 scientists
  - 4 engineers
  - 1 post doc
  - 3 interns

- Representing 13 nationalities
  - Algeria, Bulgaria, Chile, Germany, India, Iran, Korea, Pakistan, Qatar, Spain, Switzerland, Turkey, USA

Focus areas for Social Computing @ QC

Computational Social Science
Analyze the social fabric, integration and tension in multi-cultural, multi-ethnic, multi-lingual societies with a focus on preserving cultural identity and local languages.

Social and Behavioral Aspects of Health & Wellness
Combine data from sensors, surveys and social media to implement culturally-aware interventions to reduce obesity and other health problems.

Social Media and News Analytics
Study the interplay between social media news and traditional news, to contextualize stories, to relate them to the reader, and to predict news consumption.

Social and Behavioral Aspects of Urban Mobility
Combining social data with transportation sensor data to better understand congestion, incidents, response, and customer engagement

Social Computing for Crisis Response
Support emergency response by extracting timely and credible information from social media and other sources, applying machine intelligence and human intelligence.

Prototypes and Tools
- Develop industry-strength prototypes and tools.
- Partner with key stakeholders to involve them in the participative design and deployment of these tools.

Commercialization
- Licensing
- Spin-offs

Research

Development

Slide 3

1 Move Social Start-ups to new slide.

Expand Prototype and Tools to include research/science, platforms, operations, infrastructure, services, (actual, social) experiments, ... What we do.

Potentially add likely time scales.

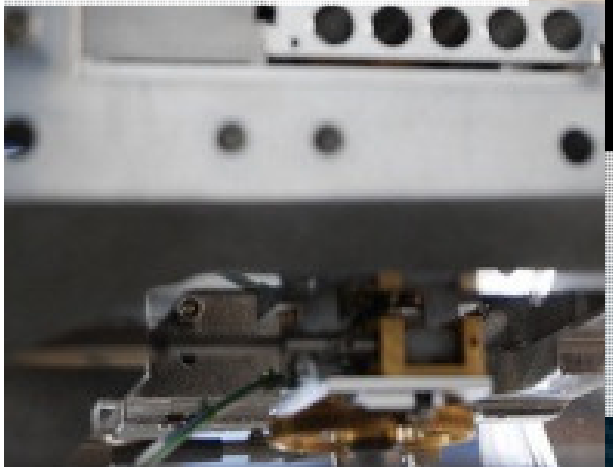
Left column defines the problem space. Things have to fit there. What we do our work for. Why we do something.

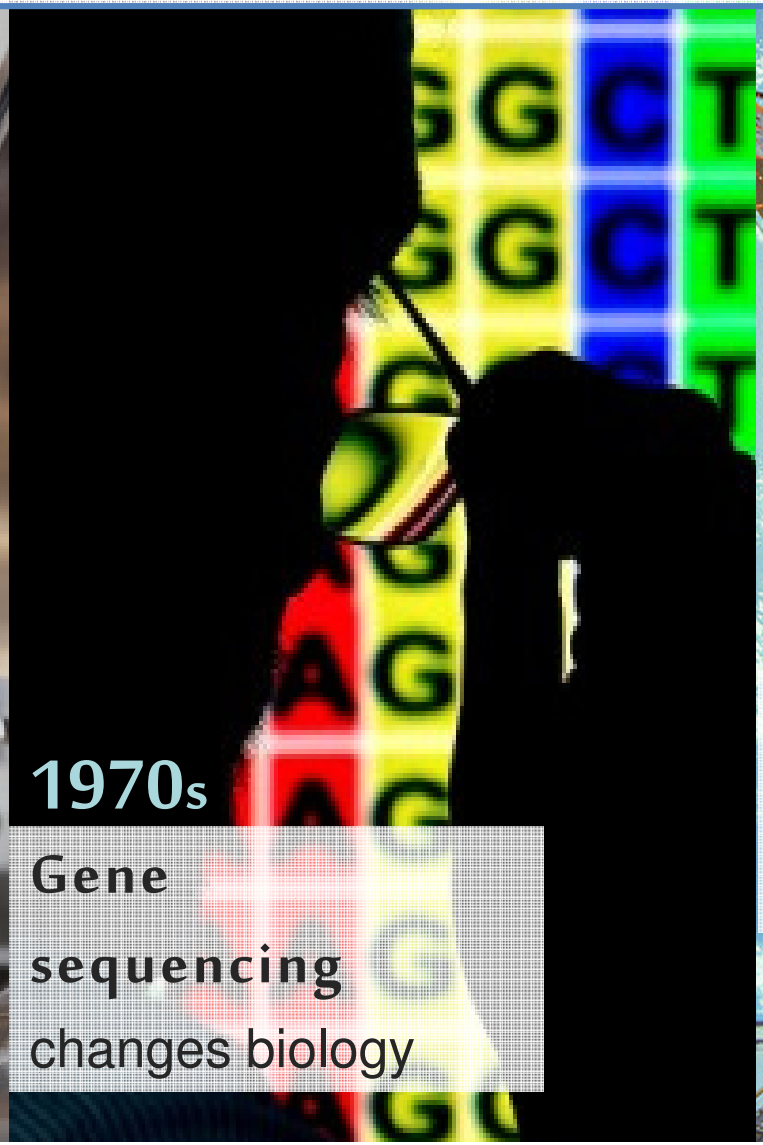
expertise skills needed, how, capacities,
Ingmar Weber,

Radically new instrumentation

1950s

Electron microscope
changes chemistry





1970s

Gene sequencing
changes biology

1980s

Hubble telescope
changes astrophysics

Radically new instrumentation

today

Social networks

change how we study human behavior and interaction

Massively multiplayer online games (mmog)

World of Warcraft

EverQuest II

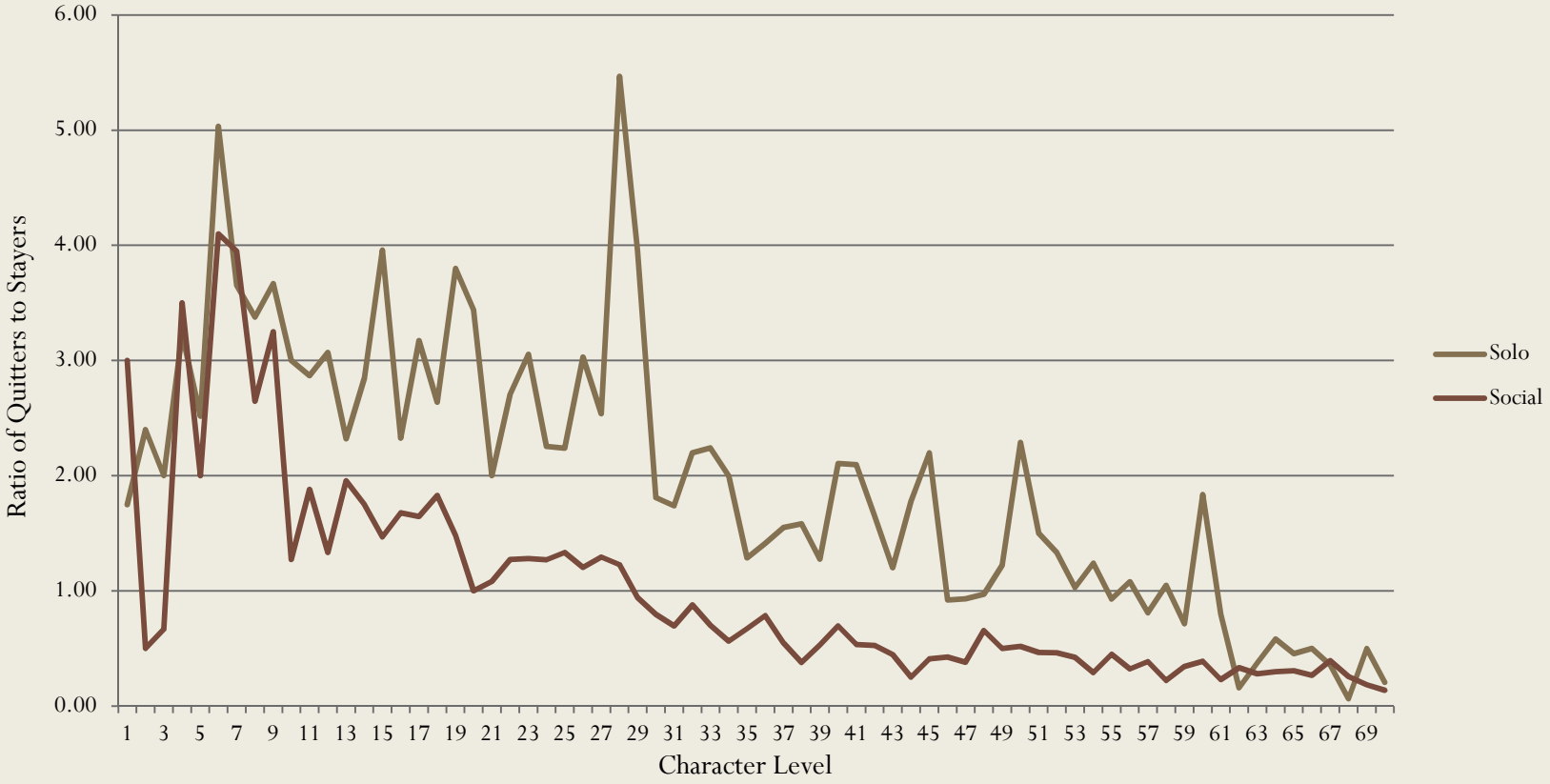
Second Life

Tens of millions play mmogs

By studying these virtual worlds

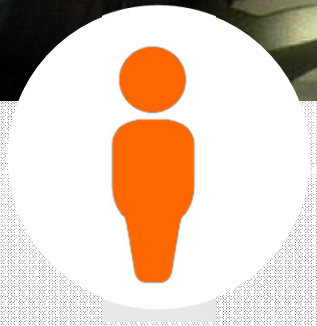
we can learn new things about the real world.

Example: Churn in Online Games



- Isolated players are 3.5x more likely to quit (B = 1.26, p<.001). Focus design on facilitating social interaction.

Social engagement and player retention



Social engagement:

Solo players

Players in small to medium networks

Players engaged in largest networks

Likelihood of quitting:

65.3%

34.8%

5.7%

Levis' – Example of Social Commerce

- Levis' leverages its brand to ensure customers **provide** their social network
- Levis' can leverage predictive social analytics technology to **understand the value** of the customer's social network

A study of trust

Using data from

EverQuest II

Big Picture questions about trust

Expressions of trust

In different social contexts?

- Cooperative (PvE)
- Adversarial (PvP)

In different types of social networks?

- Housing, mentoring, trade, group

Characteristics of trust

In MMOGs?

Of related networks in MMOGs?

Compared to social networks in other domains?

- Citation networks, co-authorship networks

Role of trust

What role can features derived from trust networks play in prediction tasks?

- Link prediction (formation, breakage, change)
- Trust propensity
- Success prediction

Dynamics of trust formation

Trust initiation	Trust reciprocation	Trust revocation
What role does social interaction play in trust initiation? What role does trust play in socialization?	When is trust reciprocated? How do other relationships or activities factor in? Can we predict reciprocation?	What causes revocation? Can we predict it? Is revocation an indicator of distrust? What about cascades and the 'scarlet letter effect'?

“housing trust” and other relationships in everquest II

To communicate in-game messages and invitations to other players

To buy, sell, or exchange in-game items

To assist lower-level players and gain experience points

To allow another player access in order to store and share in-game items

Activity and relationships in everquest II

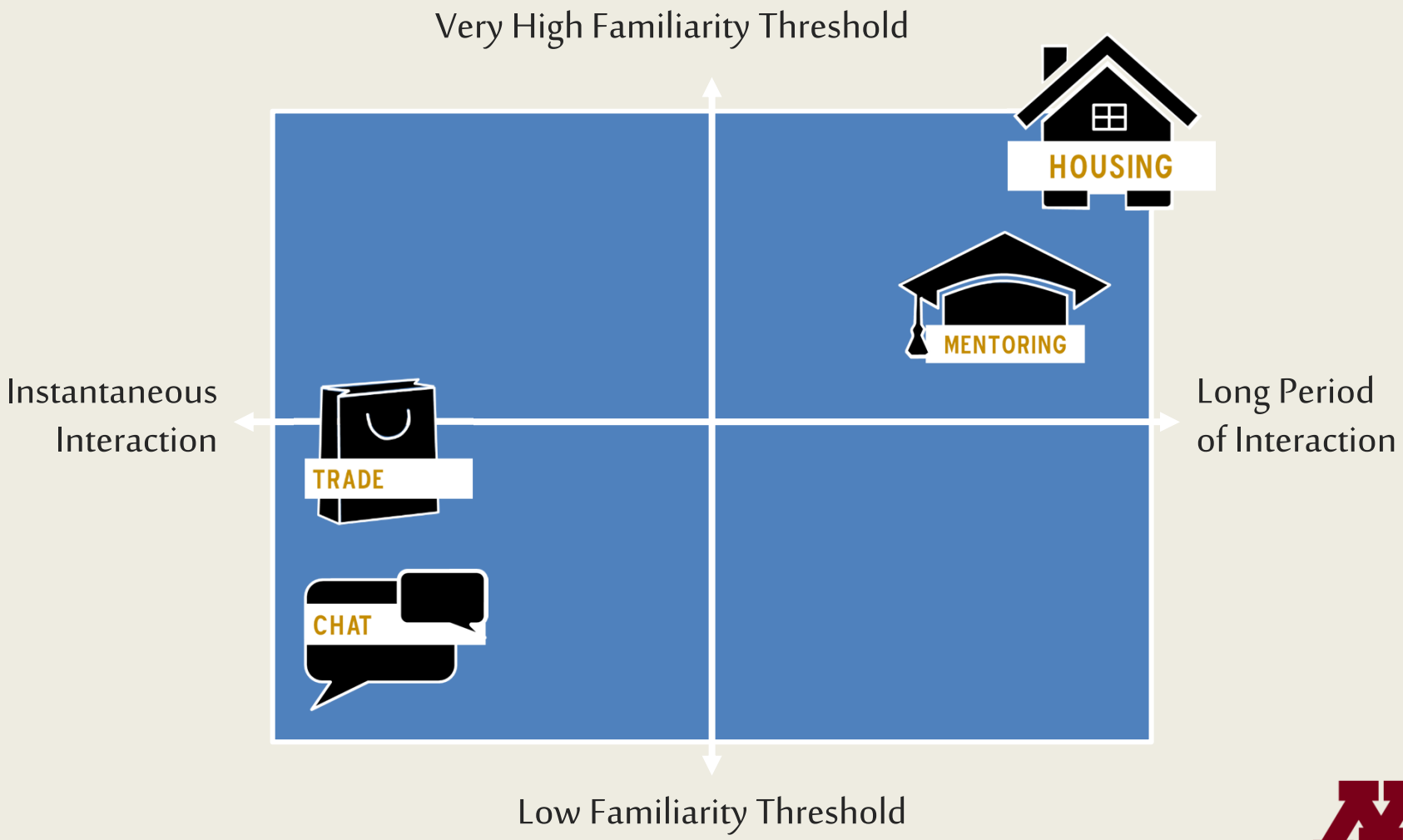
349,654 Nodes
86,948,748 Edges
1 Month

295,055 Nodes
28,594,929 Edges
9 Months

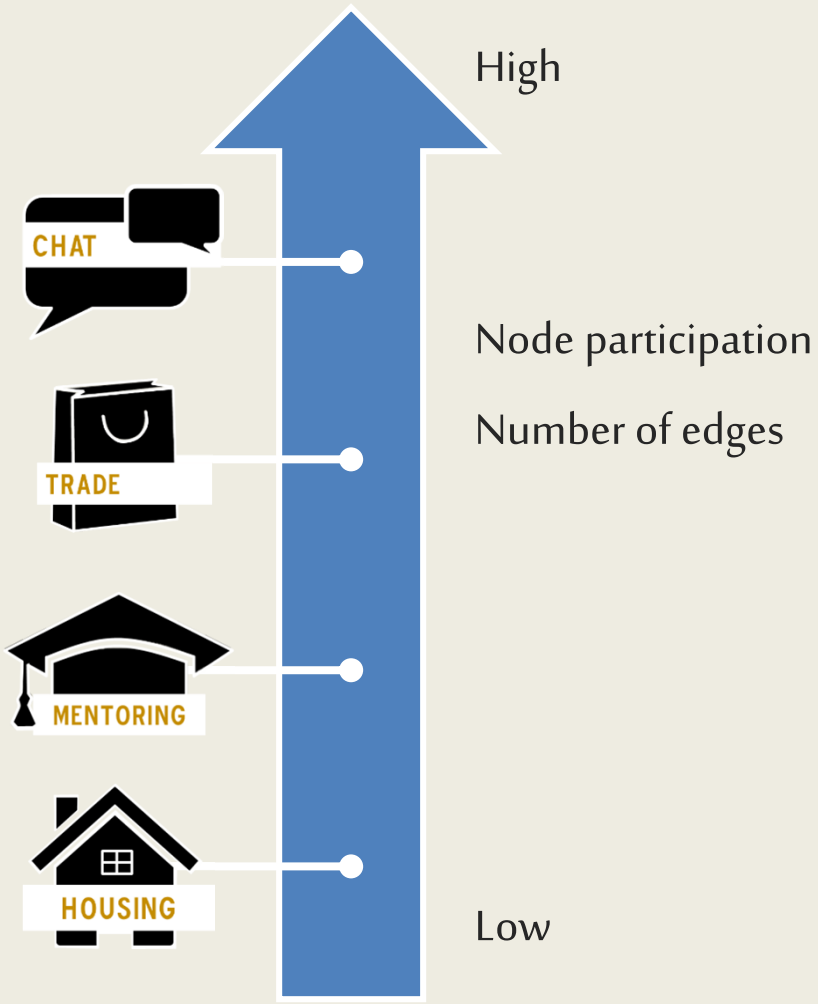
86,495 Nodes
11,913,994 Edges
9 Months

63,918 Nodes
128,048 Edges
9 Months

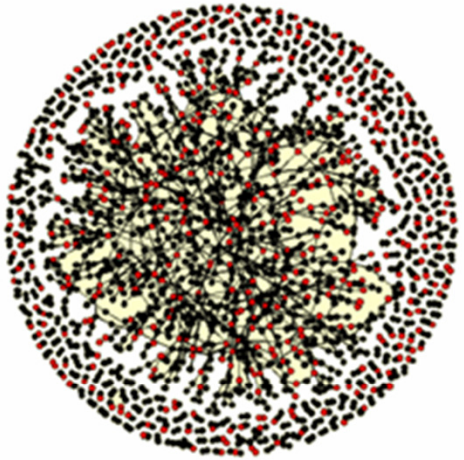
Nature of these relationships



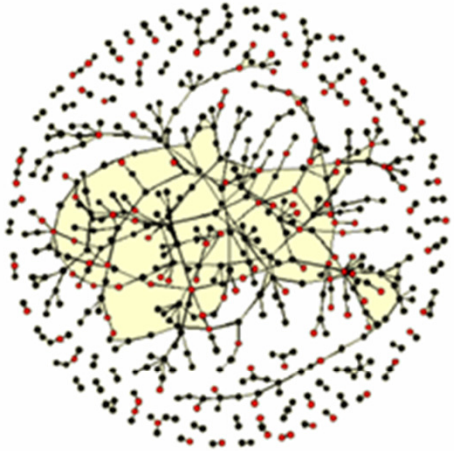
Graph Density



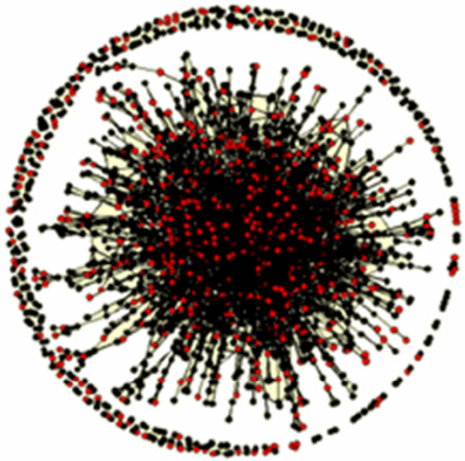
Activity and Relationships Visualized



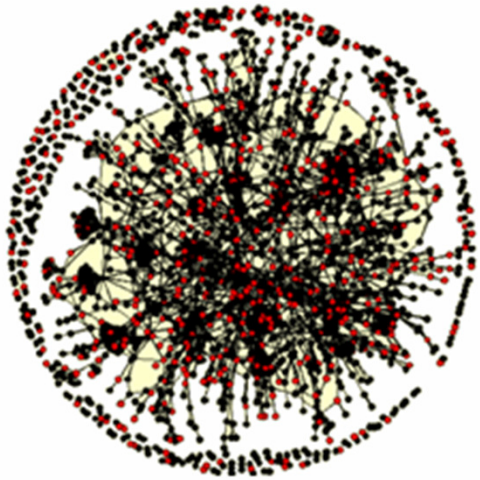
Partnerships



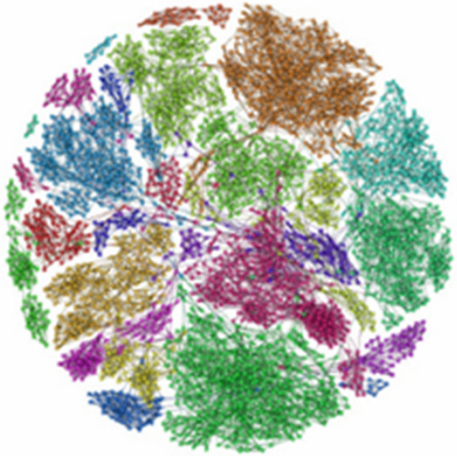
Instant Messaging



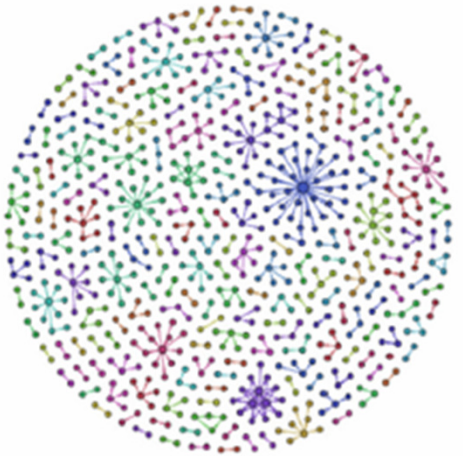
Trade



Mail



Chat

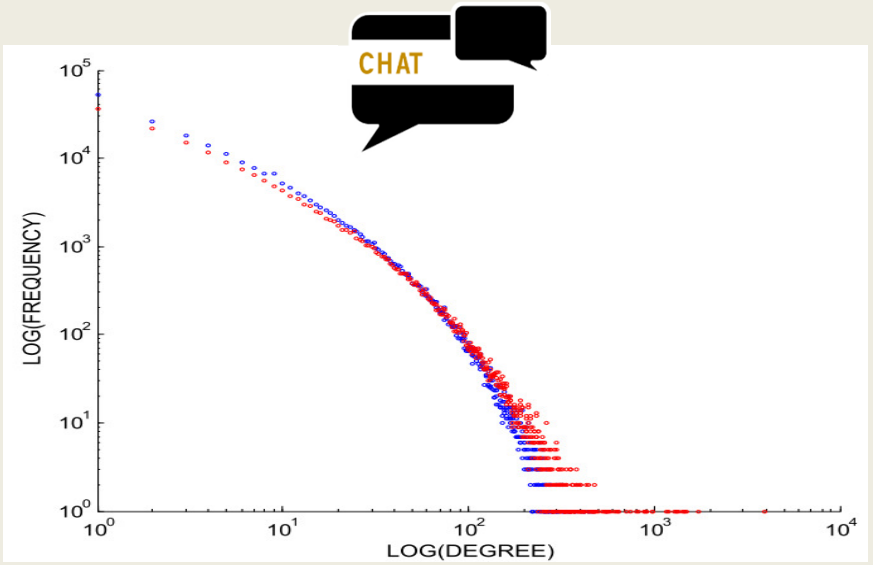


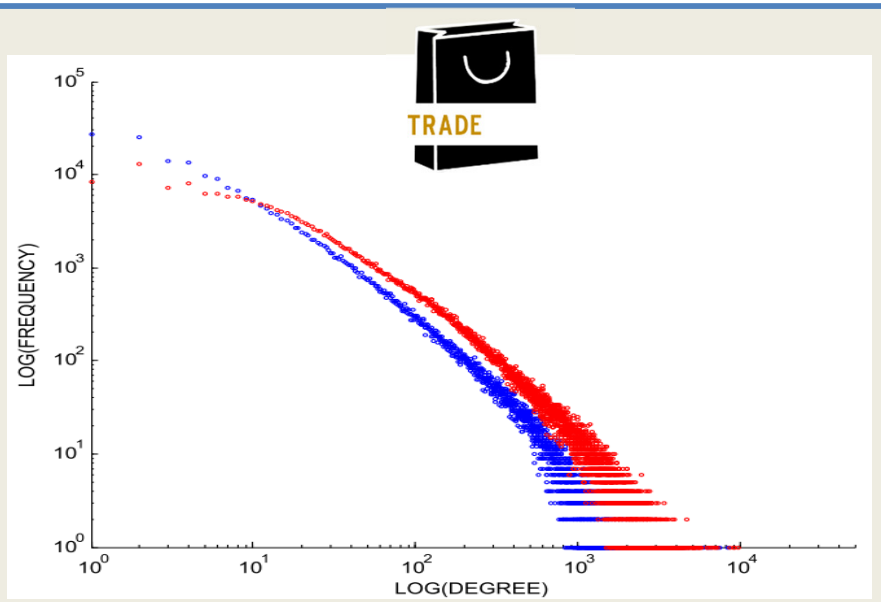
Housing Trust

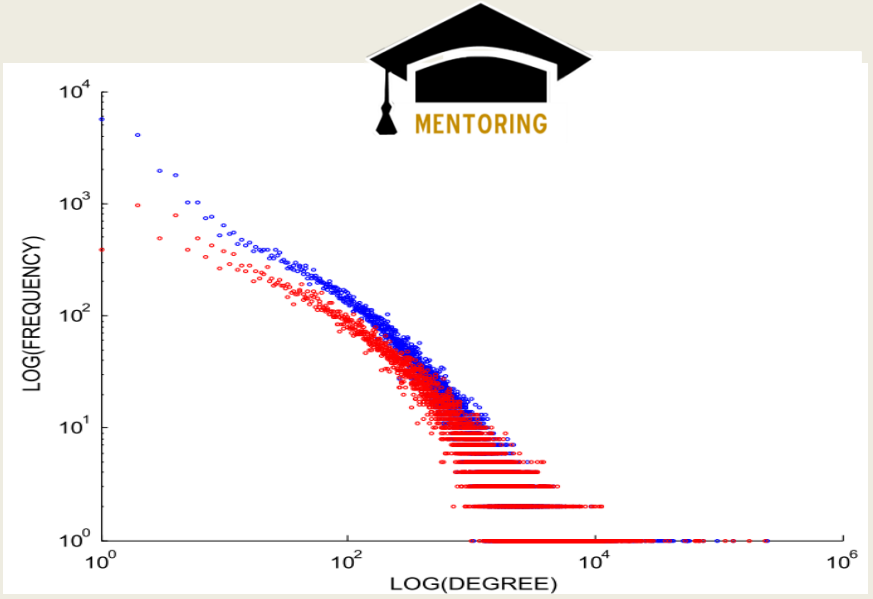
Degree distribution

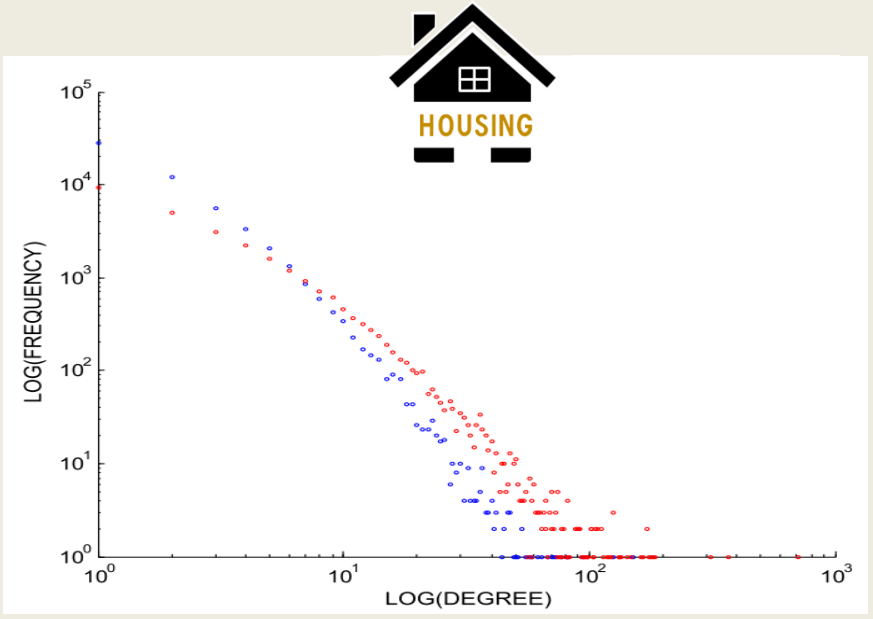
In-degree

Out-degree









Housing trust

- Players can carry a limited number of items
- Player buys a house to store extra in-game items
- House is shared with a partner until the owner revokes permission

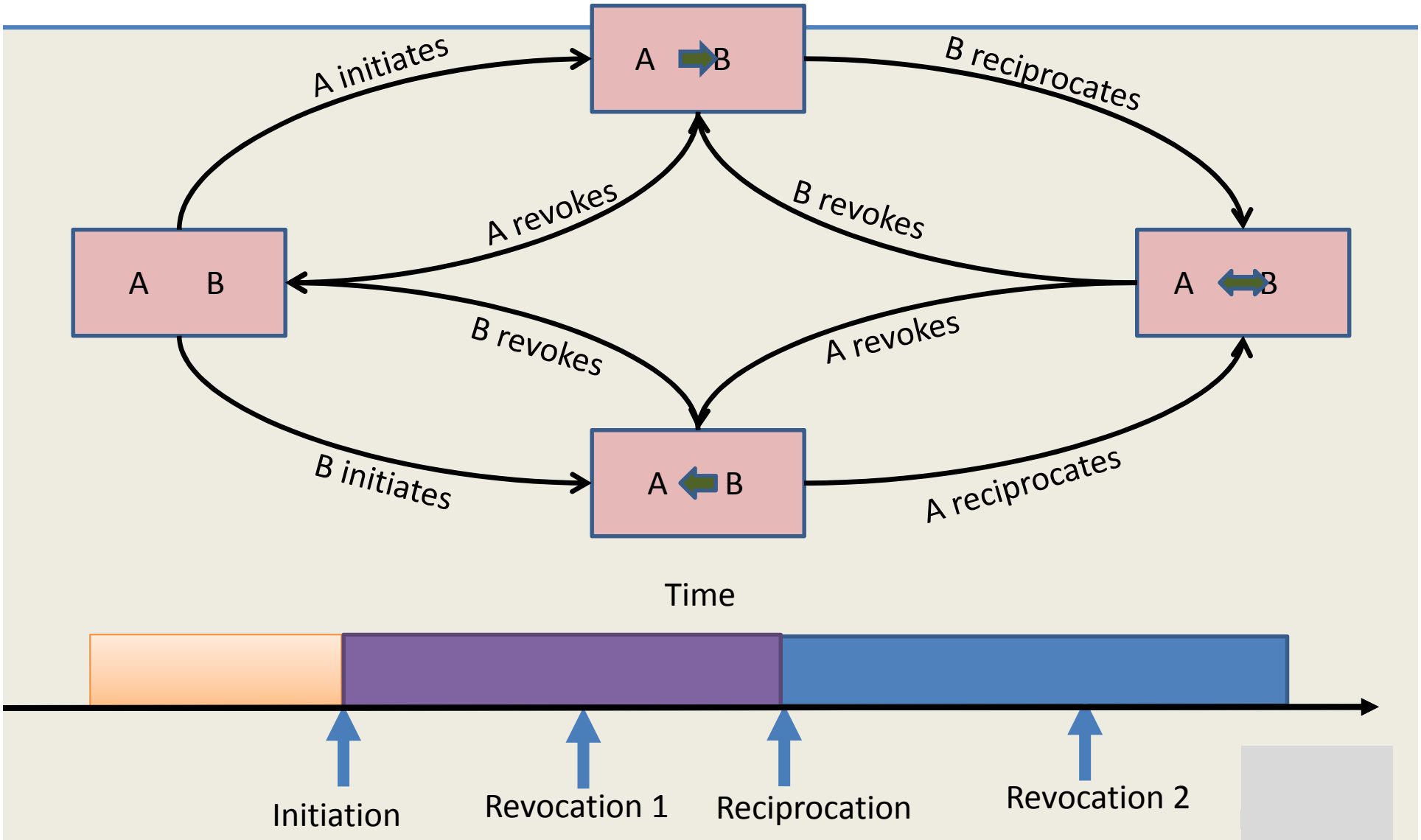
Housing trust: permission levels

TRUSTEE	Partner can enter house, store and move items in and out
Friend	Partner can enter house, store and move his items only
visitor	Partner can see and enter house
none	Partner can see the house from outside
Remove	Partner cannot see the house

Housing trust: permission levels

- Do players prefer a specific trust level?
- Is there any stable trust level?
- Do players express higher trust level quickly compared to lower?

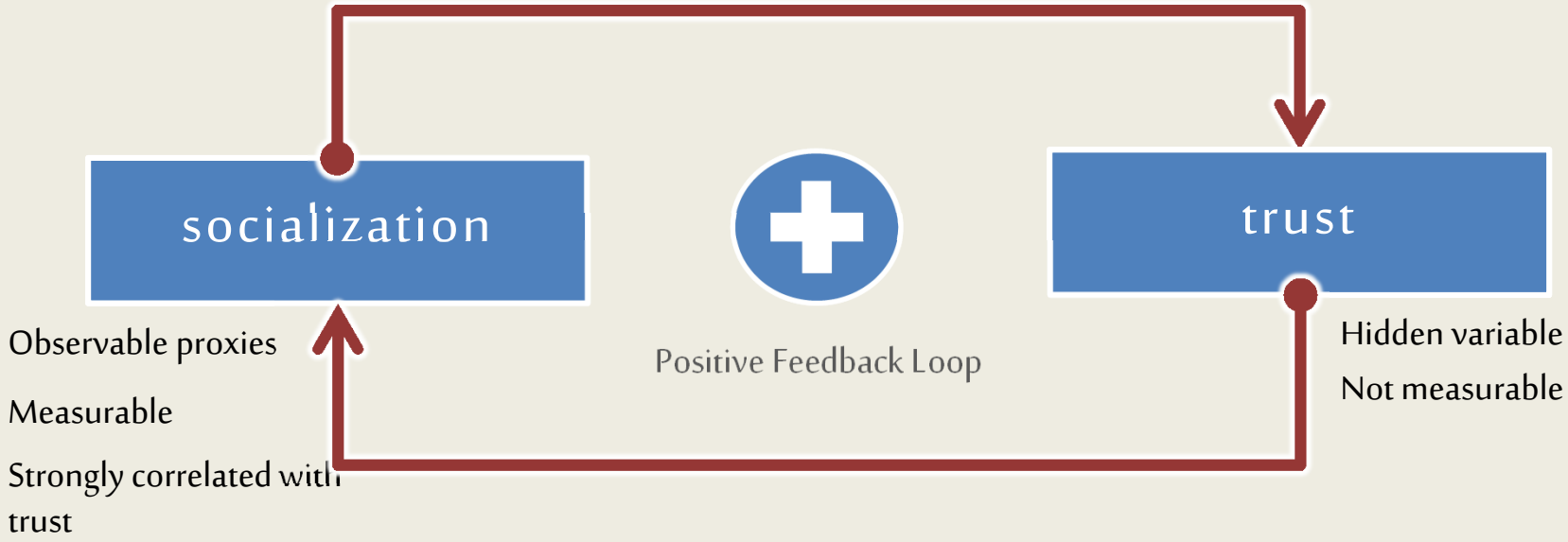
Dynamics of Dyadic Trust



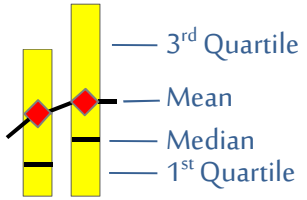
social & trust

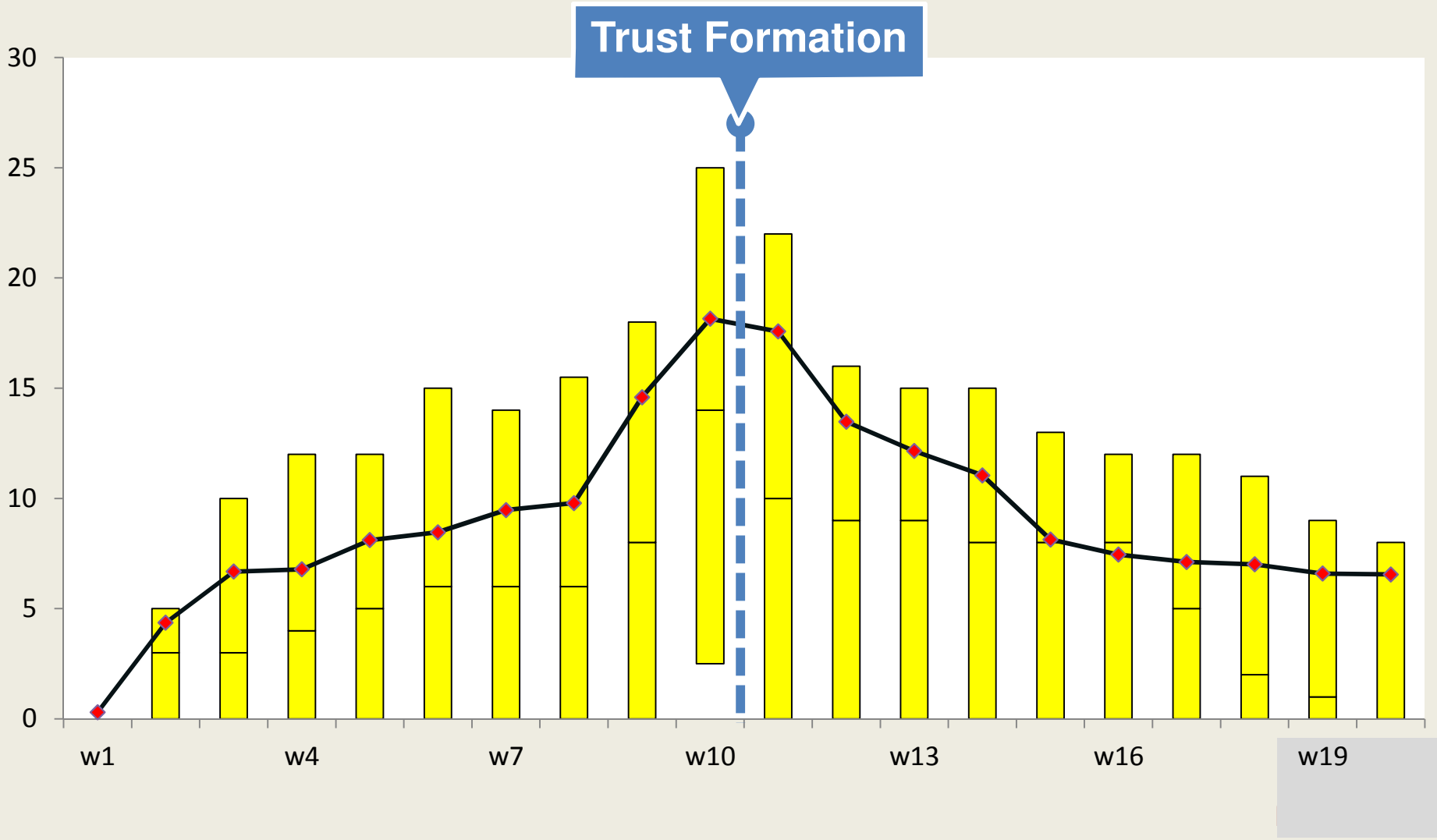
interaction initiation

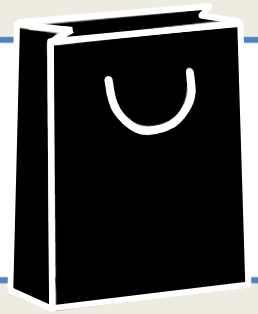
Trust and Social Interaction



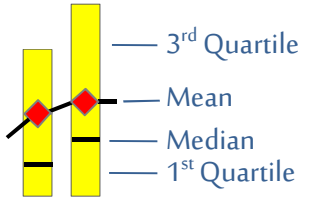
Grouping activity and trust initiation

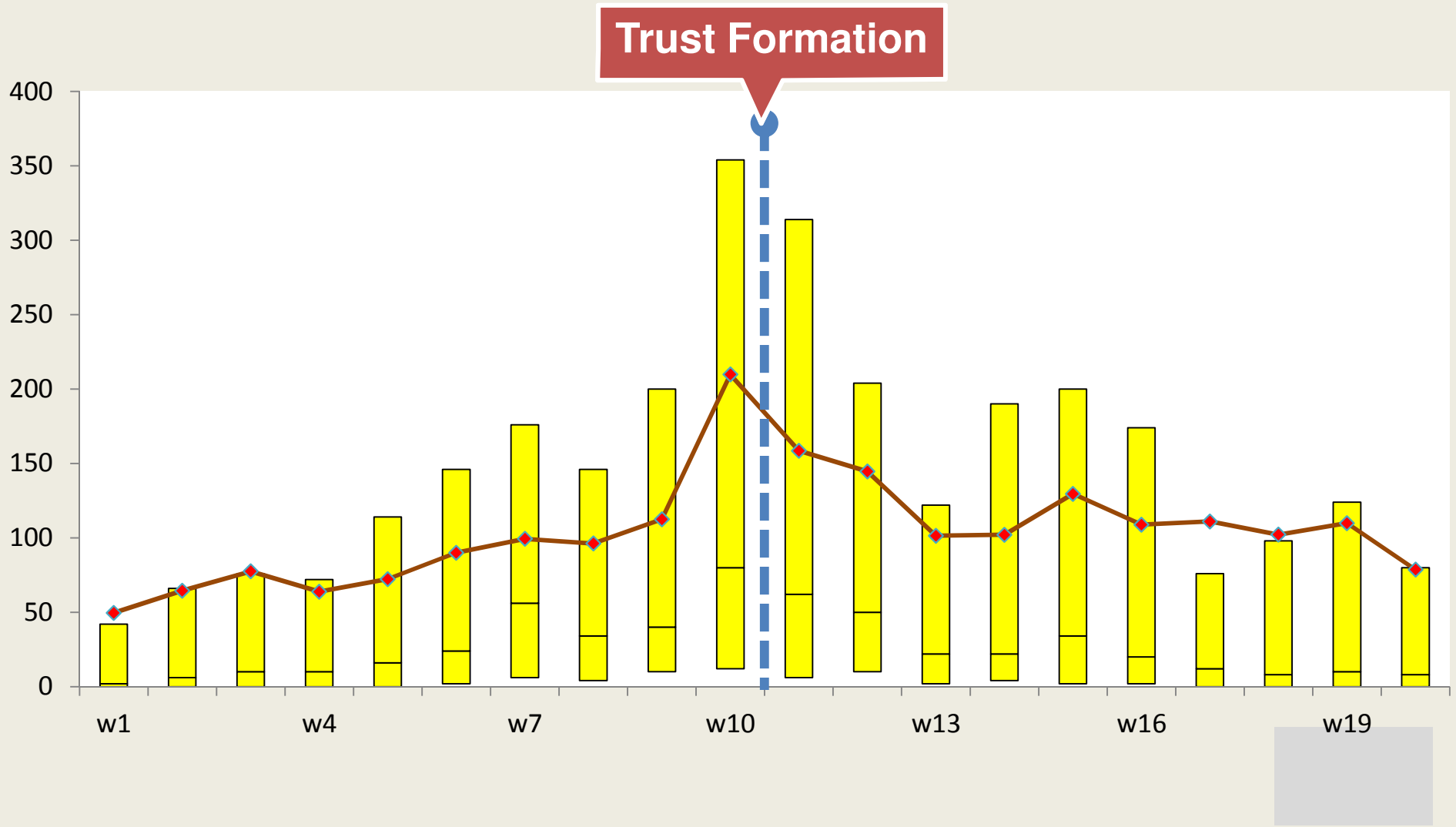






Trade and trust initiation





Observations

Sharp increase in social interaction
before trust is formed

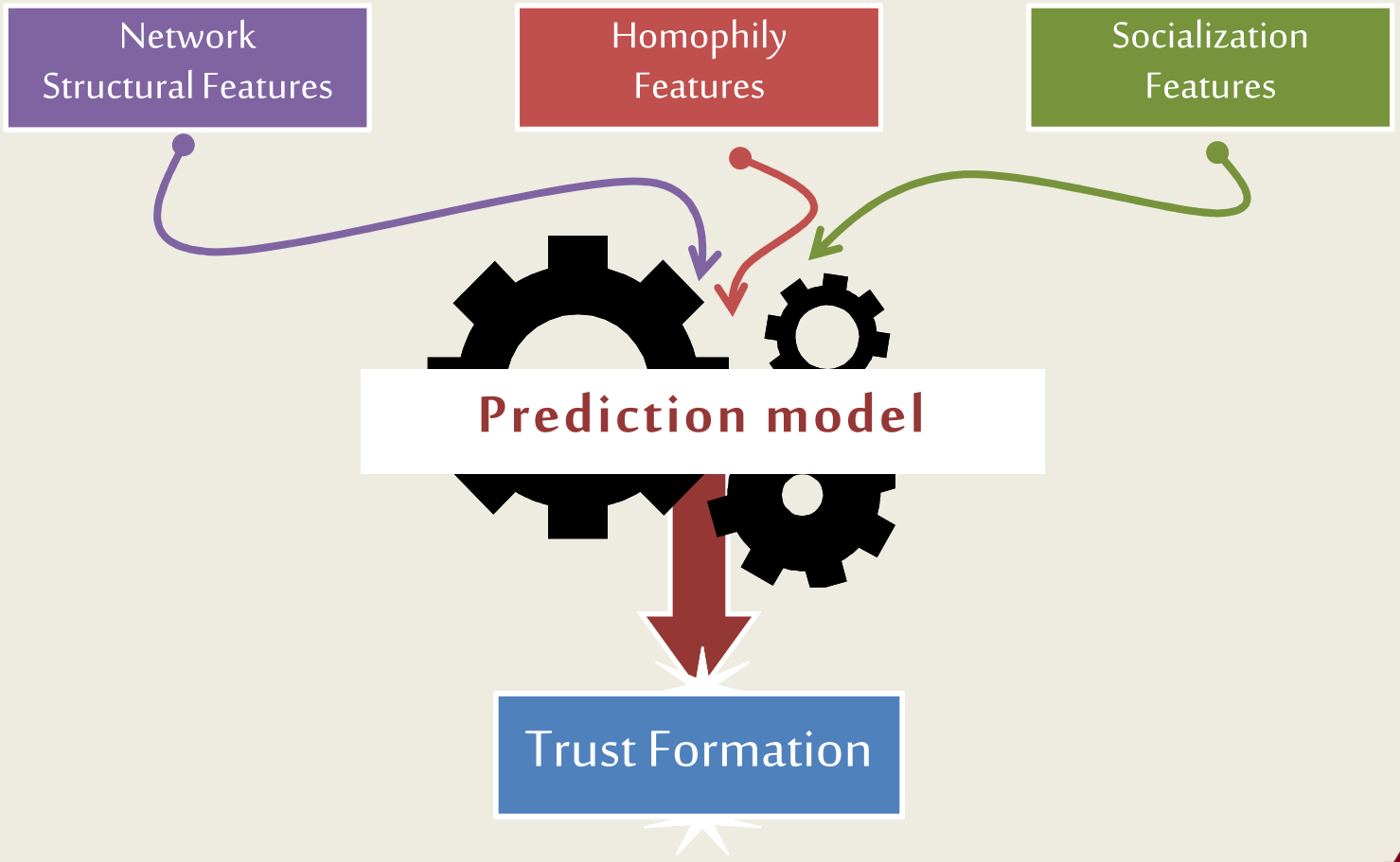
Decrease in social interaction
after trust is formed

A threshold is required for trust to form
(differs from person to person)

After trust formation, less socialization required
to maintain the relationship

Trust Prediction

Binary Classification Task



Trust Prediction

Binary Classification Task

Network Structural Features	Homophily Features	Socialization Features
Topological •Common Neighbors •Adamic-Adar •Jaccard •Preferential Attachment •Shortest Distance •Sum of degrees of node	Sum & Difference of character levels Guild Indicator	

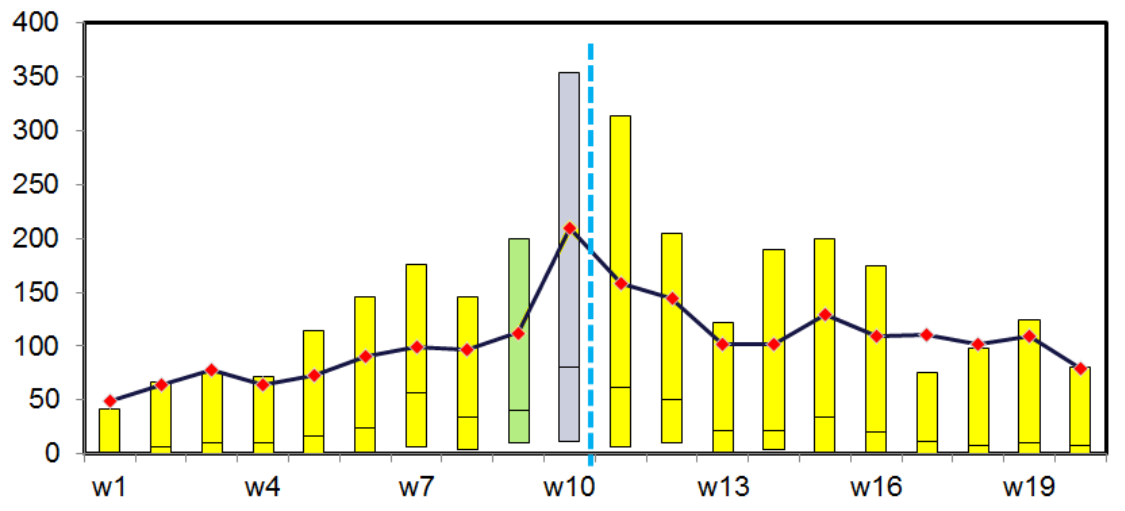
Trust Prediction

Binary Classification Task

Network Structural Features

Homophily Features

Socialization Features



$Engagement_{10}$

Amount of social interaction in a week

$Intensity_{10}$

Ratio of engagement of current with previous week

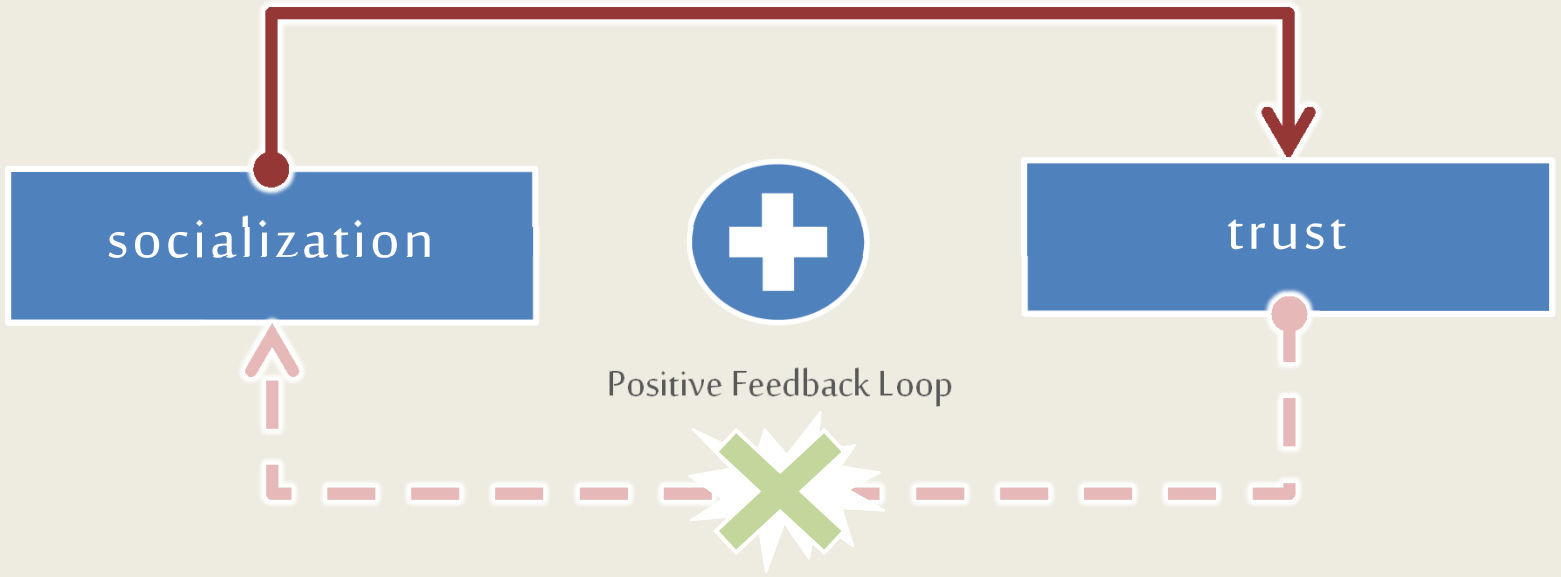
$Stability_{10}$

Indicator function to compare engagement with previous week

Trust Prediction Results

F-Measure					
	Trust				
	Without Social	With Socialization			
		Trade	Group	Mentor	T + G
J48	82.26	87.56	89.86	89.86	91.98
JRip	83.01	88.95	90.12	90.12	92.65
BayesNet	80.04	84.65	85.65	85.65	86.32
3-NN	79.65	84.01	84.08	84.08	83.98

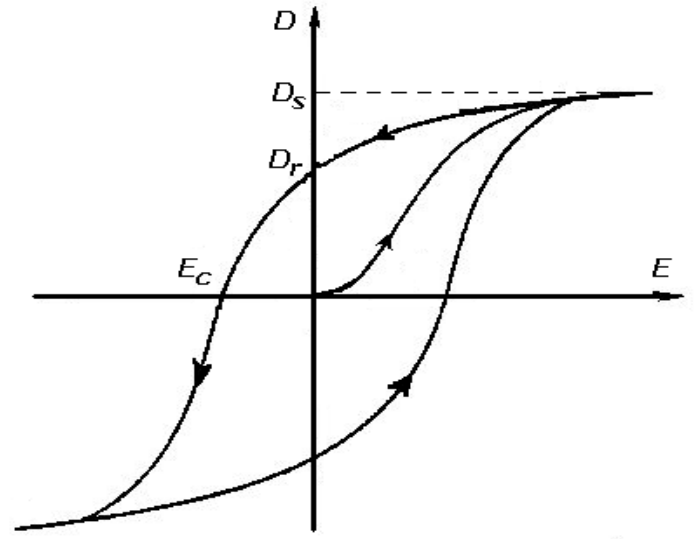
Conclusion

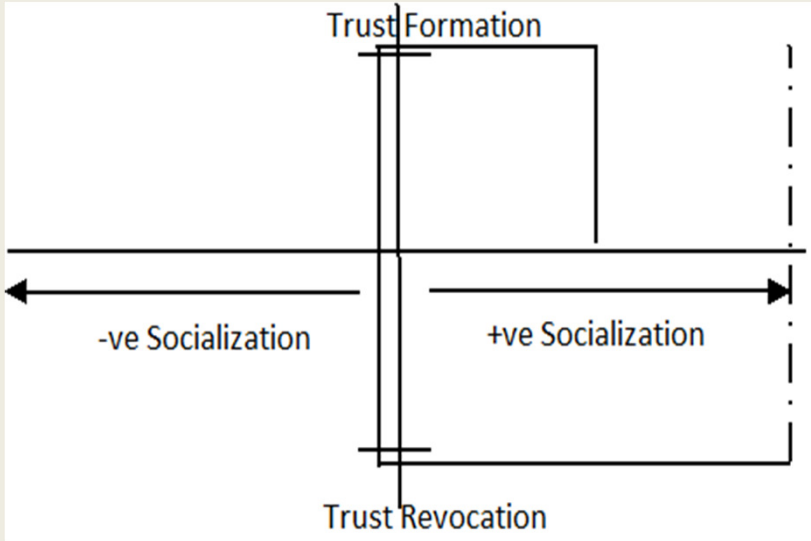


Primary Hypothesis

- Social interaction has an unique relationship with trust formation
- Formation of trust depends on socialization but vice versa does not hold

Does trust exhibit a social hysteresis?





Magnetic Hysteresis	Social Hysteresis
Polarity changes requires equal effort	Trust is harder to build than distrust
Ease of magnetization depends on the magnetic material	Ease of trust formation depends on the characters of the persons involved
Depends on the strength of magnetic field	Depends on the type of social interaction

Trust reciprocation

Reciprocation in Granting Trust

	Responses received	No Response	Second or more Interaction
Trust Forward Link	16904/72445 = 23.3%	54273/72445 =74.9%	1268/72445 =1.75%

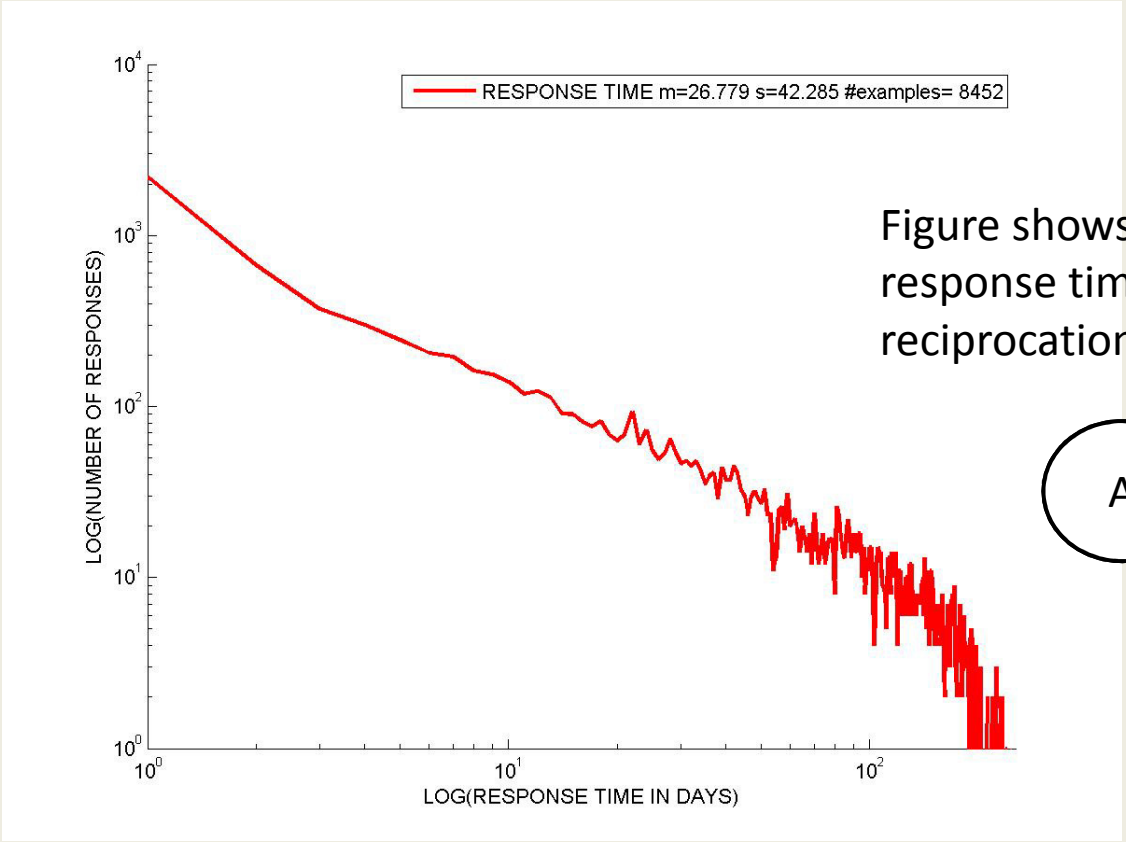
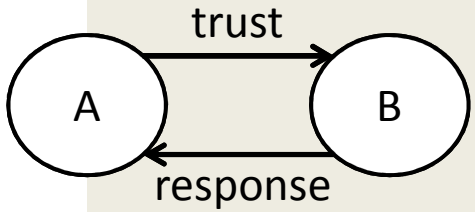


Figure shows the distribution of response times for trust reciprocation



Reciprocation in Chat, Trade and Trust

Network Type (period)	All Forward edges	First reciprocation	Second reciprocation	Third Reciprocation	All other reciprocation	Total reciprocation
Chat (1 month)	1840492	441039 (23.9%)	79412 (4.3%)	32128 (1.7%)	46969 (2.6%)	599548 (32.6%)
Trade (9 months)	520861	74137 (14.23%)	11850 (2.3%)	3766 (0.72%)	47056 (9.0%)	136809 (26.3%)
Trust (9 months)	62674	8452 (13.5%)	351 (0.56%)	0 (0.0%)	0 (0.0%)	8083 (14.0%)

- Chat is a low barrier relationship
- Trade is a medium barrier relationship
- Trust is a high barrier relationship

Reciprocation in Heterogeneous Networks

Forward Type	First Forward Edge	Chat Reciprocation	Trade Reciprocation	Trust Reciprocation
Chat	1645623	435758	1187	105
Trade	74428	7953	11402	335
Trust	10502	907	1016	722

With trust request, chat and trade responses are surprisingly higher

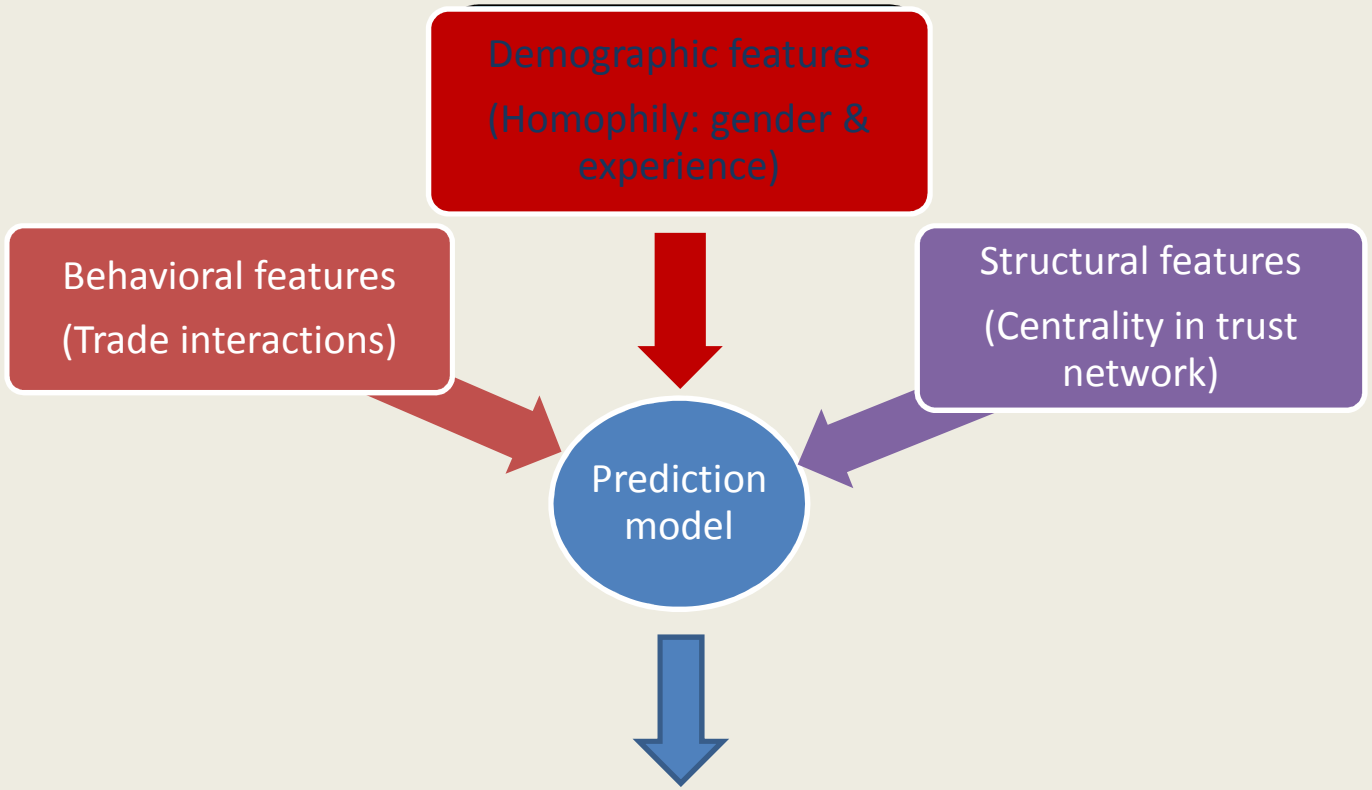
➔ 'feeling the requester out'?

Role of low barrier relationships on Trust reciprocation

Trust type	Forward Edges	CHAT responses	TRADE responses
Reciprocated	743	243(37%)	408(63%)
Unreciprocated	9145	6962 (75%)	2331(25%)

Reversal behavior of chat and trade for trust reciprocation completion

Predicting Trust Reciprocation



- (+) class (trust reciprocated=yes)→ 8083 instances
- (-) class (trust reciprocated=no)→ 52574 instances

Reciprocation Prediction Results

Classifier	CWA	AUC	Avg Precision	Avg recall	F-measure
Trust	**0.515**	**0.659**	**0.800**	**0.863**	**0.806**
Trust+trade (T=1)	**0.526**	**0.637**	**0.825**	**0.866**	**0.816**
Trust+homophily	**0.519**	**0.604**	**0.788**	**0.849**	**0.808**
Trust+trade (T=1) +homophily	**0.527**	**0.634**	**0.826**	**0.866**	**0.817**
Trust+trade(T large)	**0.588**	**0.714**	**0.871**	**0.885**	**0.851**

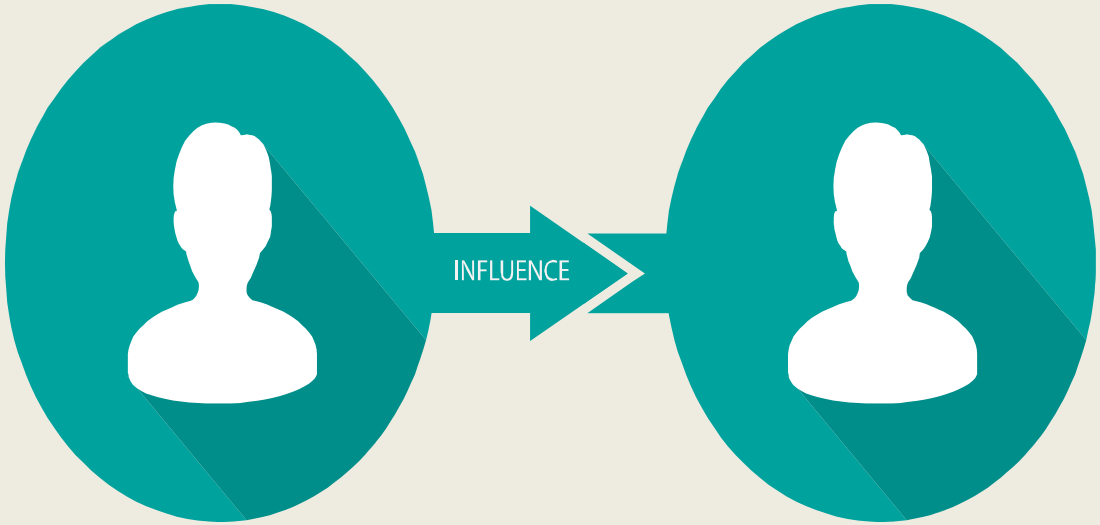
T: number of days of socialization

Application to

Game analytics

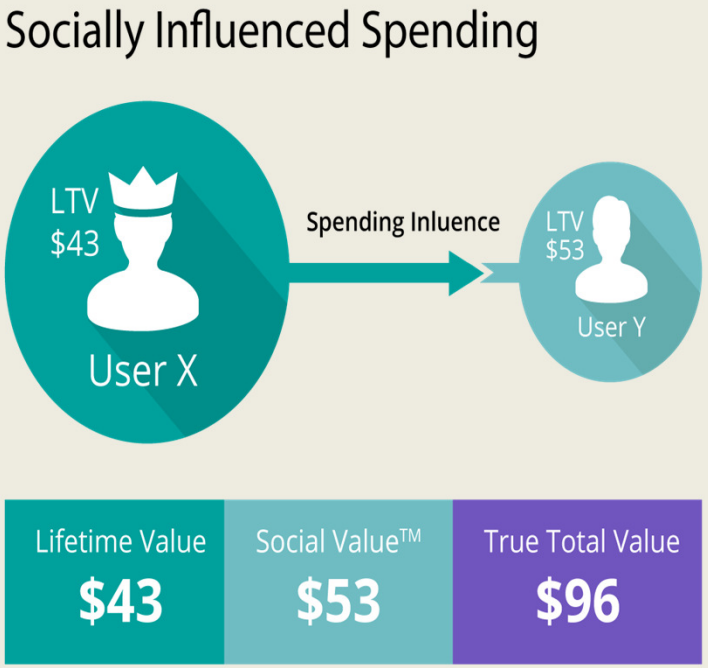
Spend + social capital = total customer value

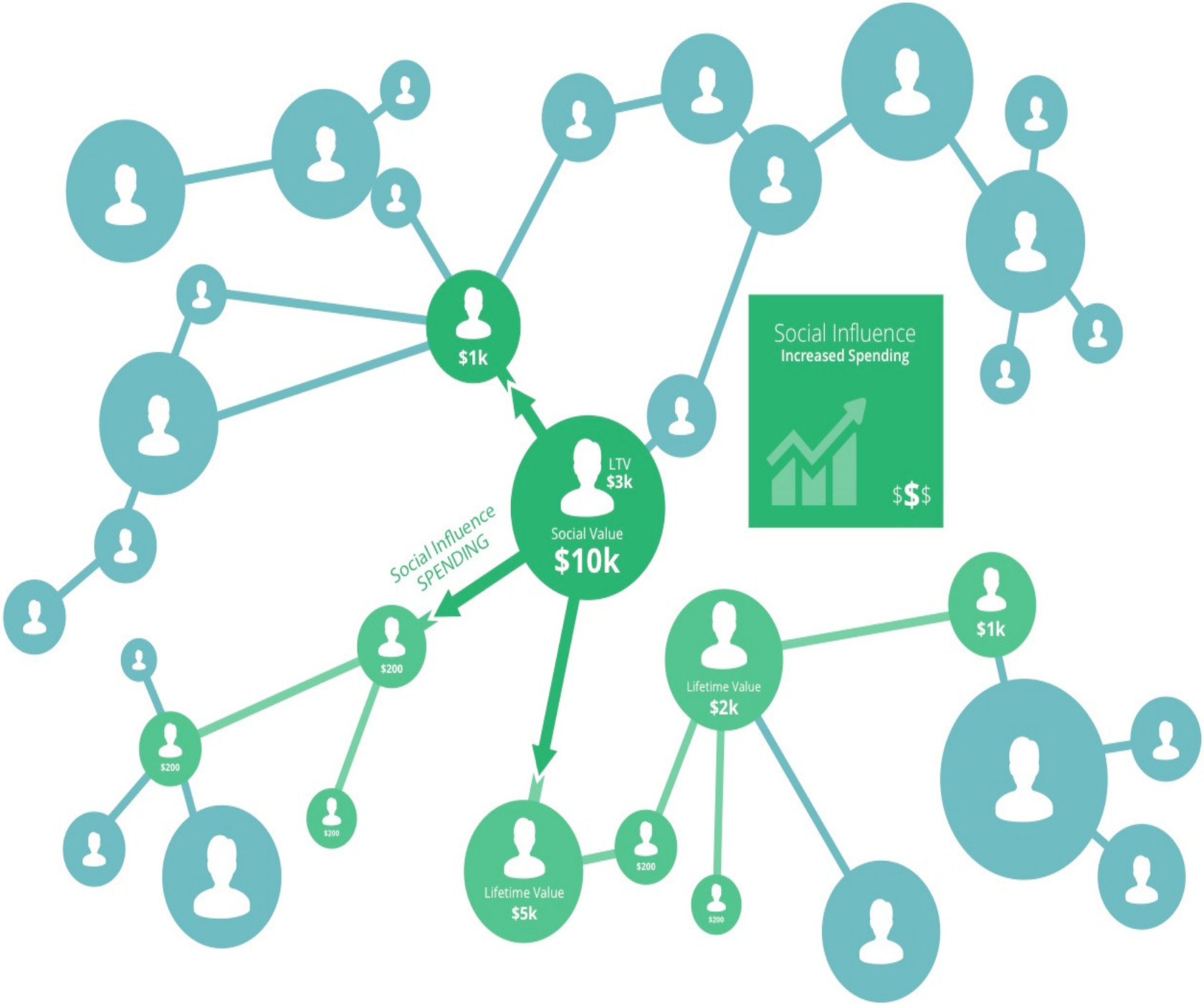
How do you measure the impact of players on each other?



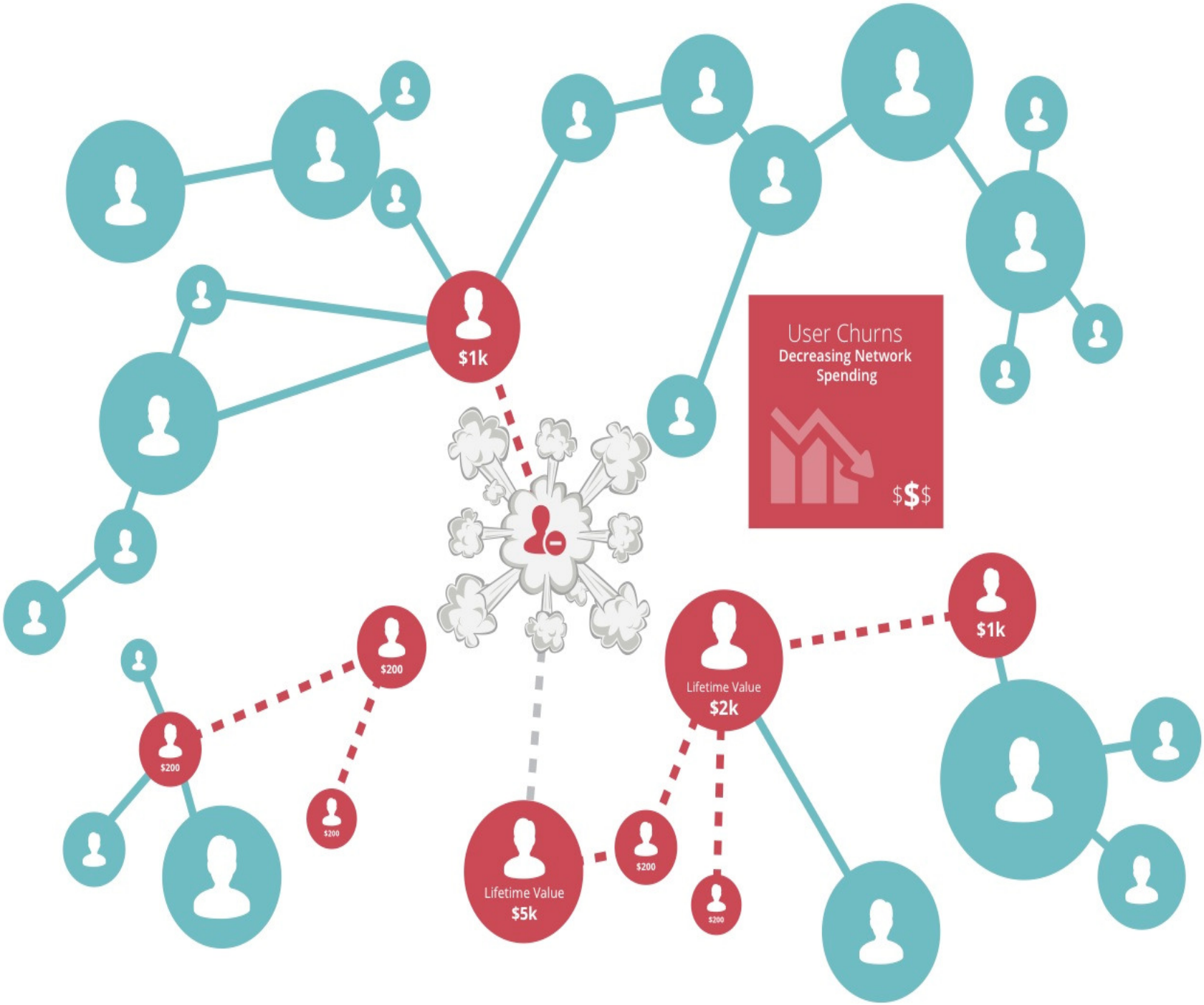
What is Social Value?

- The extra behavior created by someone across their social graph
- Spending, time or sessions
- Social Value vs. Asocial LTV
- Add the two: true total value
- $43 + $53 = $96 (Opportunity Cost)



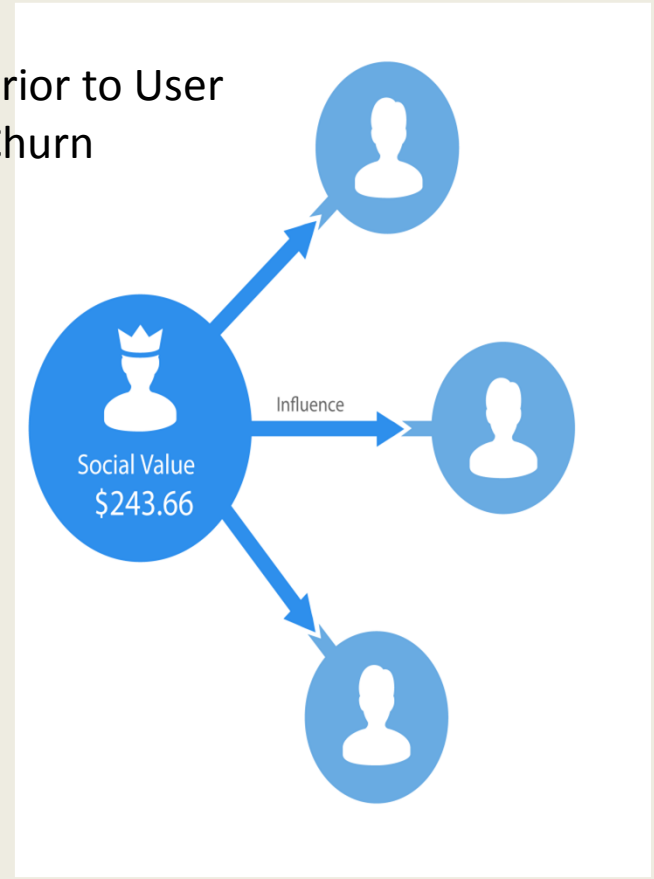

$1k
LTV
$3k
Social Value
$10k
Social Influence
SPENDING
Social Influence
Increased Spending
$$$
$200
$200
$200
$200
Lifetime Value
$5k
Lifetime Value
$2k
$1k

Why Do We Care?

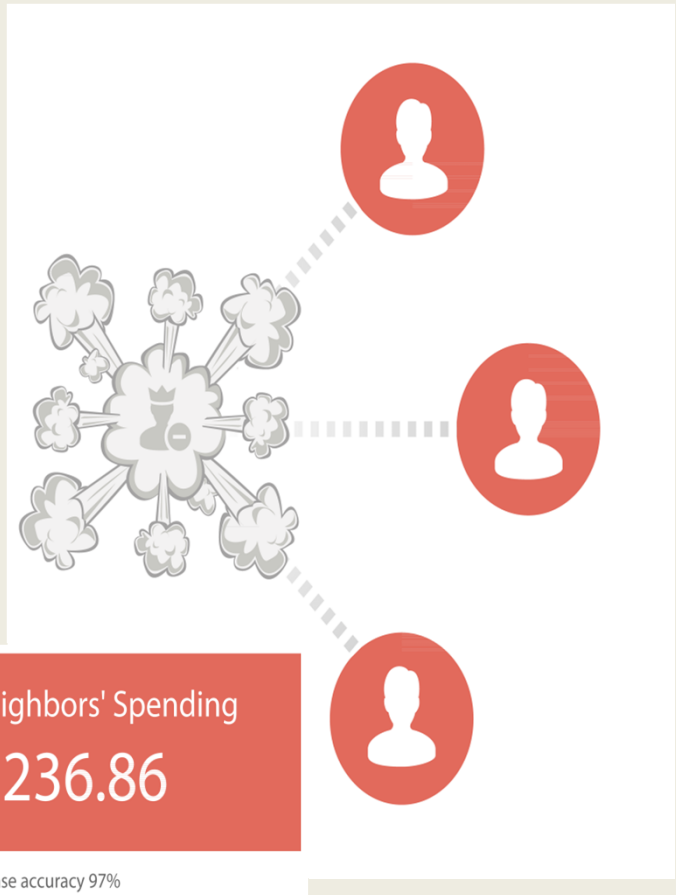

$1k
User Churns
Decreasing Network Spending
$$$
$200
$200
$200
Lifetime Value
$5k
$200
$200
Lifetime Value
$2k
$1k

Real-World Churn Example

Prior to User Churn



User Churns



Understanding Social Whales

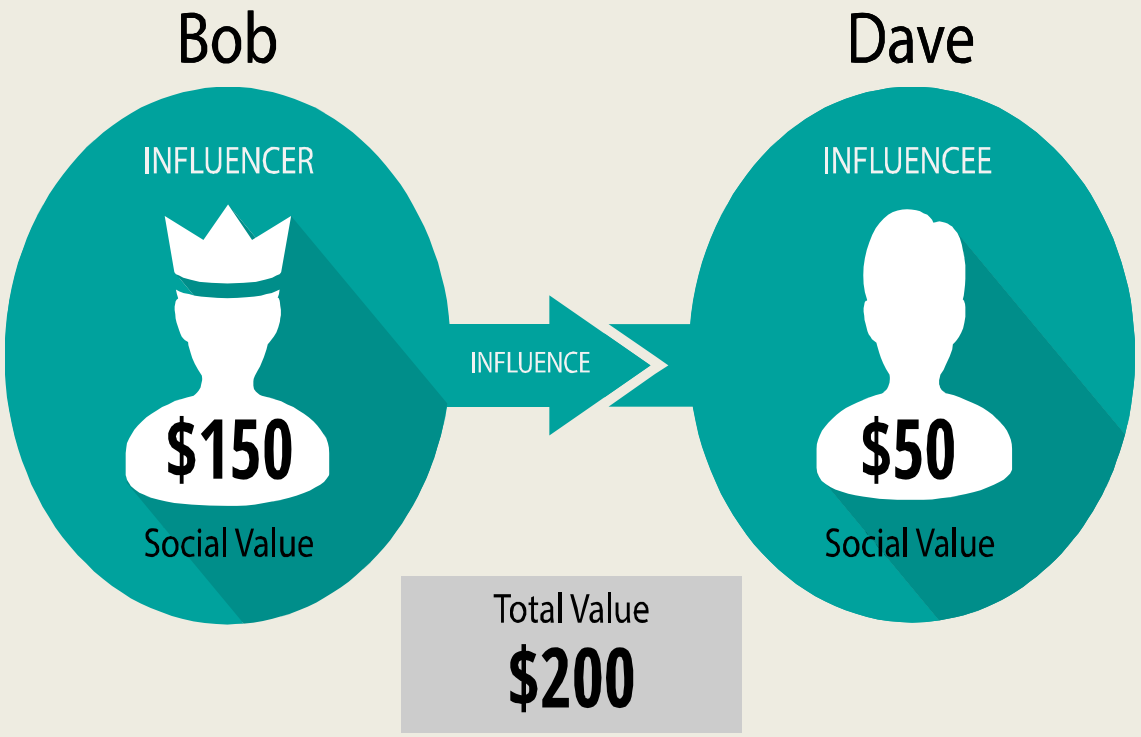
- What are they?
- They require others to have value—context dependent.
- Biggest whale to date: ~$1.5k/month in others' spending
- Distributions: not like spenders; 60% of SV from 10% of players

Social Whale™

Understanding Social Whales

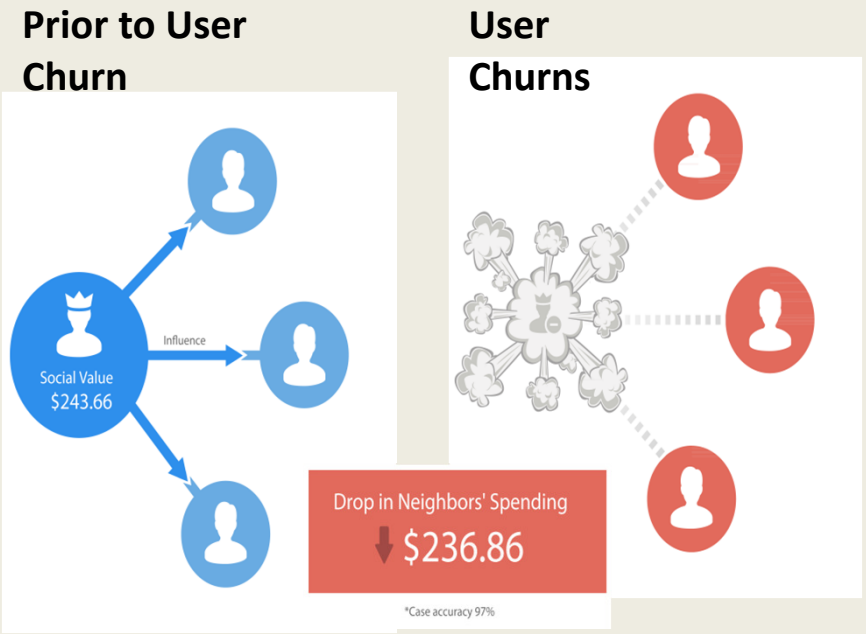
Linking Social Whales and Value to platform, geography, acquisition channel and genre/mechanics

Example:
Bob and Dave.



General report statistics

- Data size: 365m accounts, 2013-present
- Statistical significance
- Accuracy rate: 85%



% SV by Game Genres

Looked at:

- ✓ Mobile single player
- ✓ Mobile social games
- ✓ PC hardcore multiplayer
- ✓ MMOs

Big range. Why?

Mobile Single Player Games

Average is 6%

Mobile Social Games

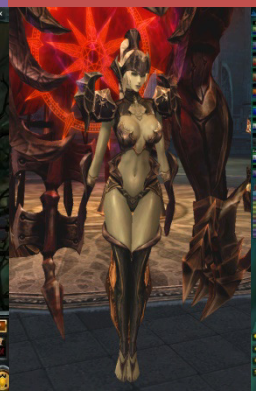
Average is 28%

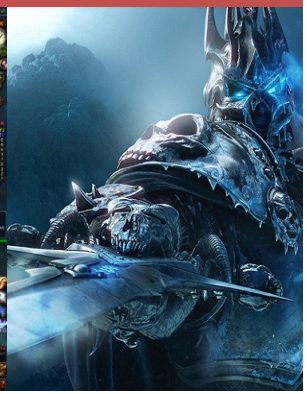
PC Hardcore Multiplayer

Average is 30%

MMOs

Average is 60%





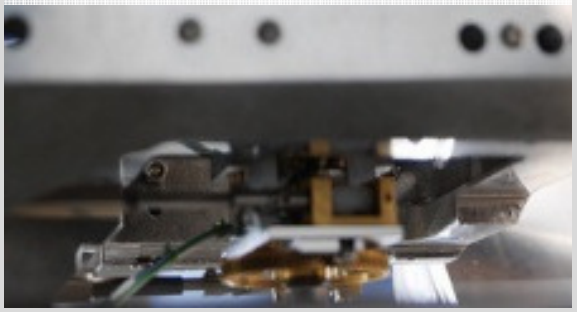
The Moral of the Story

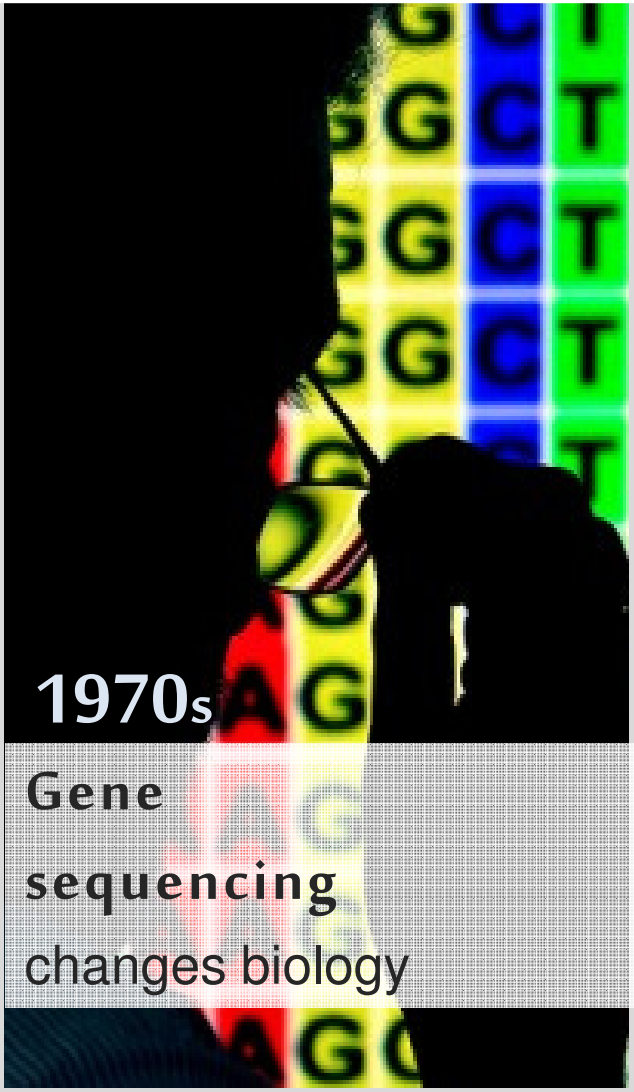
Community is not a nice-to-have.

Community is a *profit center*.

Radically new instrumentation

Electron microscope
changes chemistry





Gene sequencing
changes biology

Hubble telescope
changes astrophysics

The Virtual World Observatory

http://129.105.161.80/wp/

- **Four PIs, 30+ Post-docs, PhD and MS students, UGs, high-schoolers**
  - **Noshir Contractor, Northwestern: Networks**
  - **M. Scott Poole, Illinois Urbana-Champaign/NCSA: Groups**
  - **Jaideep Srivastava, Minnesota: Computer Science**
  - **Dmitri Williams, USC: Social Psychology**
- **Collaborators**
  - **Castronova (Sociology, Indiana), Yee (Xerox PARC), Consalvo, Caplan (Economics, Delaware), Burt (Sociology, U of Chicago), Adamic (Info Sci, Michigan), …**
- **Data, technology, funding partners**
  - **Sony (EverQuest 2), Linden Labs (2nd Life), Bungie (Halo3), Kingsoft (Chevalier's Romance), others …**
  - **Cloudera Systems (Hadoop), Microsoft (SQL Server), Weka, …**
  - **NSF, DARPA, CDC, ARL, ARI, IARPA, …**