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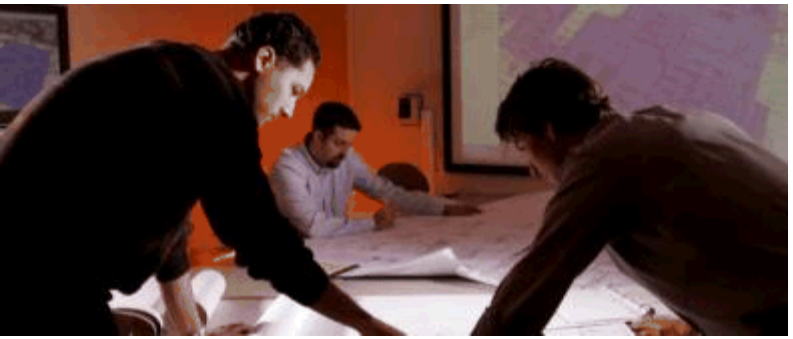

Analyzing effects of public communication on player behavior in massively multpilayer online game

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May 7th, 2013

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Motivation

- Richly-Communicative Non-Player Characters (RC-NPCs)
- What are the communicative behaviors of players within an MMOG?
- Preliminary work to study these behaviors.

3 results

- Differential posting habits
  - In-game country and in-game race impact public communication frequency.
- Public communication reflects in-game behavior
  - Notoriety effect – players who attack more are mentioned more publicly,
- Public and personal communications are linked
  - Players who talk to each other publicly also talk to each other privately.

Related Work

- Demographic studies
- Behavior modeling
  - Predominantly “kinetic” behaviors:
    - Actions that directly change the state of the game world.
- Our focus: Communicative behaviors.

The Potential of MMOGs

- Our argument: Massively Multiplayer Online Games (MMOGs) could serve as a data source (a proxy for the real world)
  - Ability to capture data on thousands of people simultaneously interacting within virtual world.
  - MMOGs are *social*.
  - Have data on public and private interaction.

Outline

- Why games are a useful data source.
- Description of the game data set.
- Experiment
- Results

Games have been with us for centuries

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Senet

Social games are not new

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Dungeons and Dragons

Telnet british-legends.com

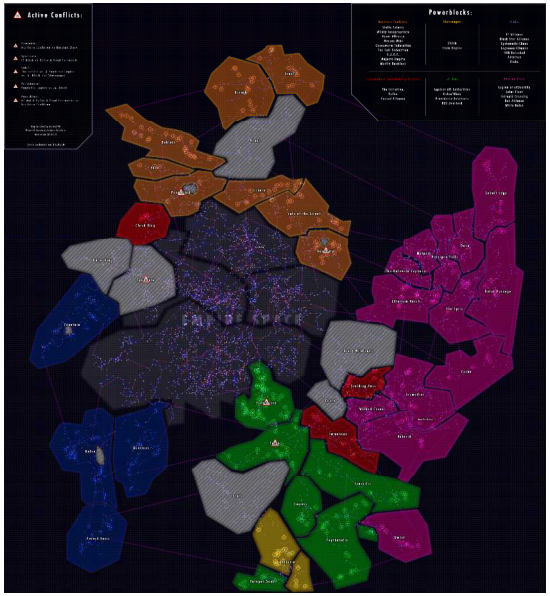
```
*n
Path.
You are standing on a path which leads off a road to the north, to a cottage
south of you. To the west and east are separate gardens.
*w
Flower garden.
You are in a well-kept garden. There is an unexpectedly sweet smell here, and
you notice lots of flowers. To the east across a path there is more garden.
*w
Cliff.
You are standing on the edge of a cliff surrounded by forest to the north and
a river to the south. A chill wind blows up the unclimbable and unscaled
heights. At the base of the cliff you can just make out the shapes of jagged
rocks.
*w
As you approach the edge of the cliff the rock starts to crumble. Hurriedly,
you retreat as you feel the ground begin to give way under your feet!
*leap
You are splattered over a very large area, or at least most of you
is. The rest of your remains are, evn now, being eaten by the seagulls
(especially your eyes). If you'd have looked properly before you leaped you
might have decieded not to jump!
Persona updated.
Would you like to play again?
:
```

MUD1

What is a Massively Multiplayer Online Game?

Large number of players

Large world



Persistent World

Are games a good data source?

- Instrumentation
  - We can observe nearly all actions within the game at a *player level.*
    - Number of combat by player vs. number of combat by region etc.
    - Communication patterns.
    - Interactions patterns.
- Manipulation
  - Potential for real-time changes in game to test theories.
- Dynamic
  - Rapid changes in organizations of players.

Real World Mirrored in Game World

Individual Level

Real-World surveys correlating with in-game behavior

Second Life
(Yee,2011A)

World of Warcraft
(Yee, 2011B)

The Sims
(Griebel, 2006)

Group Level

Real world demographic characteristics influencing VW behavior

EverQuest II
(Huang, 2009)

Second Life
(Foucault, 2009)

Societal Level

Commodity Pricing

EverQuest II
(Castranova, 2009)

Covert Networks
(Keegan, 2011)

Scenario Level

Infectious diseases

World of Warcraft
(Lofgren, 2007)

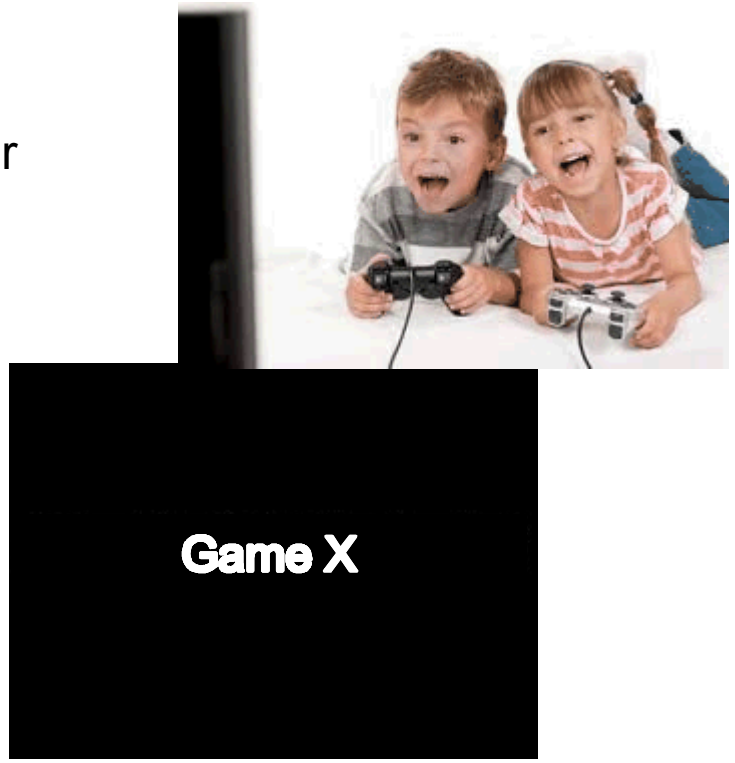
Espionage & EVE Online

- EVE Online Traits
  - Formed by players to seek economic & political advantages amongst other corporations
  - Collect taxes & develop infrastructure to support their own
  - Use leadership hierarchies to dictate policy and handle corporate affairs

- *Band of Brothers breaks apart in EVE: Goonswarm Responsible*
  - Reported BoB director turns out to be a spy for opposing corporation
  - Sells off BoB assets, destroys their sovereignty

Our Environment: Game X

- Overall
  - Browser-based exploration game
  - Large active player population
  - Players have agreed to have data from their game play collected for scientific research



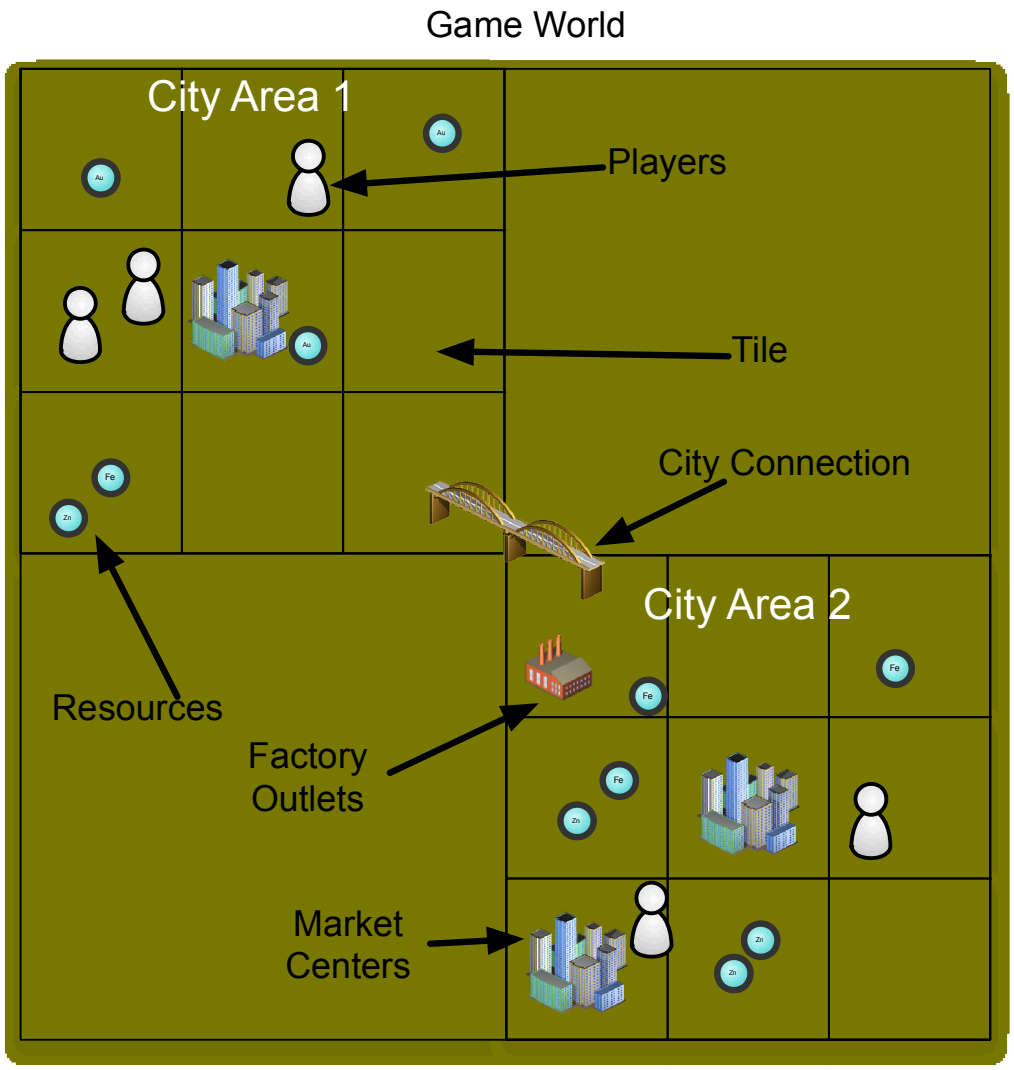
- Features of the game include:
  - Guilds with corporate structures
  - Market-based economy
  - Explicit friend and hostile networks
  - Open forums for public communication
  - E-mail / IM for private communication

- Large-Scale Conflict: Wars

Specific Details

- Turn based game – actions take fixed amount of turns
  - Turns replenished per day
  - Communication does not require turns
- Players have vehicles to explore the world
- Players collect resources:
  - Trade for “marks” – in game currency – at market centers
  - Convert to other products at “factory outlet”
- Players can build & run market centers or factory outlets
- Players can join guilds and/or nation
- Players can attack other players factories or markets

Overview of the world

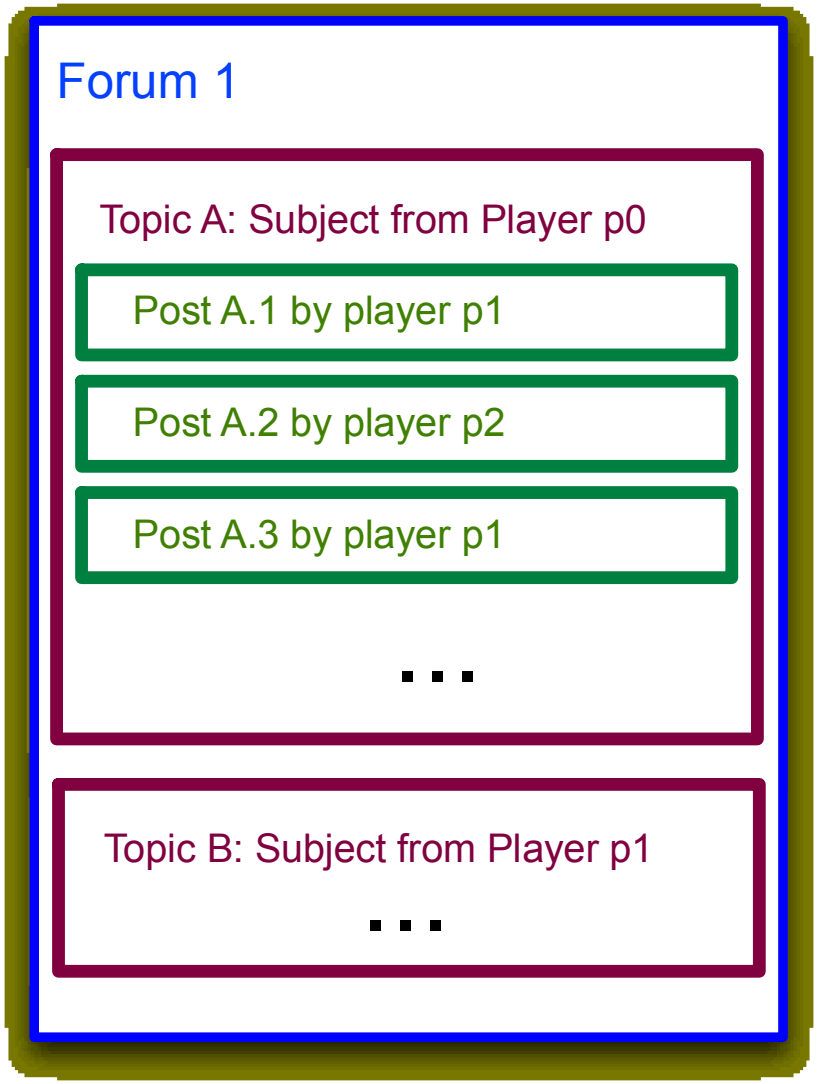


Nations vs. Guilds

Nations	Guilds
3 types	Many types
Built into Game X	Player created and run
Open to all	Invitation only
Players can elect to join	Players can elect to join
Benefits: • Special missions • Special equipment • Protection	Benefits: • Separate communication channel • Can tax members

Forums in Game X

- Similar to Usenet
- 7 Forums

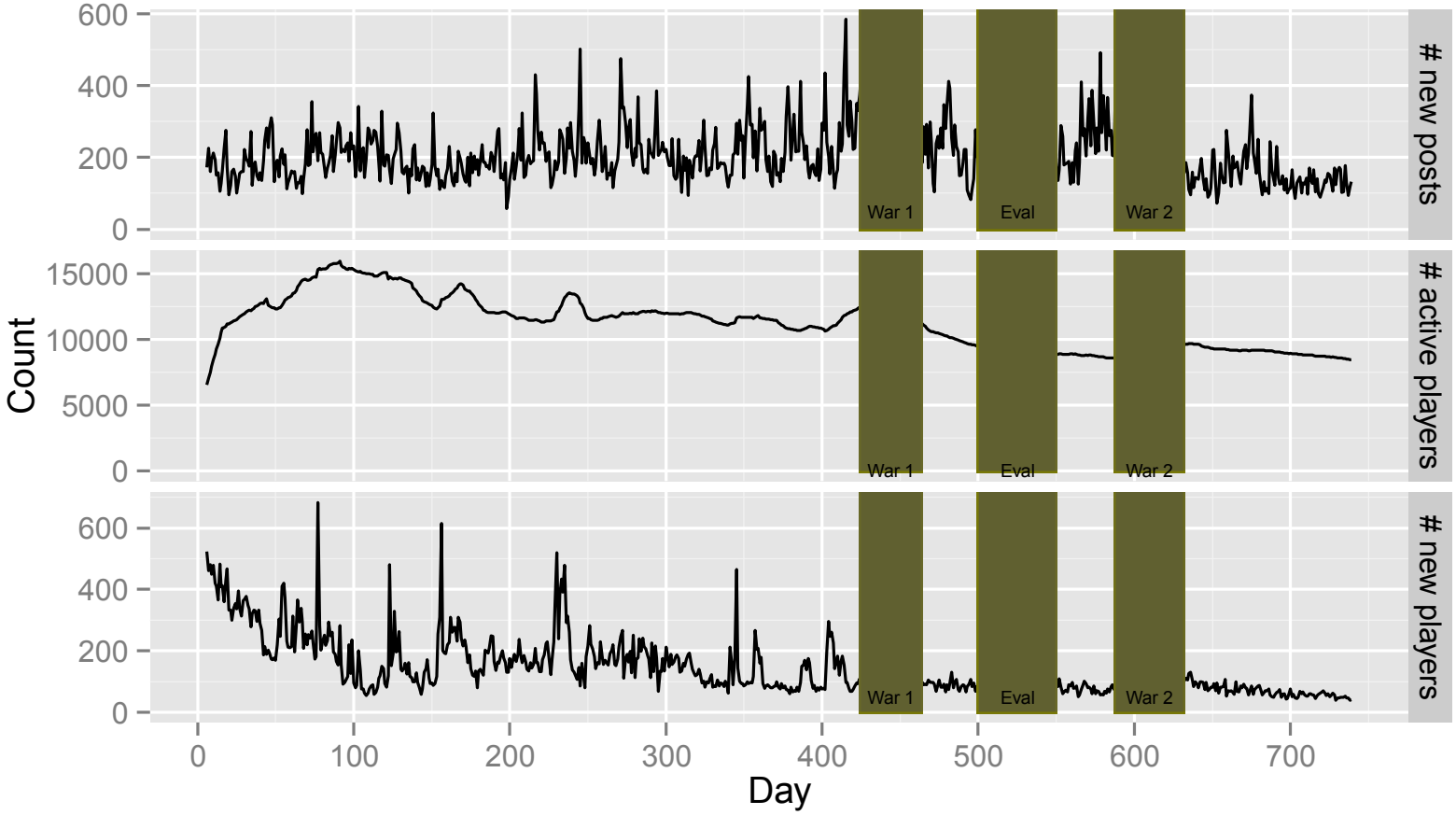


Forum overview statistics

Forum	# Posts	# Authors	# Topics	Posts/Topic
1 (NRP)	16847	1494	**2468**	6.8
2 (RP)	**62669**	**2244**	1813	34.6
3 (NRP/RP)	35069	1909	1240	28.3
4 (NRP/RP)	9544	1391	223	**42.8**
5 (NRP/RP)	11047	1424	2091	5.3
6 (NRP/RP)	13326	1497	875	15.2
7 (NRP/RP)	1778	341	286	6.2

NRP= Non-Role playing.
RP = Role playing.

Evaluation period



Some demographics of the evaluation period

- Male/Female Distribution:
  - 722 players who posted during the evaluation period.

	Count
# of posts	8543
# of topics	677
# new topics	470
# of posters	750

Table 1: Context of posting evaluation period

Attacks to mentions

- Are the topics of the forums independent of the game?
  - Does player behavior get spoken about in game?
- Qualitative evidence suggests otherwise: Players talk about the actions of others.
- We do a quantitative analysis.
- Do attackers get more publicity in the forum?
- Data set:
  - 752 players from the entire span of the data set who had been active during the entire period.
  - Track the number of attacks by the players
  - Track the number of mentions of the player over the entire period.

Confounders

- Age: Players who have played for longer have a higher likelihood to be mentioned.
- Posters: Players who post often will also have a higher likelihood of being mentioned.
- Player segmentation:
  - Divide players into low/medium/high groups based on the 33% and 66% quantiles.

Attacks to Mentions

	Low turns	Medium turns	High turns
Low Posting	.062 (-0.110, 0.230)	.182 (-0.038, 0.385)	.023 (-0.286, 0.329)
Medium Posting	**.239** (0.014, 0.441)	**.344** (0.147, 0.516)	**.277** (0.056, 0.472)
High Posting	**.396** (0.092, 0.632)	**.330** (0.116, 0.515)	**.477** (0.336, 0.597)

Table 1: Correlations between combat activity and mentions.

Discussion

- Attackers are mentioned more (as long as they already post)
- What does it mean?
  - An RC-NPC should post about in game activities.

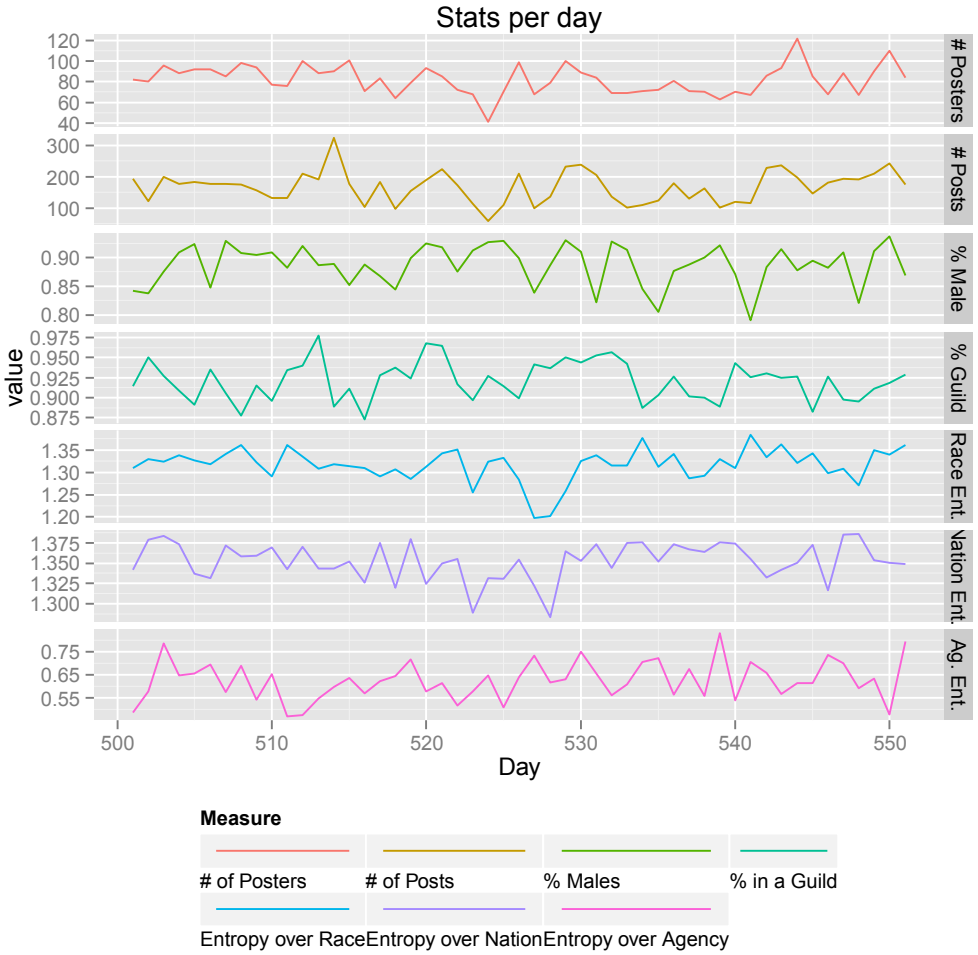
Differential posting habits

- A priori assumption: Public posting is a function of player personality.
- Quantitative analysis: Are certain in-game groupings more/less likely to post and communicate online?
- Confound (not addressed yet): Personality influencing choice of in-game group.

Measures

- # of posters: Number of players who posted during that day.
- # of posts: number of posts that were created that day.
- % Male: Fraction of players who posted that day that were male.
- % Guild: Fraction of players who posted that day that were in a guild.
- Entropy over Race: Entropy over the proportion of players in different races.
- Entropy over Nation: Entropy over proportions of players in different nations.
- Entropy over Agency: Entropy over the proportions of players in the different agencies.

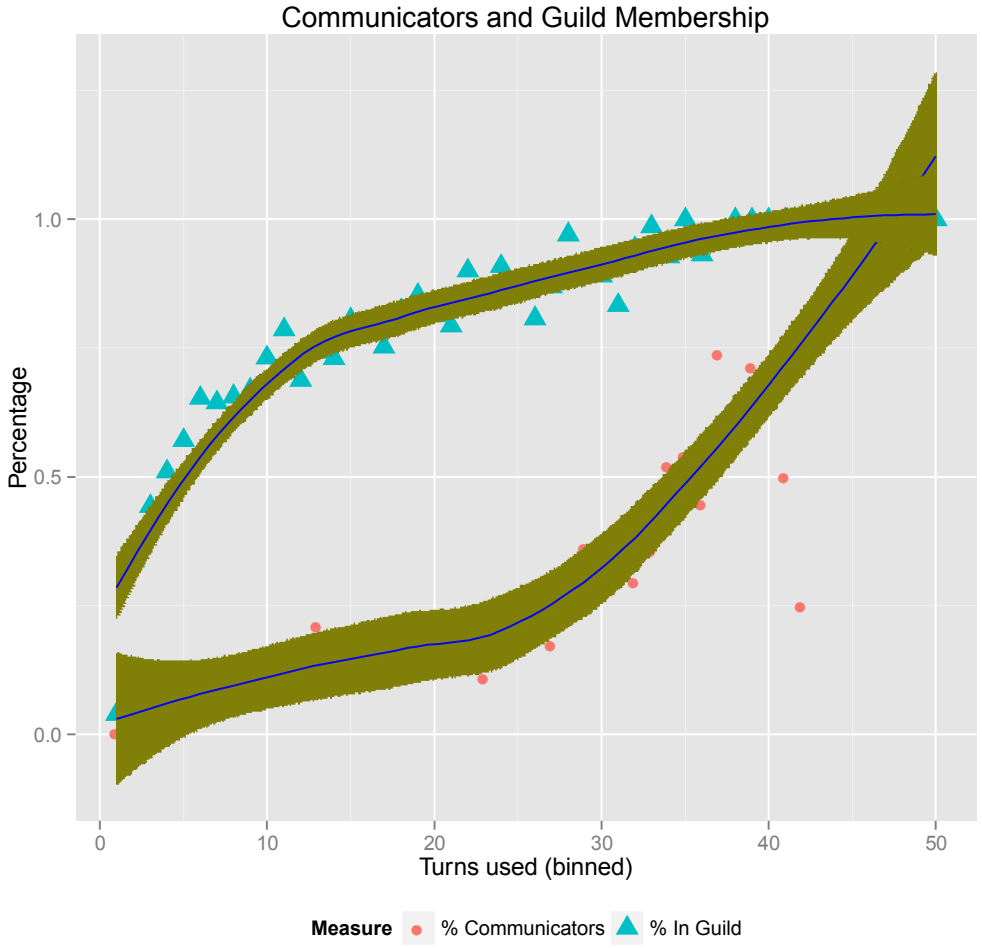
Time vs. Communication rates



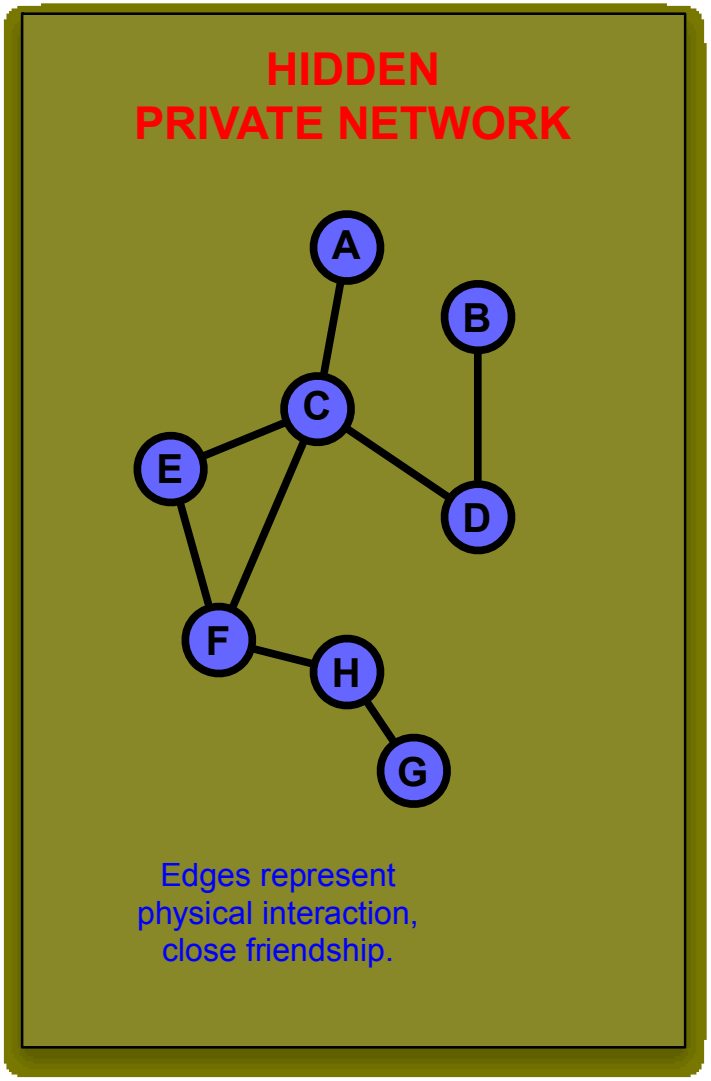
Discussion 1/2

- Relatively stable across evaluation period.
- Confound: Guild membership and age in game

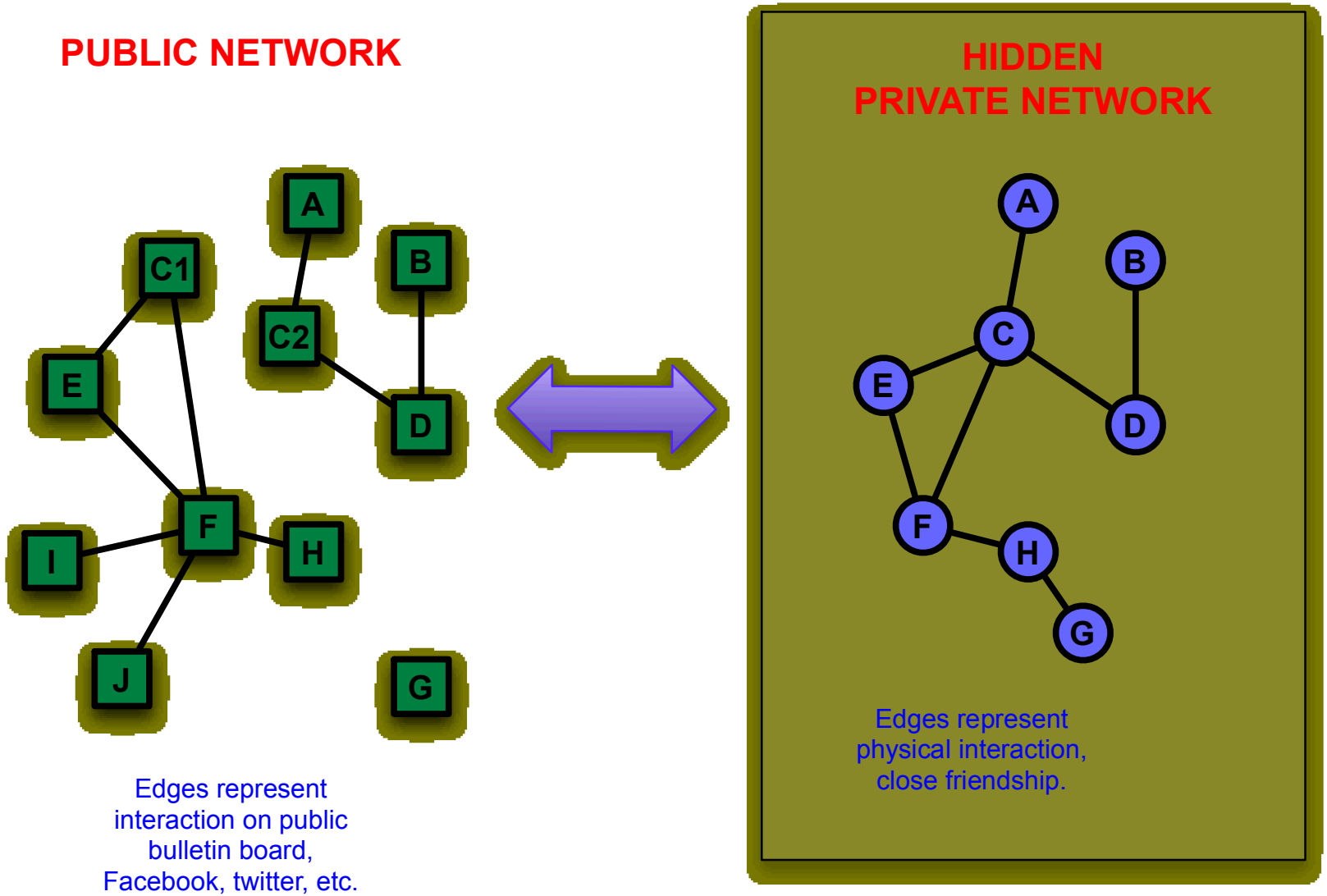
Communicators and Guild Membership



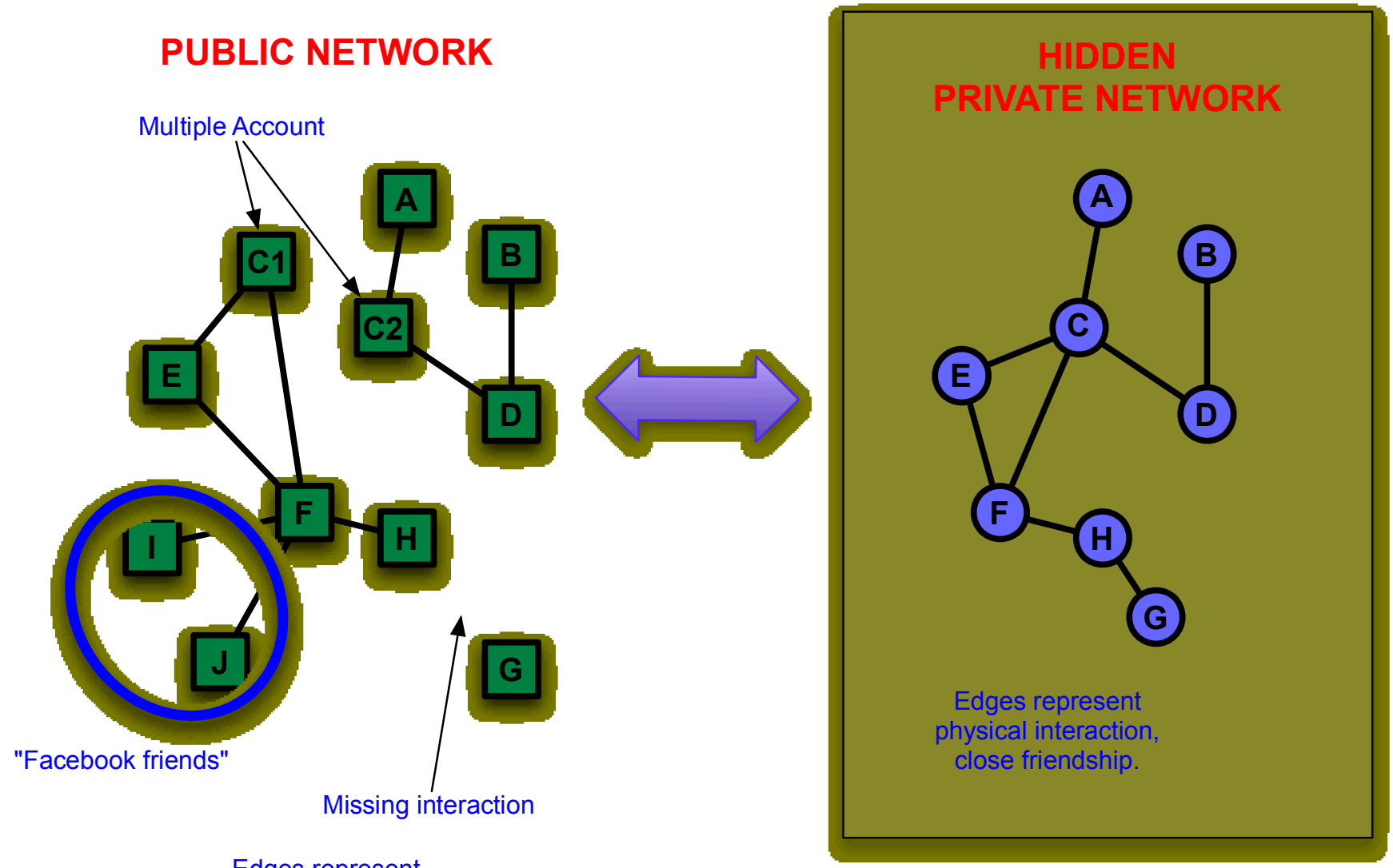
Private networks



Public network + private network



Public and private interaction



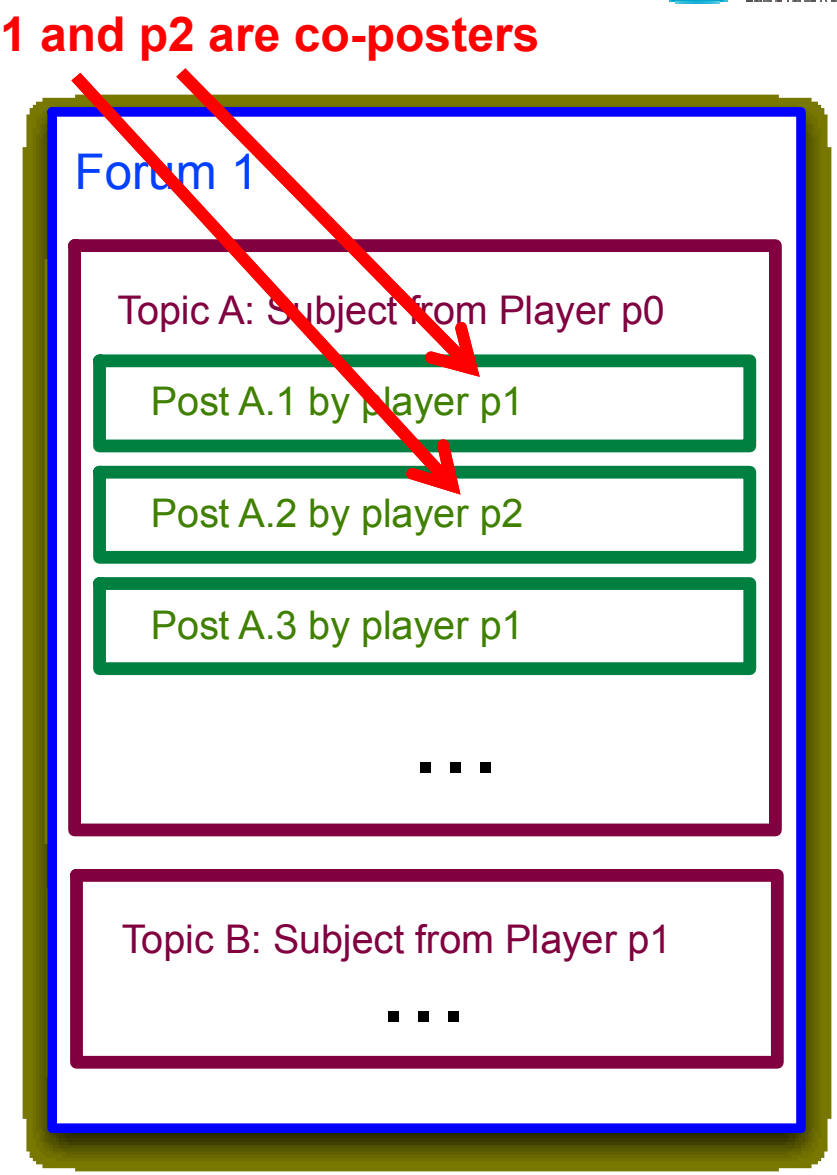
Research Question

What can we learn about private interaction networks from public interaction networks?

- Similar question: Predicting tie strength (Gilbert, 2009)
- What do we need?
  - Public interaction
  - Private interaction/relationships

Coposting network

- Two players are “co-posters” IF:
  - They both post to the same topic.
- Represents a public “relationship”.
  - Players read through posts on topic and decide to post on:
    - Content
    - Other people who have posted.
- Generated the “co-poster” network over 50 days.



Private networks

- For each pair of co-posters identify private interactions/relationships:
  - Are the players in the same **NATION**?
  - Are the players in the same **GUILD**?
  - How many **PERSONAL MESSAGES** between the players?
  - How many **TRADES** between the players?
  - Are the players **FRIENDS**?
  - Are the players **HOSTILE**?
- Calculates the “overlap:
  - Fraction of co-poster pairs that also have a private interaction/relationship.
  - Co-poster threshold: How many topics the players posters on.

Link Overlap Measure

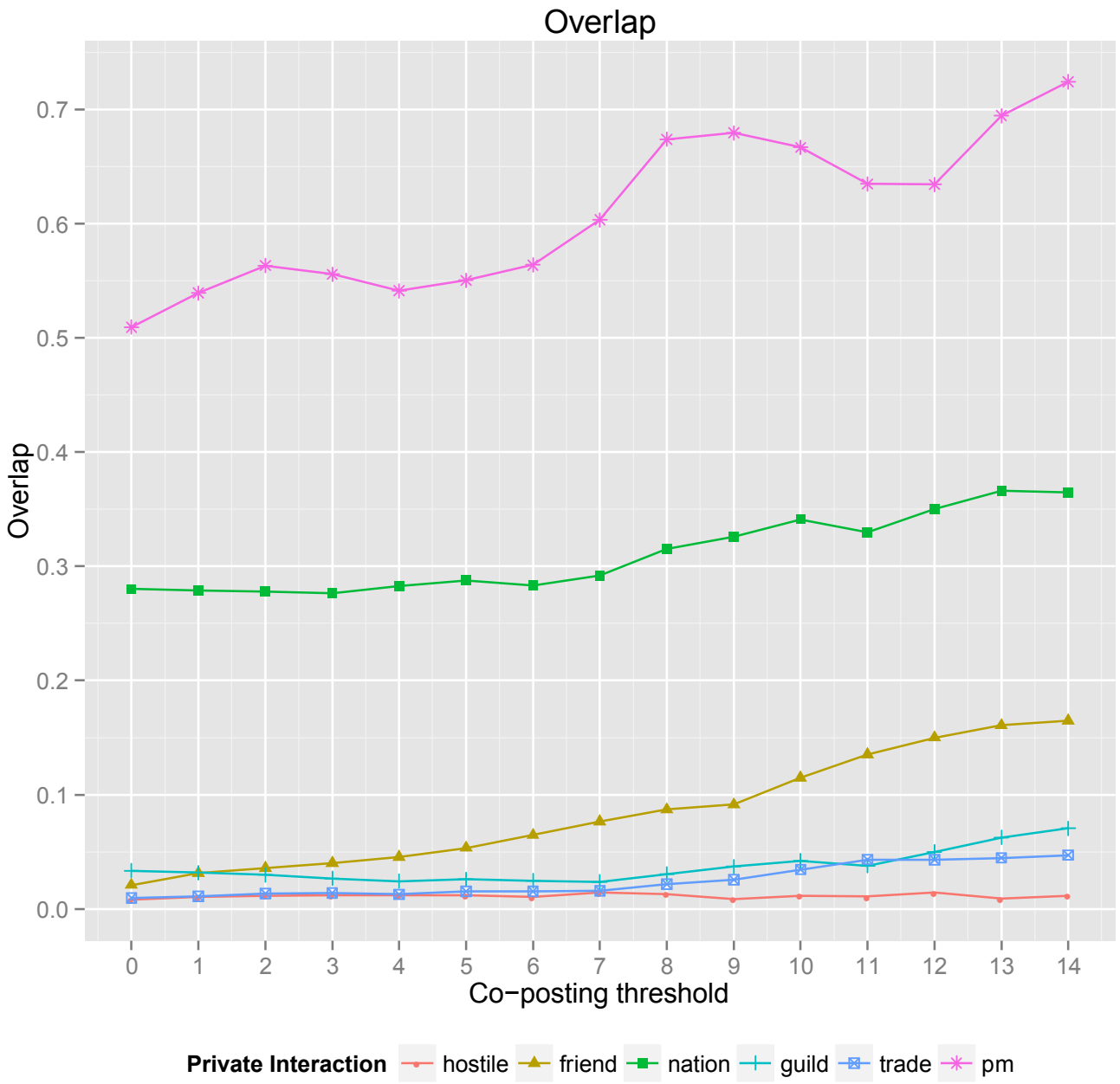
$L_R(x) =$ Link overlap on relationship R

$$L_R(x) = \frac{1}{|N(x)|} \sum_{i,j \in N(x)} M_R(i,j)$$

Where:

$$M_R(i,j) = \begin{cases} 1 & \text{If (i,j) satisfy the relation } R \\ 0 & \text{otherwise} \end{cases}$$

$N(x) =$ Set of all edges in G_{cp} with weight greater than x


Overlap
Overlap
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Co−posting threshold
Private Interaction
hostile
friend
nation
guild
trade
pm

What does it mean?

- Approximately 50-70% of public interaction edges reflect personal message interaction.
- Only 15% of public interaction edges reflect friendship ties.

- A beginning to understanding how public interaction networks reflect private interaction networks.

Thanks

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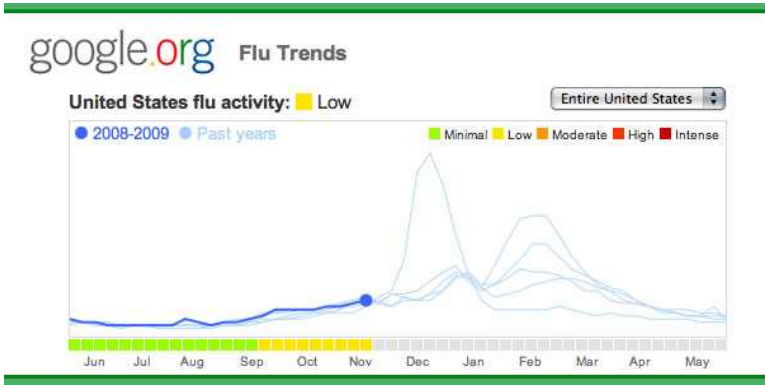
Google Flu

- Google uses flu related searches to predict flu activity.
- 2012 season Google predicted 11%, CDC predicted 6%.
- What happened?
  - People were searching for flu even though they didn't have it.
- Can use individual level behaviors to modify algorithms!

Google™ & the Flu



National Security Case Study: Espionage & EVE Online

- EVE Online Traits
  - Formed by players to seek economic & political advantages amongst other corporations
  - Collect taxes & develop infrastructure to support their own
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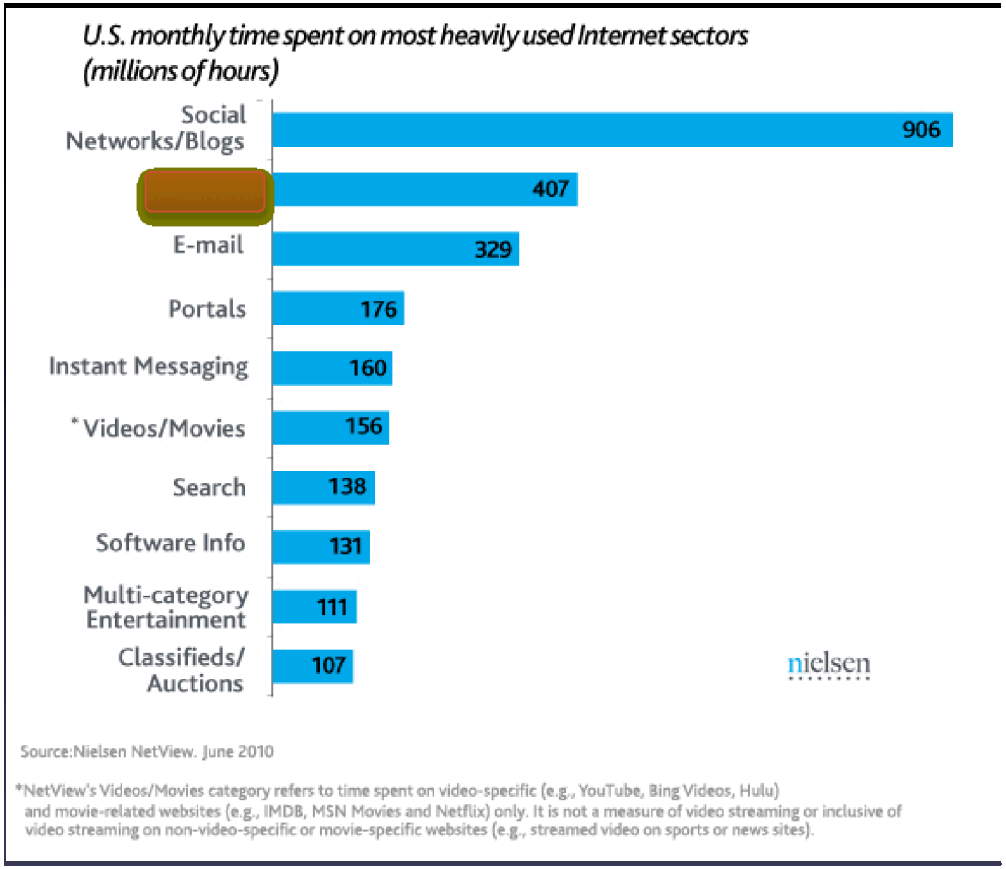
Rising Popularity of MMOGs



Rising Popularity of MMOGs

- MMOGs popularity not limited to first world nations
  - *Travian:* Active player population over 50,000
  - Popularity of *Travian* website by region[1]:
    - 7th: Iran
    - 9th: Libya
    - 5113th: USA
- [1] https://www.strategicsocial.com/archives/861

What can we do with game data?

- Calibration/parameterization: Use game data to calibrate existing algorithms.
  - Google Flu
  - Using game data to help calibrate the Generic Threat Matrix (GTM).
  - Behavioral Influence Assessment.
- Understanding online social systems
  - Games as a type of social media.
- Dynamics
  - Rapid evolution of social structures.
  - We can study the emergence, rise, and fall of organizations all within a short amount of time.

What makes studying games difficult?

How does player in-game behavior relate to real-world behavior?

- Similar questions can be asked of “traditional” social media
  - Facebook friends vs. real friends.
- If player behavior in game is random, does it tell us anything about how people will behave in the real world?

What makes studying games difficult?

How do we understand and make inferences over the actions of thousands of players over long time scales with many types of activities?

- Multi-modal data set
  - “Kinetic” Actions: Combat
  - Economic Actions: Trading
  - Communicative Actions: Public forums, private chat channels.
- Twitter, etc are predominantly one mode, often communication.

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