Center of Attention
How Facebook Users Allocate Attention across Friends

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Outline

• Motivation and introduction
• Data and quantities of interest
• Balance of attention
  • Relation to activity and network size
  • Individual variation
  • Intergroup variation
• Temporal shifts in attention
• Conclusion
Motivation and Introduction
Motivation

▪ How does attention to our important friends change as online social networks become larger and more active?

▪ Urban experience:
  ▪ Milgram (1970): more interactions diminishes time spent interacting with any one individual
  ▪ Mayhew and Levinger (1976): model assumes a uniform decrease in attention as a function of interaction volume

▪ Not a priori obvious how increased number of interactions or network size impacts the amount of attention given to any particular individual

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The Angle

▪ Our Claim:
  ▪ Attention is allocated differently across friends
  ▪ Increased activity does not necessarily mean core contacts receive less attention

▪ Measure what % of attention is allocated toward a core set of friends
  ▪ Requires complete information about all interactions

▪ Consider both communication and observation interactions
Data and Setup
Data

▪ 16M heavily engaged users on Facebook

▪ All interactions over one year (2010):
  ▪ Communication
    ▪ messages sent
    ▪ comments given
    ▪ wall posts left
  ▪ Observation
    ▪ profile views
    ▪ photo views
Quantities of Interest

- $a_k$: Fraction of attention devoted to rank $k$ friend

- $f_k$: Fraction of attention devoted to top $n$ friends

- Activity: total number of interactions along a modality

- Network size: number of users interacted with
Volume of Activity

- Approximately 1 order of magnitude more observation than communication interactions

- Plot data in terms of activity percentile

![Graph showing the volume of activity with various actions plotted against percentile.](image-url)
Attention \((a_k)\) by Rank

- Average attention toward top \(k\)th friend decreases rapidly with \(k\) \((a_k \sim k^{-0.75})\)

- More attention given to top communication friends compared to observation friends
The Balance of Attention
Attention and Activity

▪ Consider the total fraction of attention given to top 15 friends

▪ Large increases in activity level do not lead to large changes in how much attention is allocated to top $k$ friends
Activity and Network Size

Profile views

Comments

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Individual Variation
Gender

Gender

Profile Photo Comments Messages Wall

Attention toward top 5

Gender

F M F M F M F M

F M

F M

F M

F M

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## Distributional Differences in Gender

<table>
<thead>
<tr>
<th>Number of Contacts</th>
<th>Comments</th>
<th>Profile views</th>
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<tr>
<td></td>
<td>Median</td>
<td>Mean</td>
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<td>F</td>
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<tr>
<td>M</td>
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<tr>
<td>F/M</td>
<td>1.2x</td>
<td>1.1x</td>
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<table>
<thead>
<tr>
<th>Number of Actions</th>
<th>Comments</th>
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<td>Mean</td>
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<tr>
<td>F</td>
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<td>638</td>
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<tr>
<td>M</td>
<td>245</td>
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<tr>
<td>F/M</td>
<td>1.5x</td>
<td>1.3x</td>
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Explaining Individual Variation

- Gender and age differences can be explained by different underlying distributions of network size and activity level.

Linear model of $f_5$ as a function of individual characteristics

<table>
<thead>
<tr>
<th></th>
<th>Intercept</th>
<th>Network Size</th>
<th>Activity</th>
<th>Age</th>
<th>Male</th>
<th>$R^2$</th>
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<tbody>
<tr>
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<td>0.02</td>
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<td>0.21</td>
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<td>0.01</td>
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<td>Wall</td>
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<td>0.92</td>
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<td>0.62</td>
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</tbody>
</table>

N = 1,037,885; p < 0.0001

Continuous covariates are given in centered percentiles.
Intergroup Variation
Gender-Gender Interactions

- Females exhibit strong gender homophily in communication
  - Females send 68% of their messages to females
  - Males send only 53% to females

- Males and females both direct 60% of their profile views to females
Attention Between Genders - Messages

- Consider each individual's male and female target network separately.

- Attention more concentrated along across-gender communication, dispersed along within gender communication.

![Graph showing attention between genders](image)
Attention Between Genders - Messages

- Consider each individual's male and female target network separately.

- Attention more concentrated along across-gender communication, dispersed along within gender communication.

- Effect is stronger for females.
Attention Between Genders - Profile Views

- Females and males have similar focus in attention when viewing females.

- Focus is much higher for females viewing male profiles.

![Activity percentile graph](image)
Best Friends... Forever?

▪ Do more interactions lead to less stable relationships?

▪ Measure number of top-10 friends that remain top-10 from one two-month period to the next

▪ Comments and profile views most stable, potentially as a result of feed
Conclusion

- Proposed a measure of attention based on how an individual distributes her interactions among friends
  - Allows for easy comparison between among different modalities

- How an individual divides their attention is a stable property of the individual, and is different across age and gender
  - Differences can be partly captured by activity and network size

- Attention is divided differently within and between genders

- Greater levels of activity are associated with stability
Thanks

- Collaborators:
  - Lars Backstrom
  - Jon Kleinberg
  - Tom Lento
  - Itamar Rosenn
Questions?