Structural diversity in social contagion

Lars Backstrom (FB), Cameron Marlow (FB), Jon Kleinberg

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Cornell University
NetSci 2012
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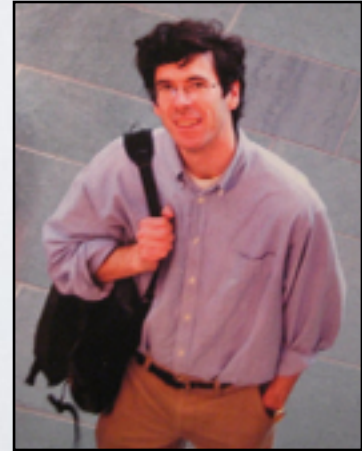
Contagion

Epidemic contagion: the spread of disease
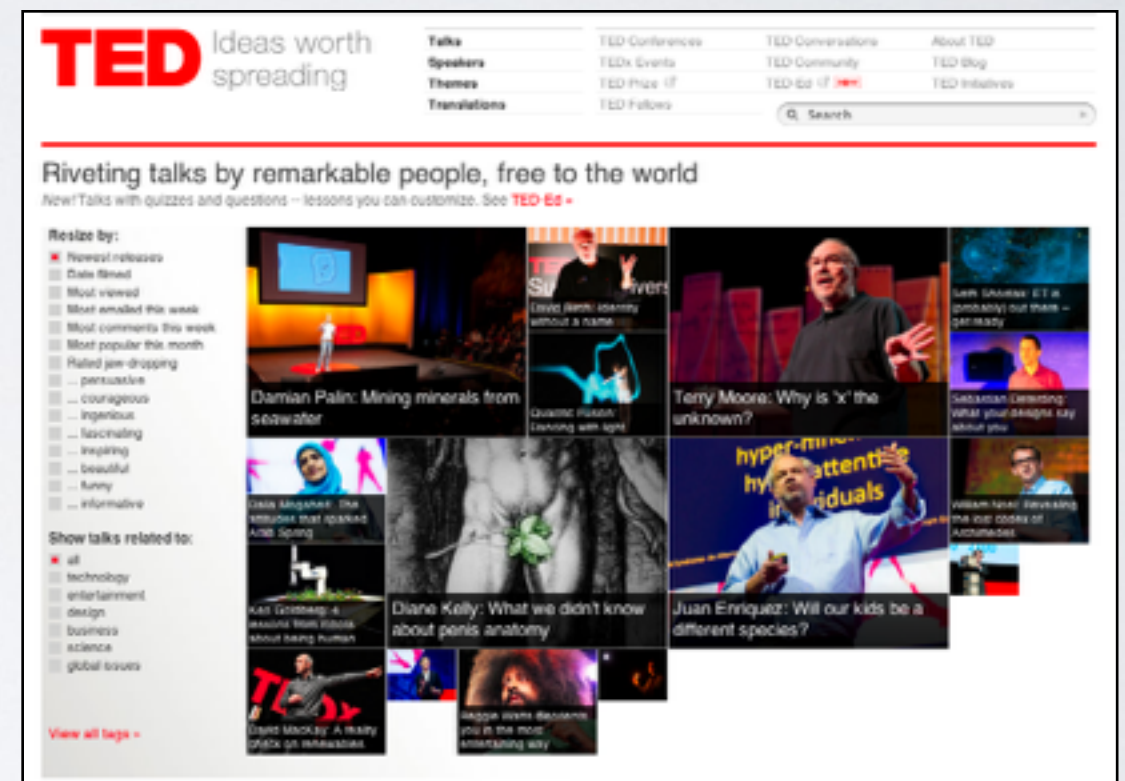
Social contagion: the spread of ideas

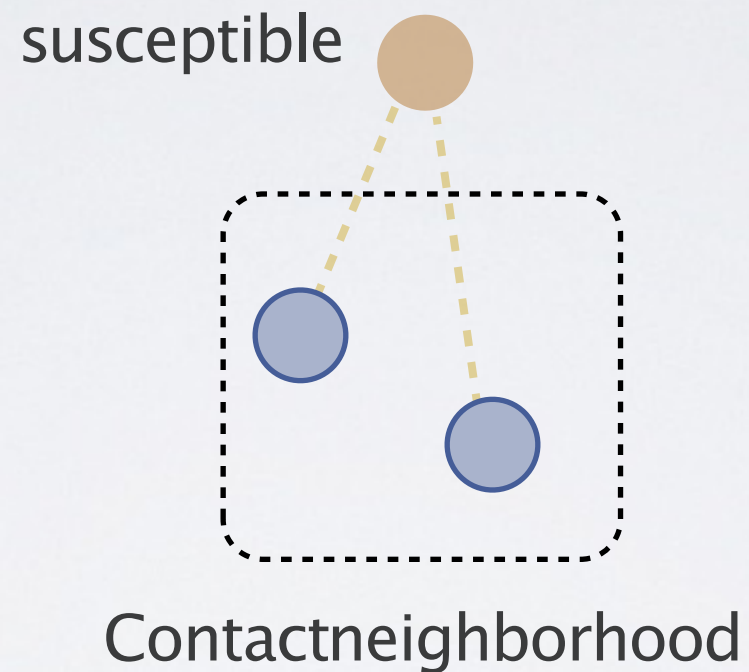# Social contagion: human decisions

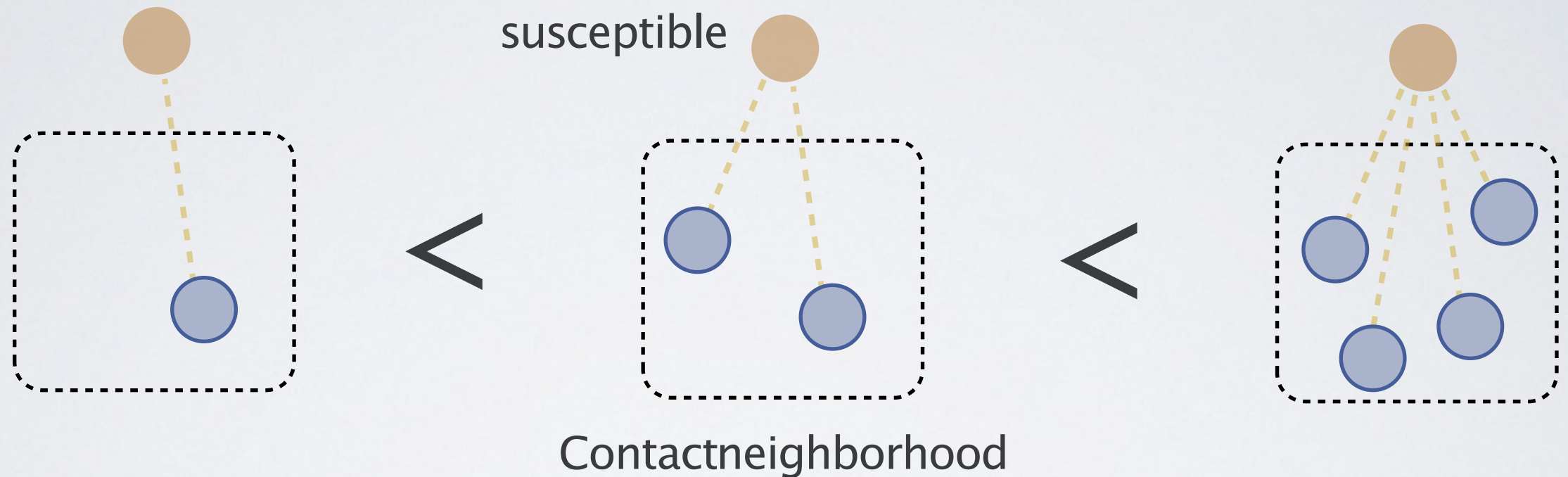Emerging technologies

Charitable causes

Consumer media

Social contagion

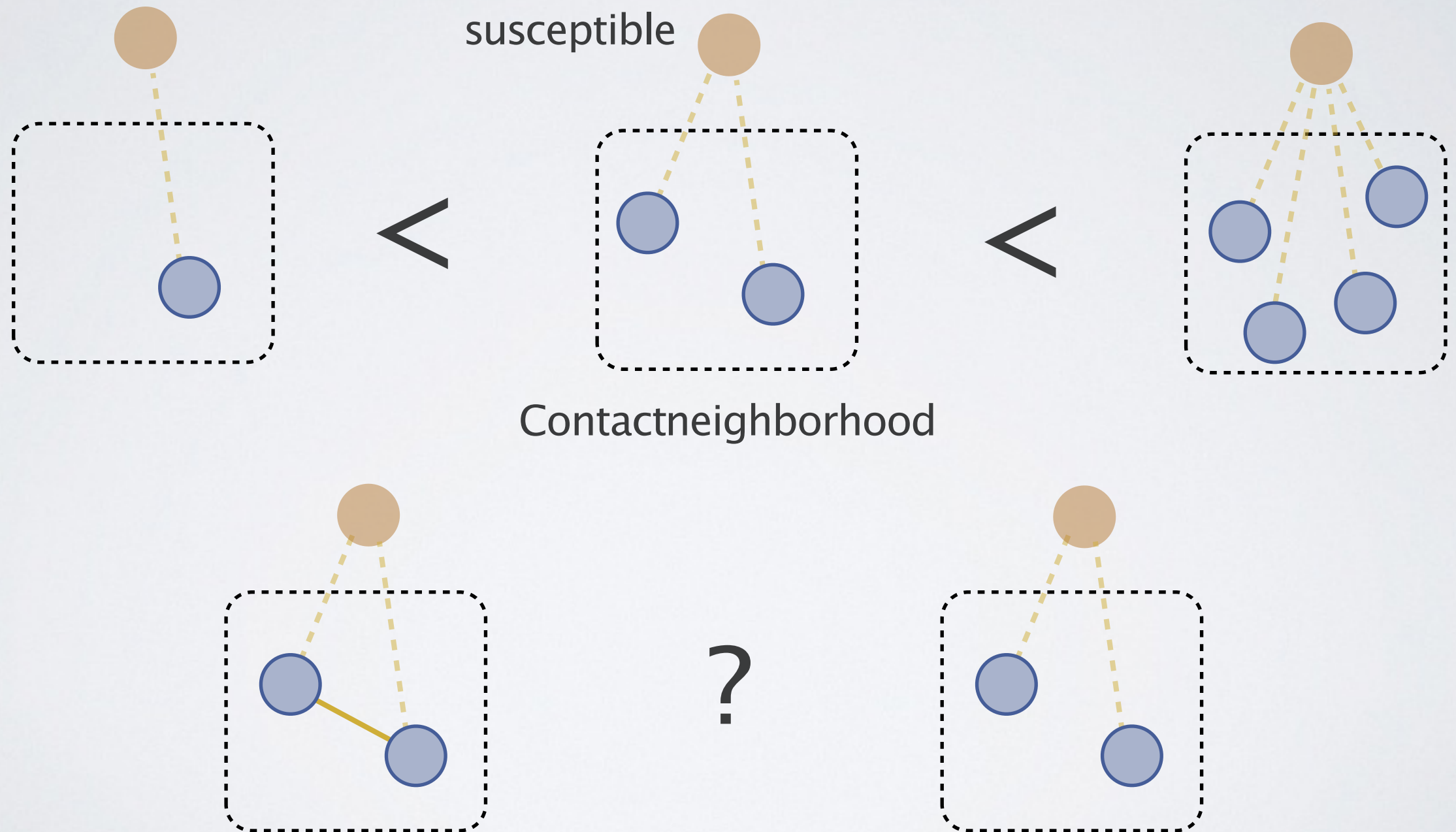- Adoption as a simple function of 'contact neighborhood' size:

susceptible

Contactneighborhood

Social contagion

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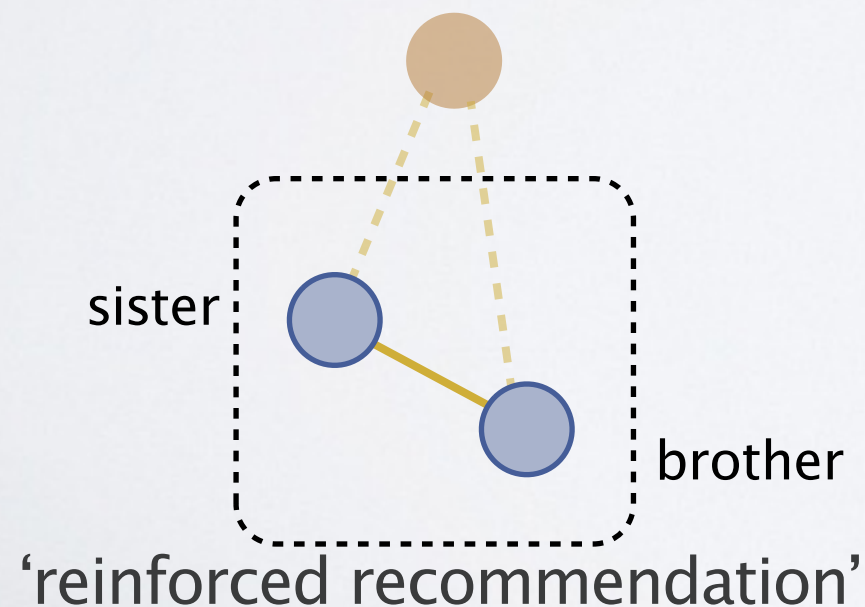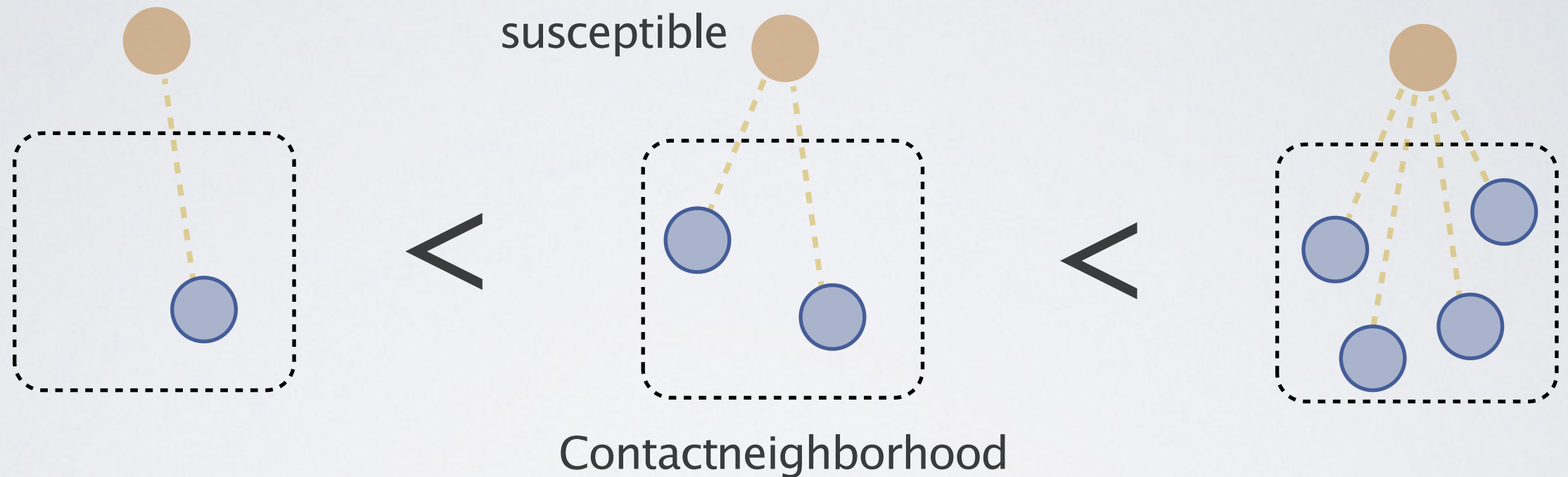
facebook

December 2010

Social contagion
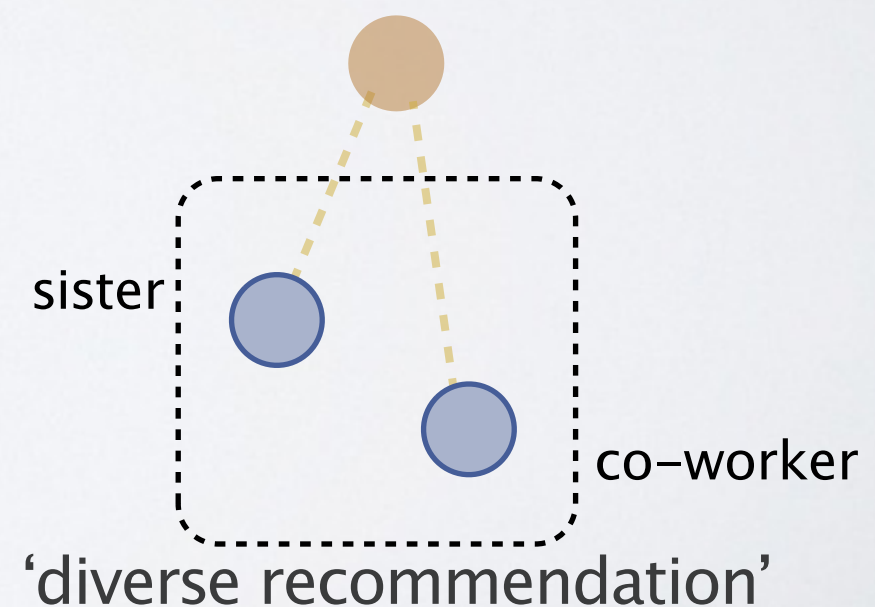
- The growth of Facebook has produced a wealth of data.

- Two questions.

Social contagion

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- Two questions.

    - **Does graph structure predict who will join Facebook?**

    - **Does graph structure predict Facebook engagement?**

Part I: Predicting recruitment

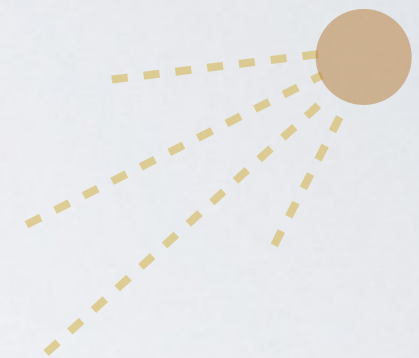Part II: Predicting engagement

Conclusions

Structural diversity in recruitment

- Email invitations to join Facebook: 54 million e-mail addresses.

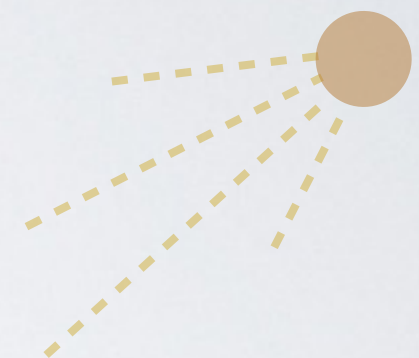- Examine contact neighborhoods **for first invite.**

susceptibleemail addre

Inviter

'Other PYMK'

Structural diversity in recruitment

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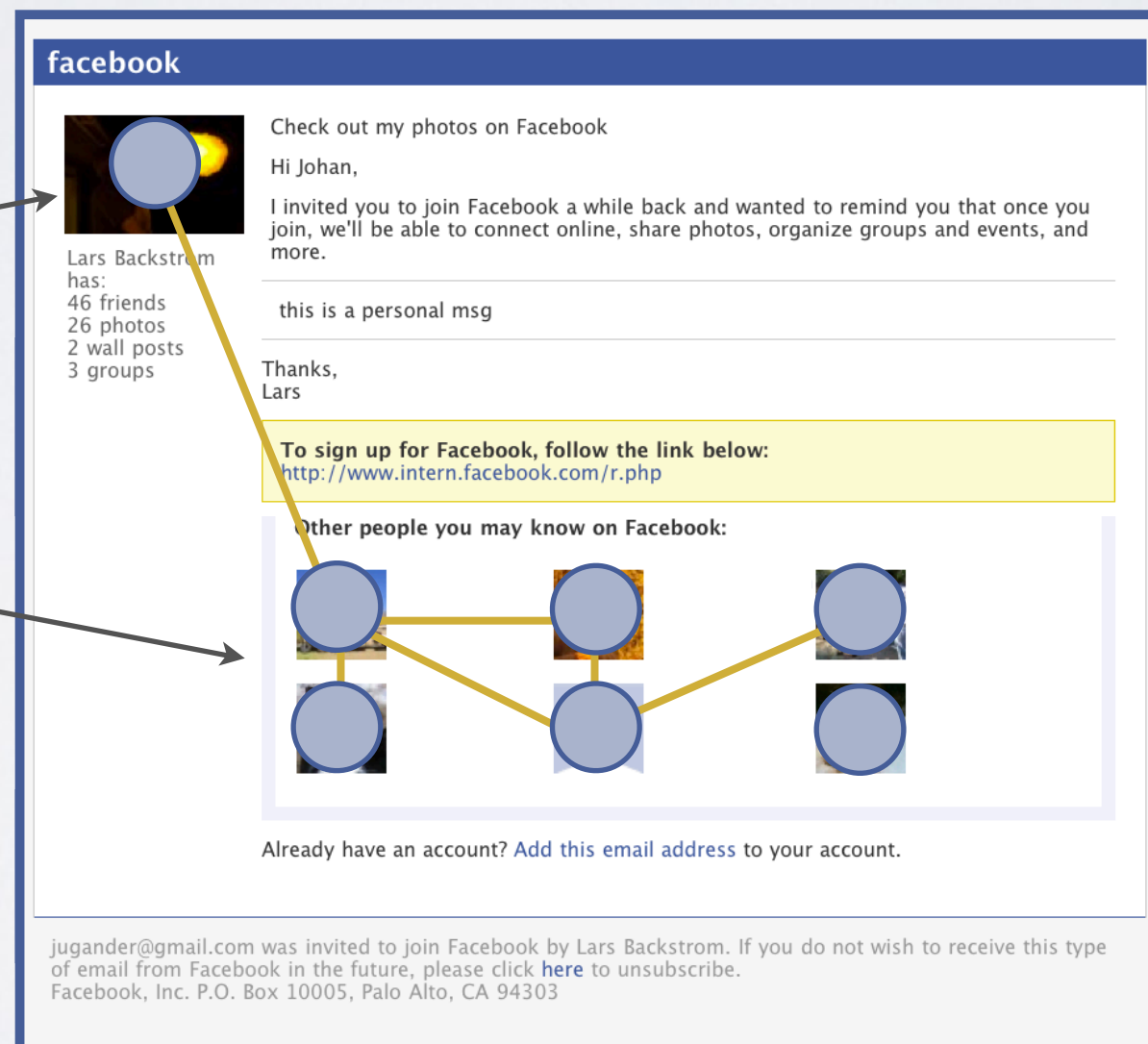- Examine contact neighborhoods **for first invite.**
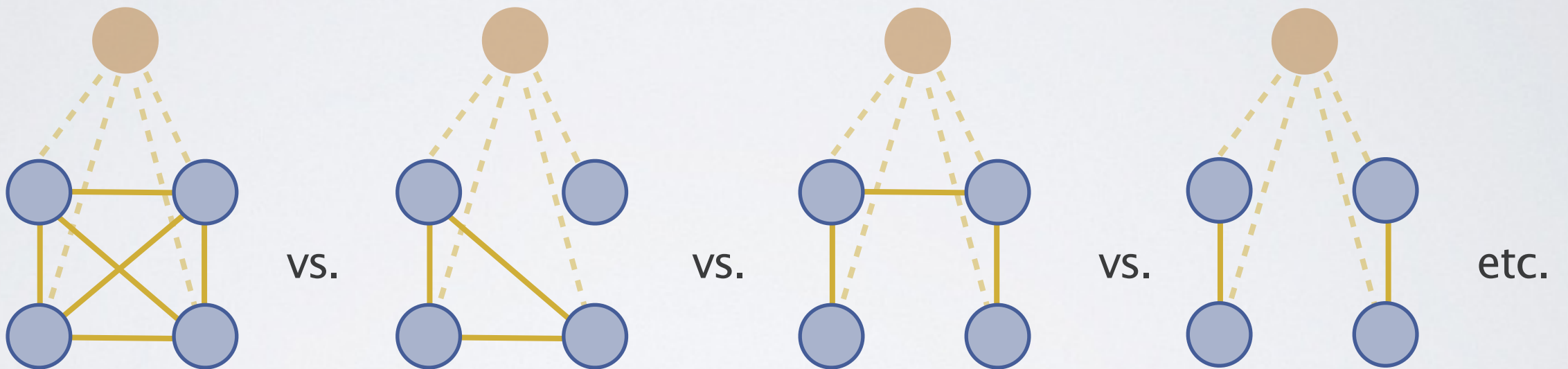
susceptibleemail addre

Inviter

+

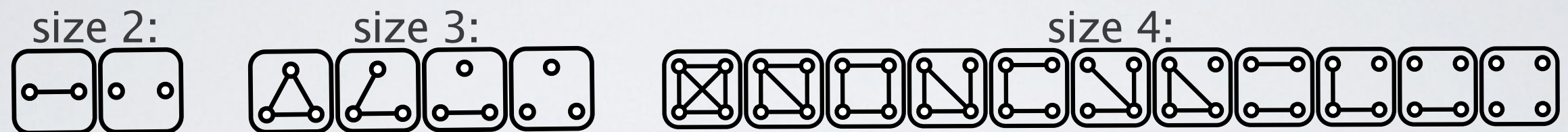'Other PYMK'

=

contact neighborhood

Structural diversity in recruitment

- Considering graph structure up to isomorphism:

Structural diversity in recruitment

- Conversion rate on invitation emails as a function of graph, "f(G)"?

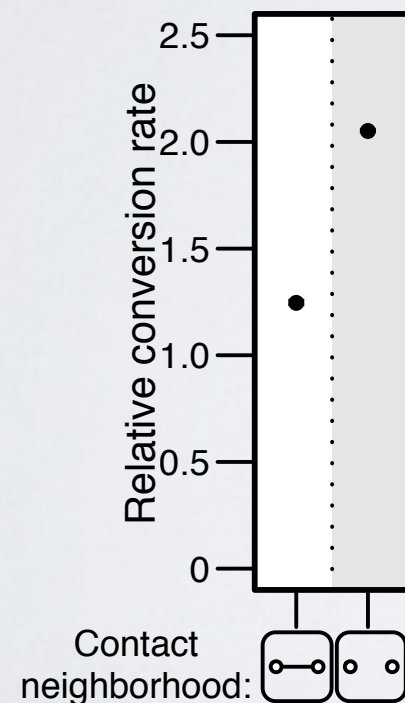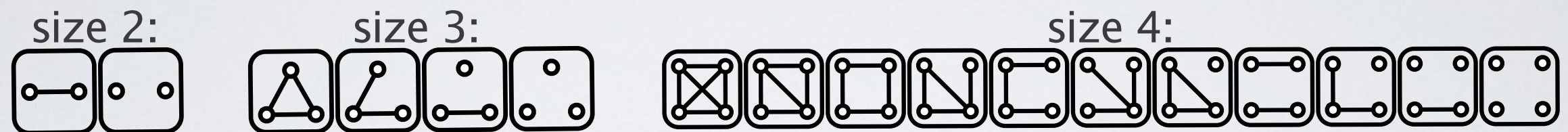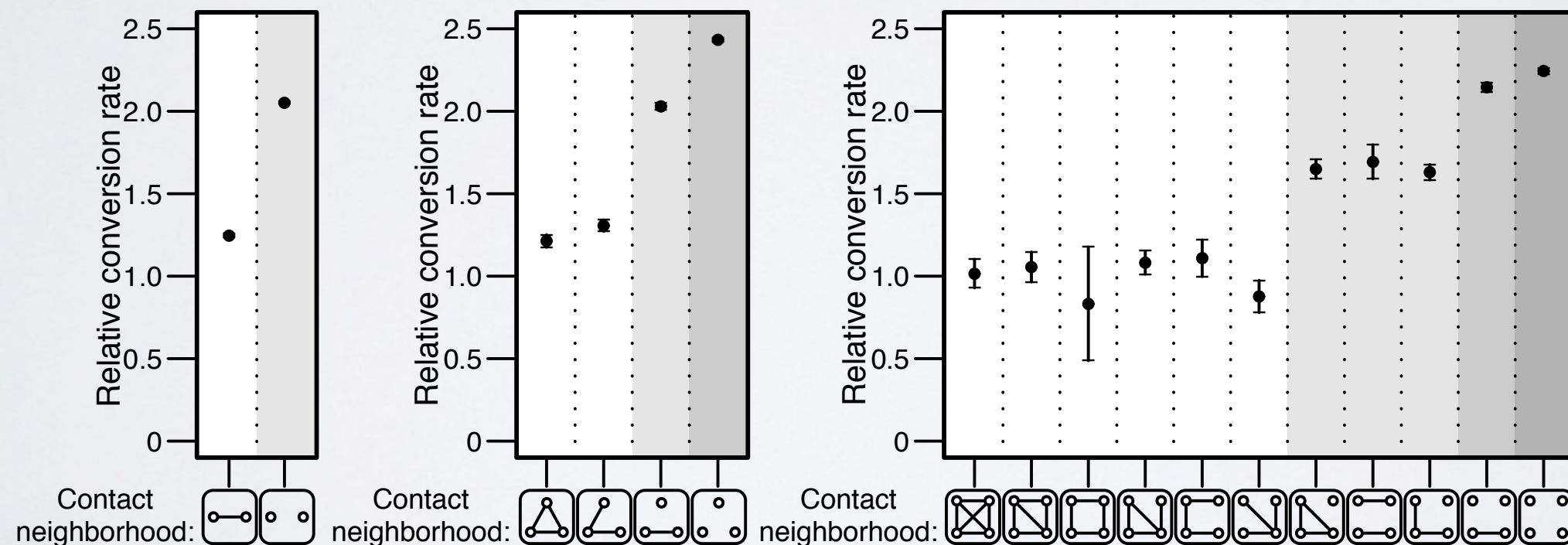size 2:   size 3:   size 4:

Structural diversity in recruitment

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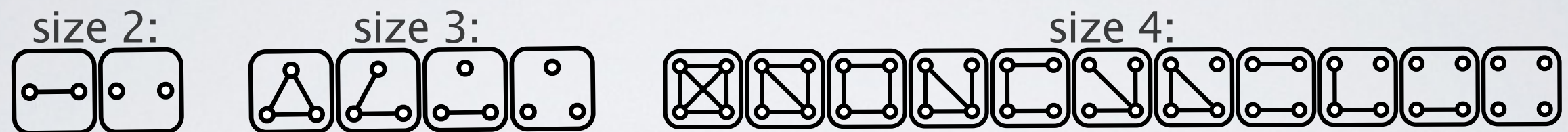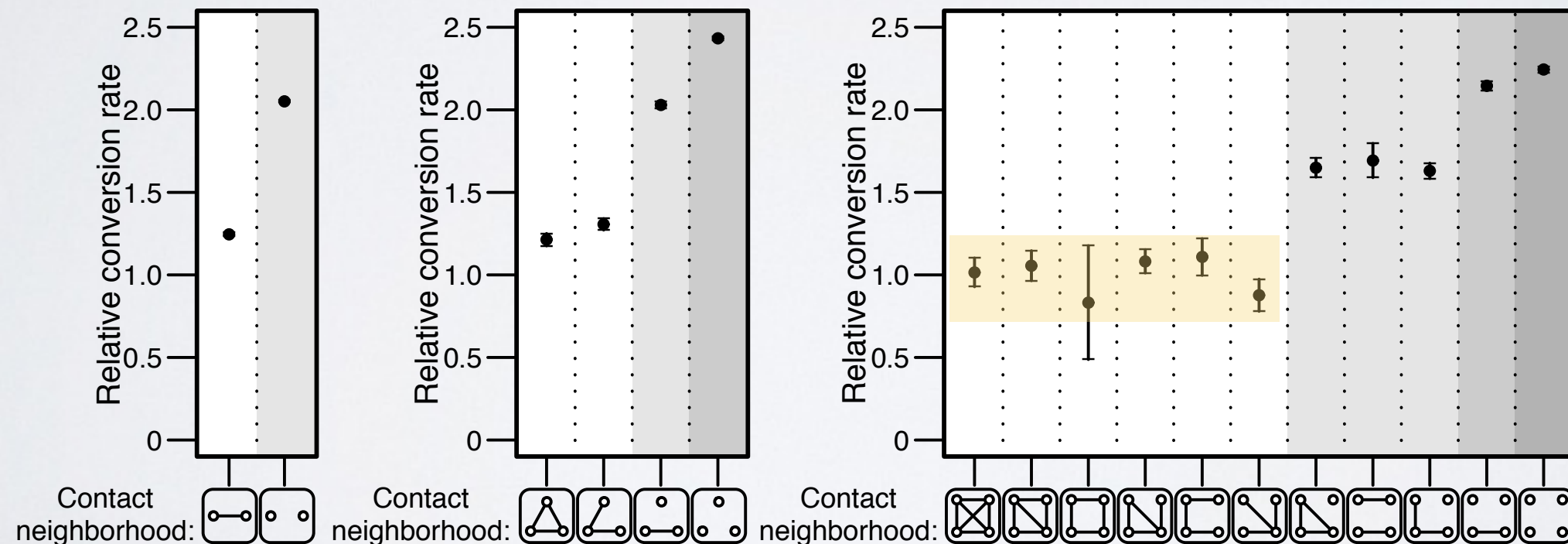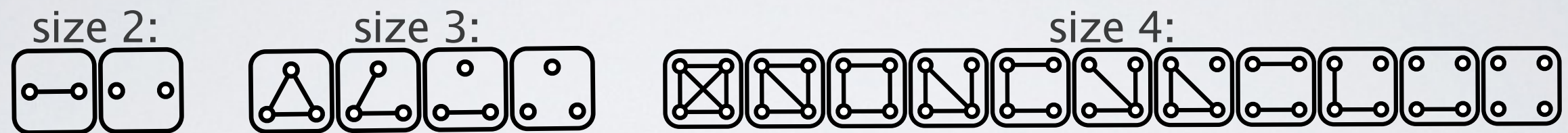size 2:   size 3:   size 4:

Structural diversity in recruitment

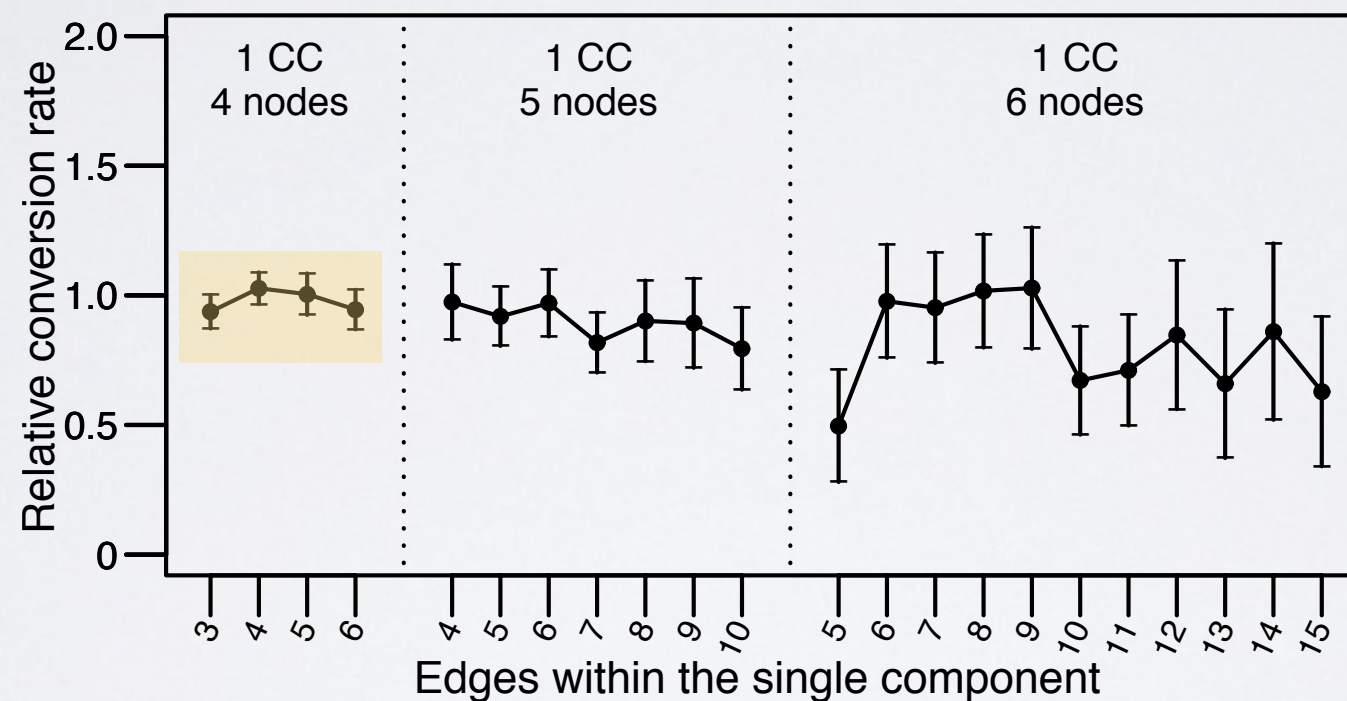- Conversion rate on invitation emails as a function of graph, "f(G)"?

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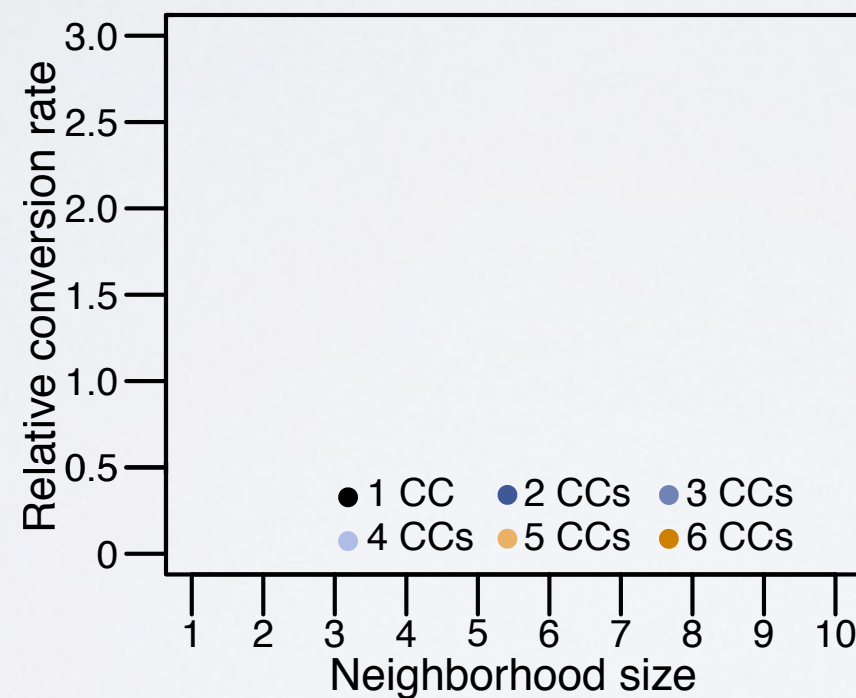- Conversion rate on invitation emails as a function of graph, "f(G)"?

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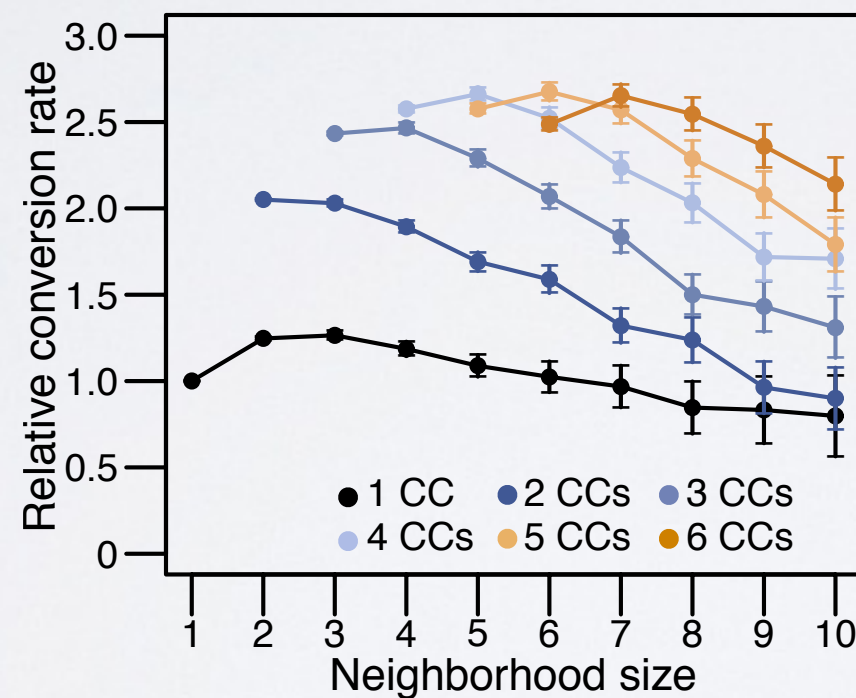- Single–component neighborhoods, recruitment by edge density:

Structural diversity in recruitment

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Structural diversity in recruitment

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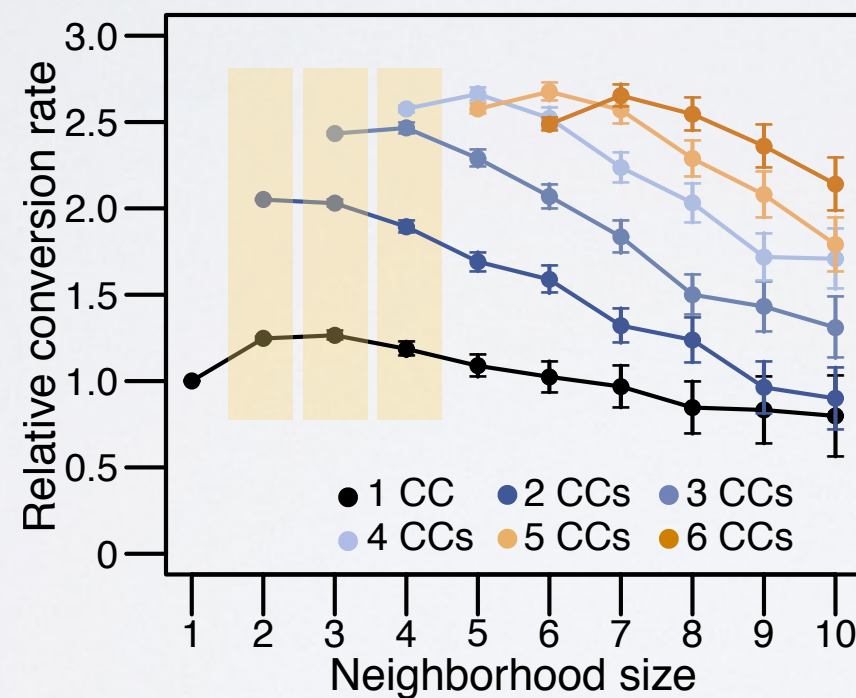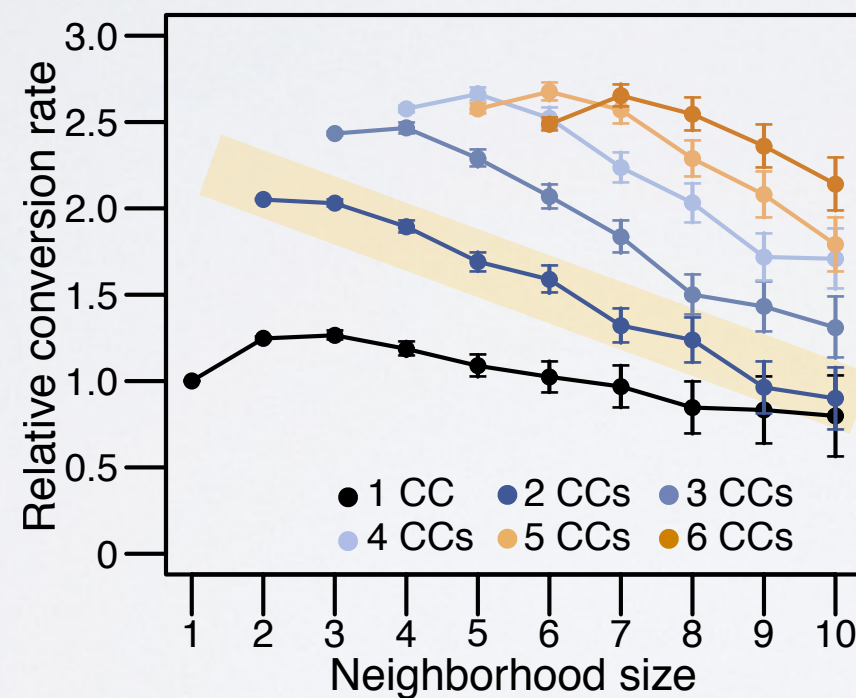
Structural diversity in recruitment

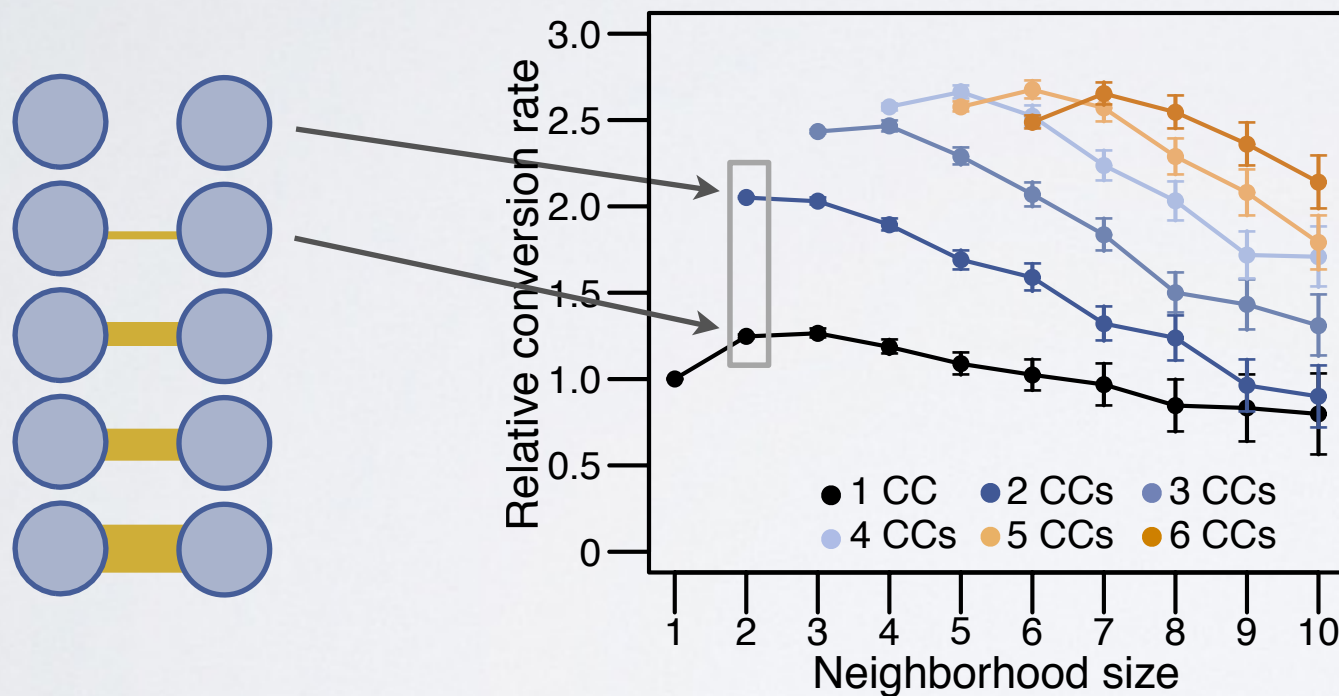- Connected component (CC) count fixed, recruitment by size:

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- Structure isn't just edges: what can we learn from **tie strength**?
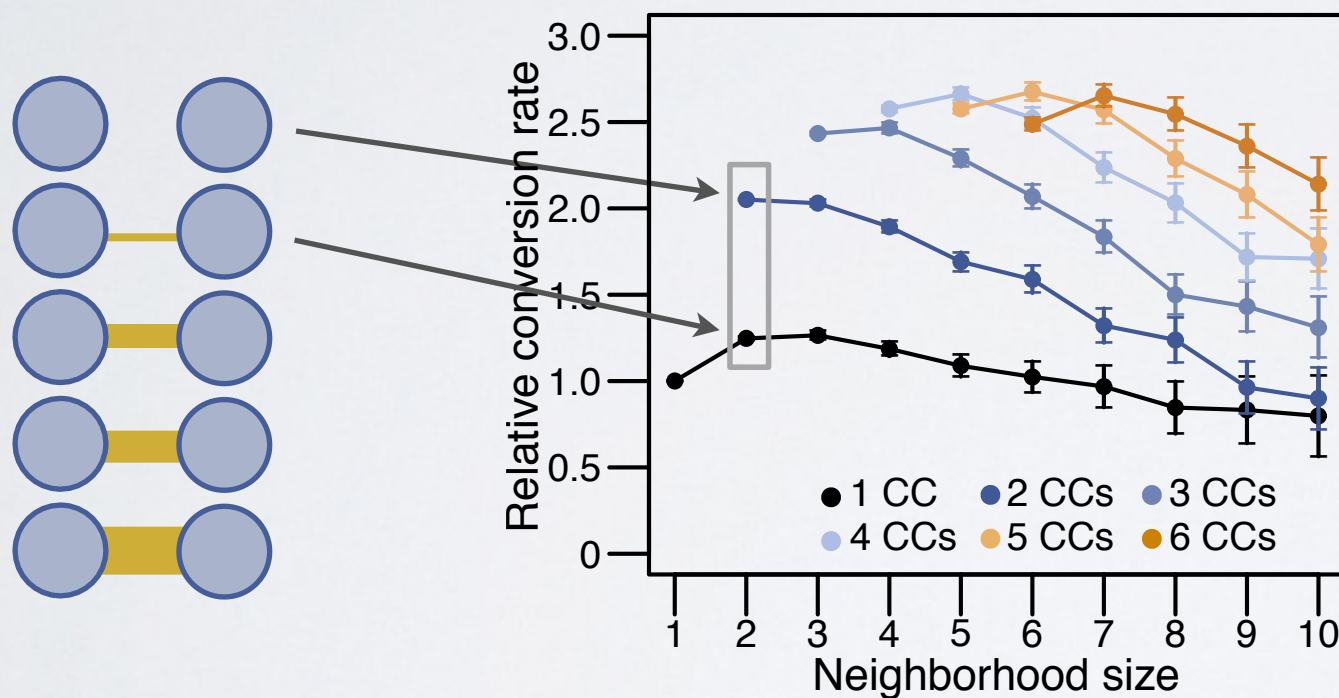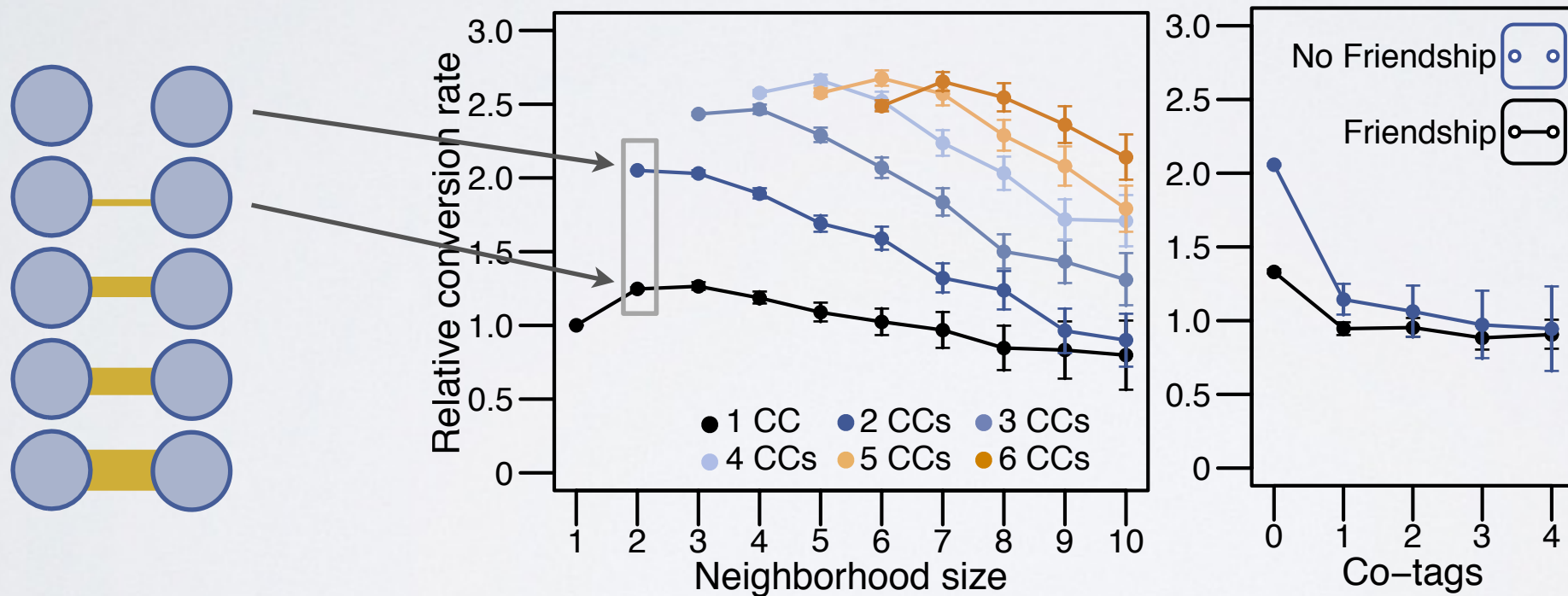
Structural diversity in recruitment

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co–tag

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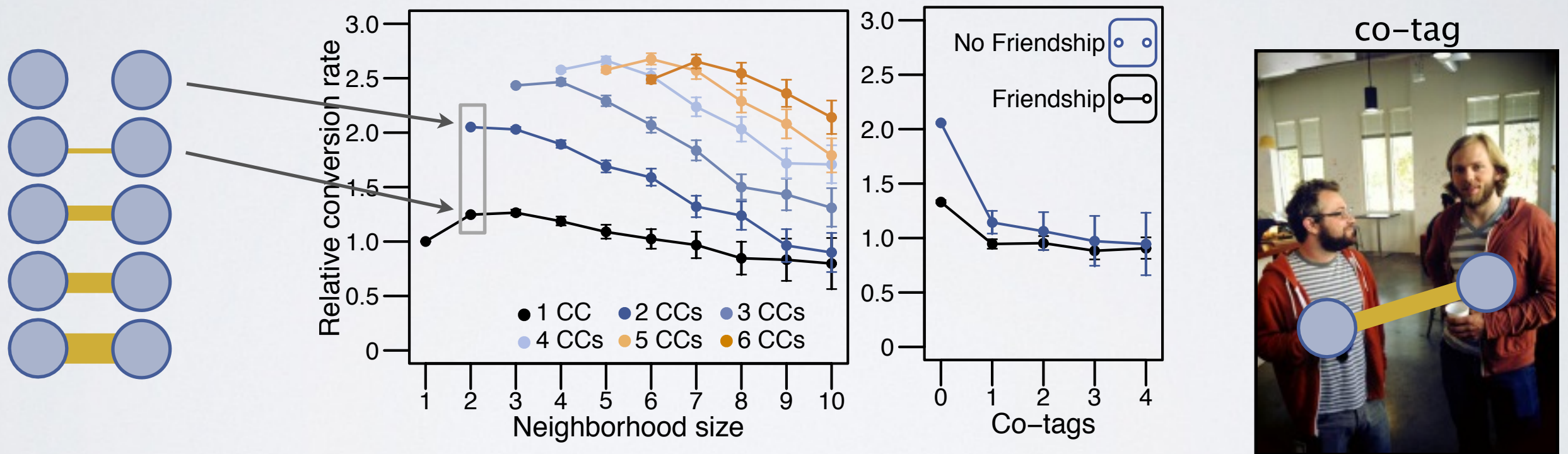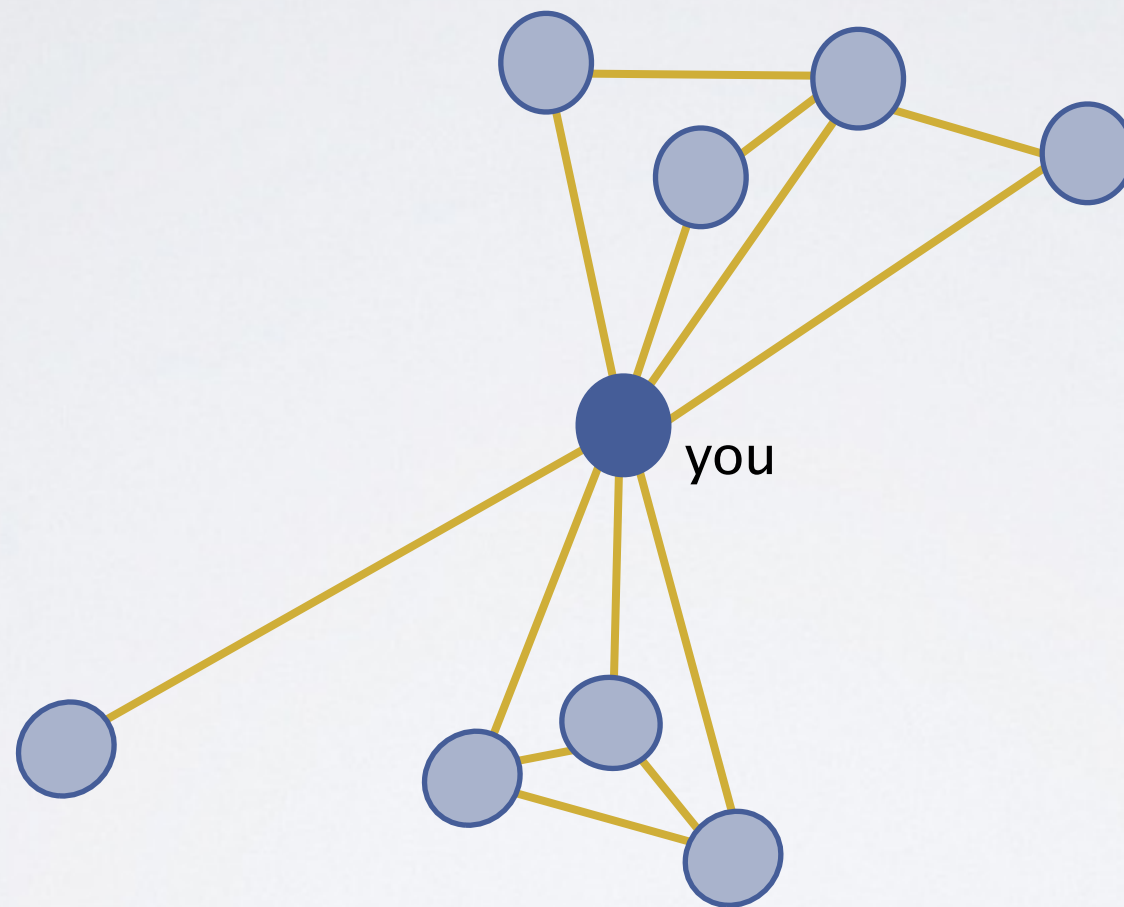

Conclusion: Substructure highly informative for predicting recruitment.
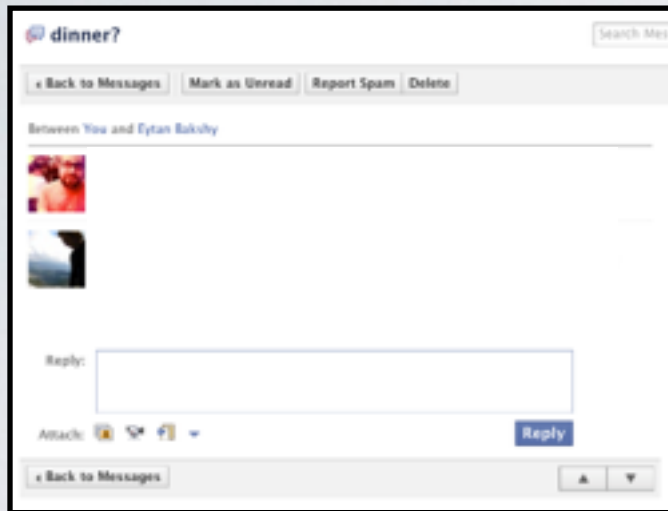
Part I: Predicting recruitment

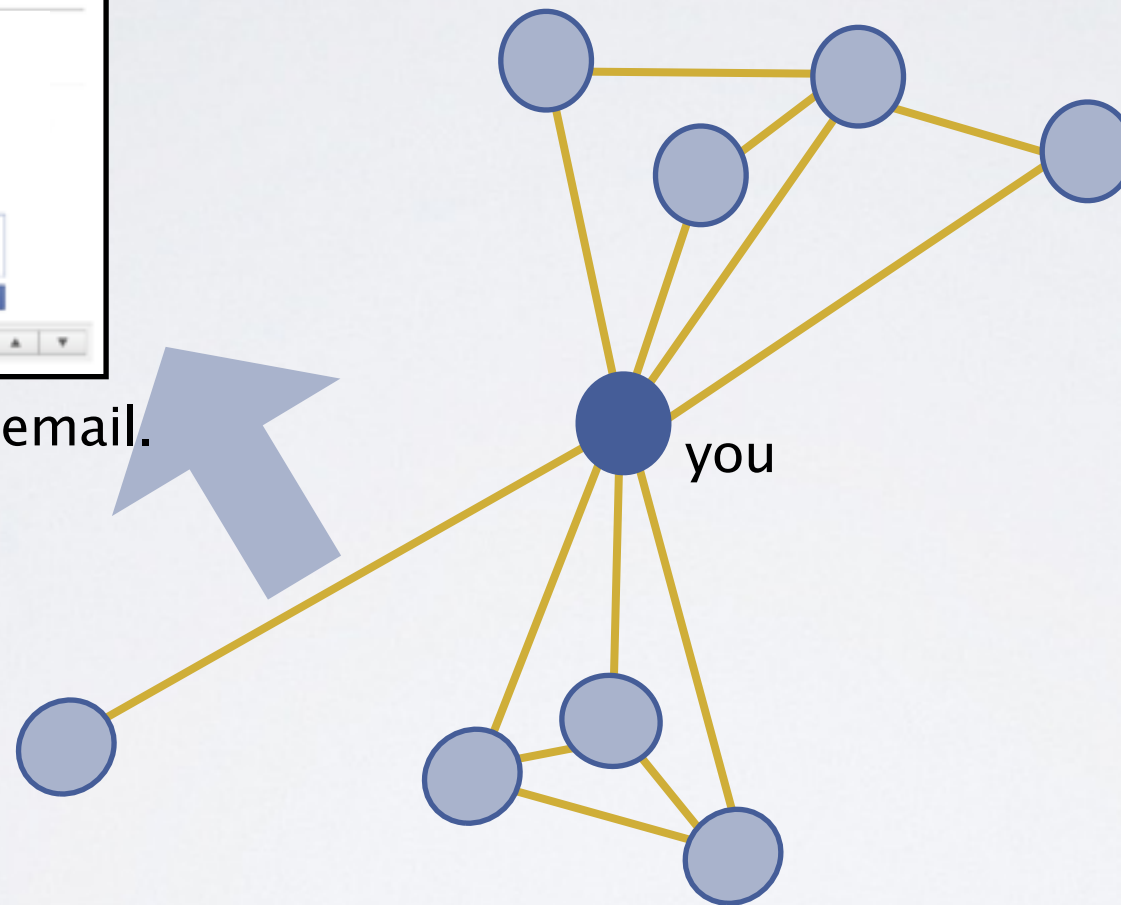**Part II: Predicting engagement**

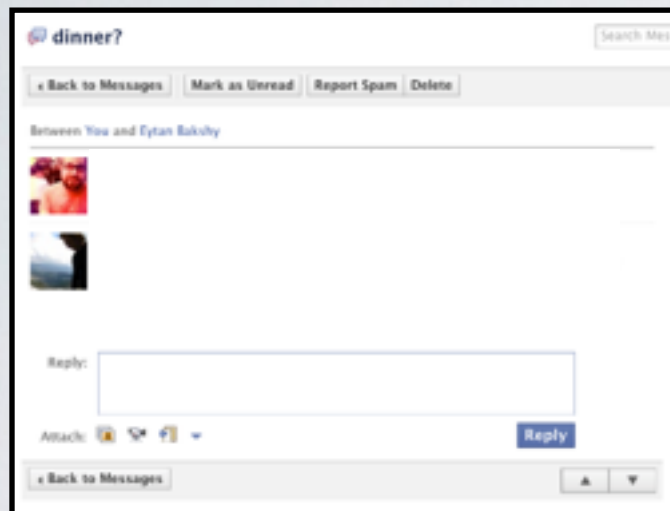Conclusions

Engagement: social utility
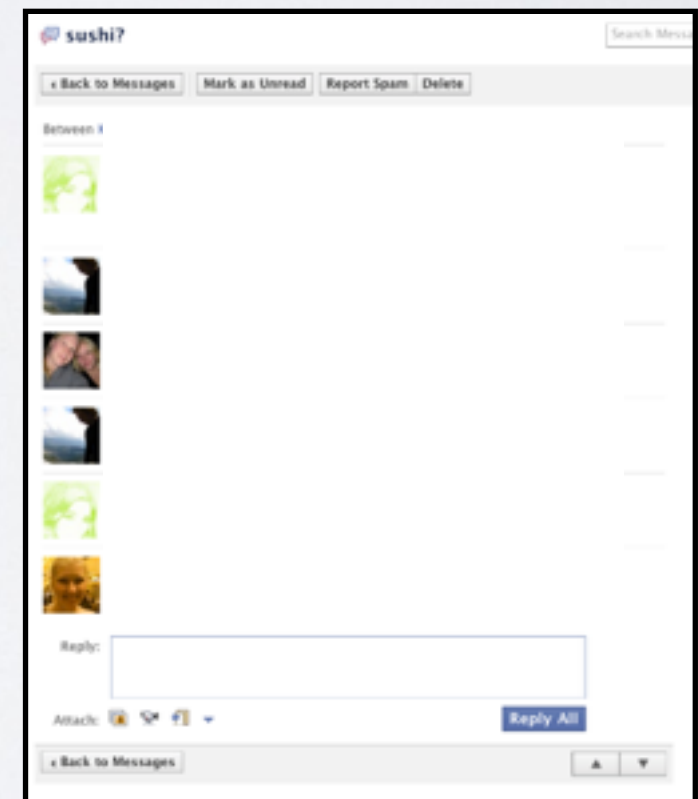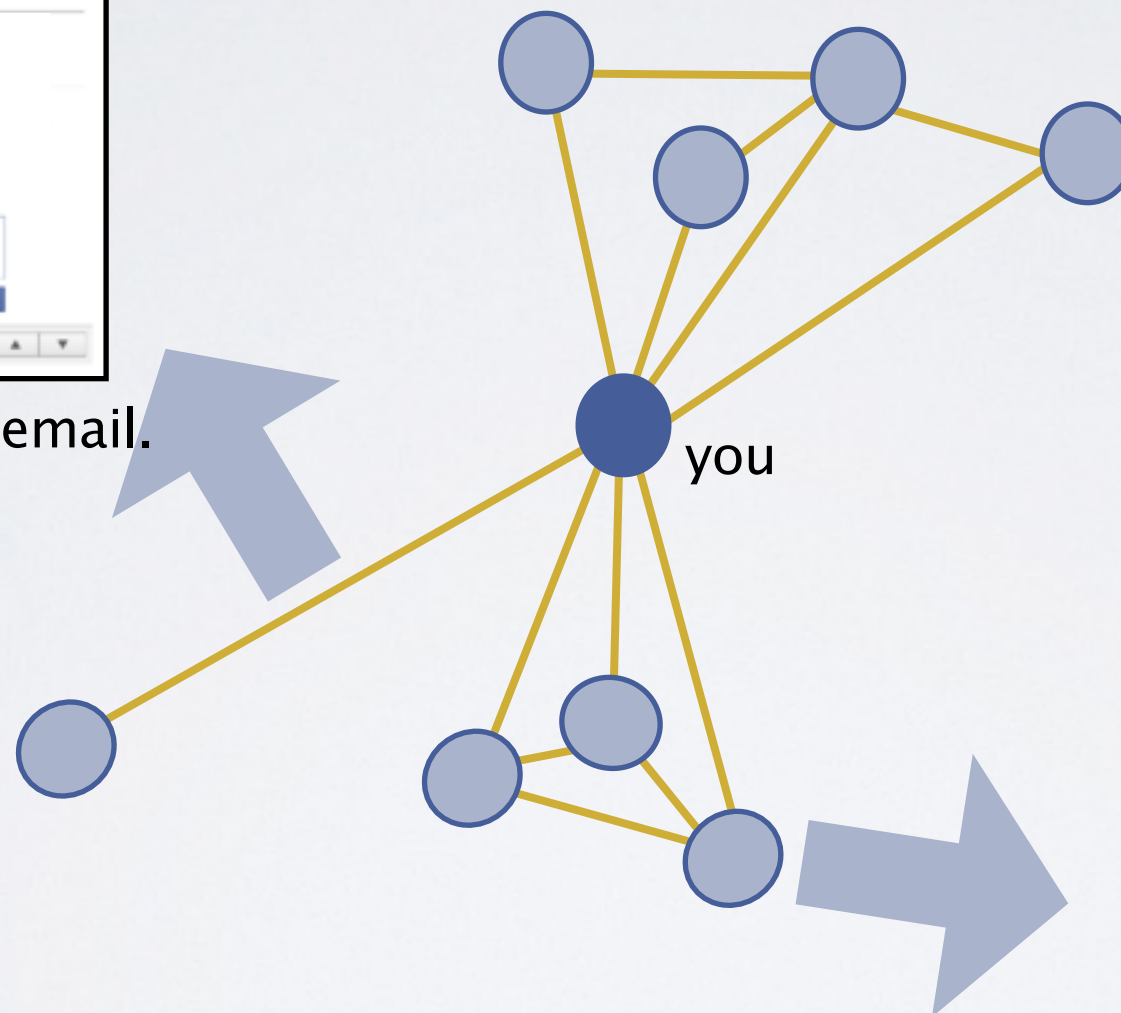

you

Engagement: social utility

Competing experience: email.
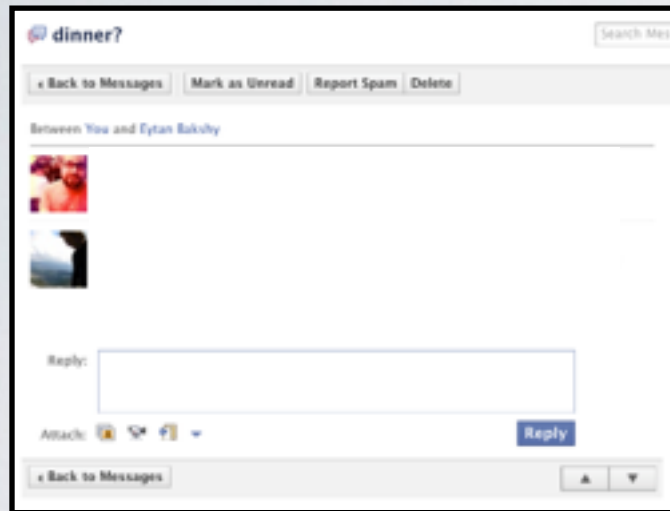
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Engagement: social utility

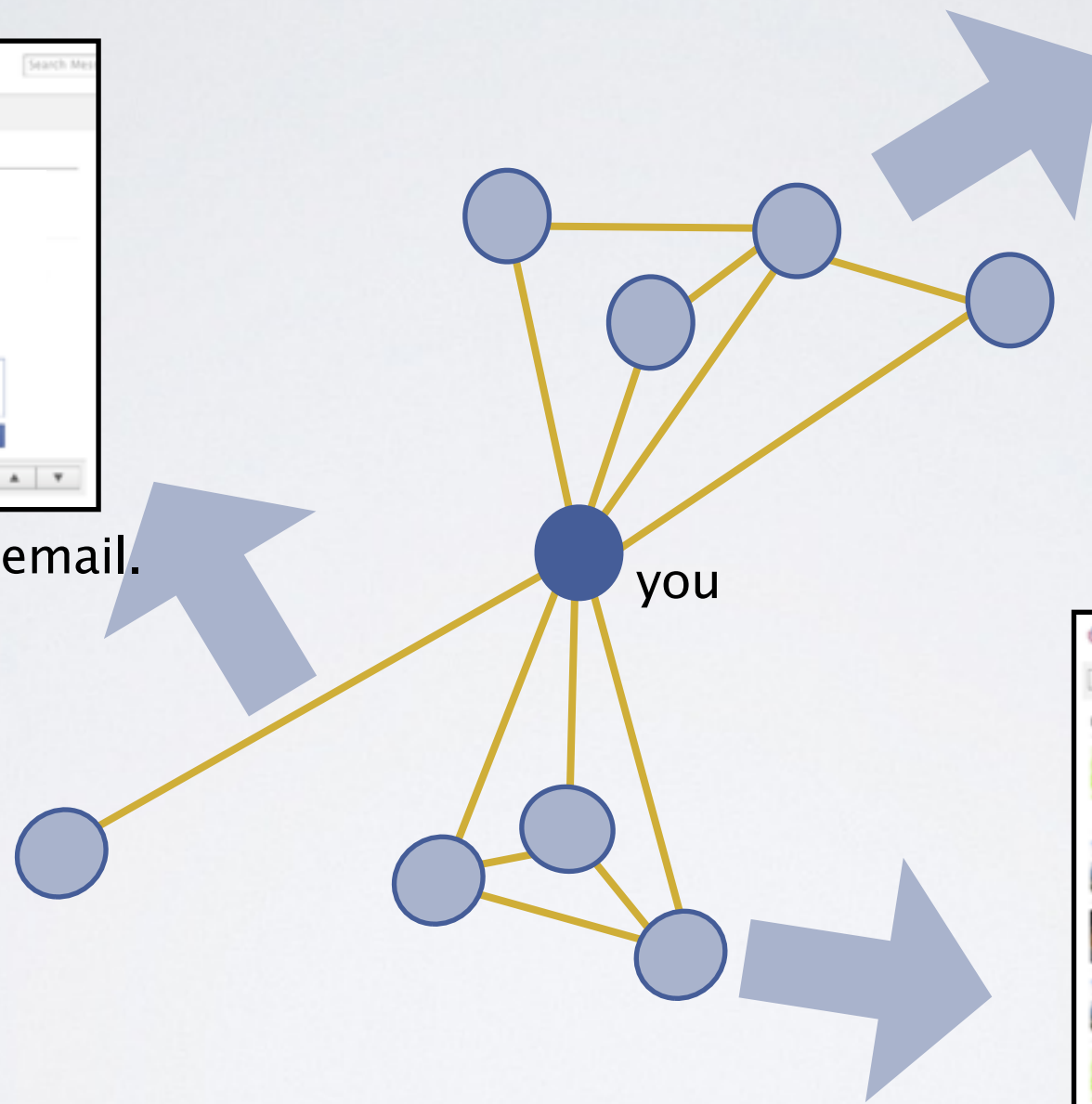Competing experience: email.

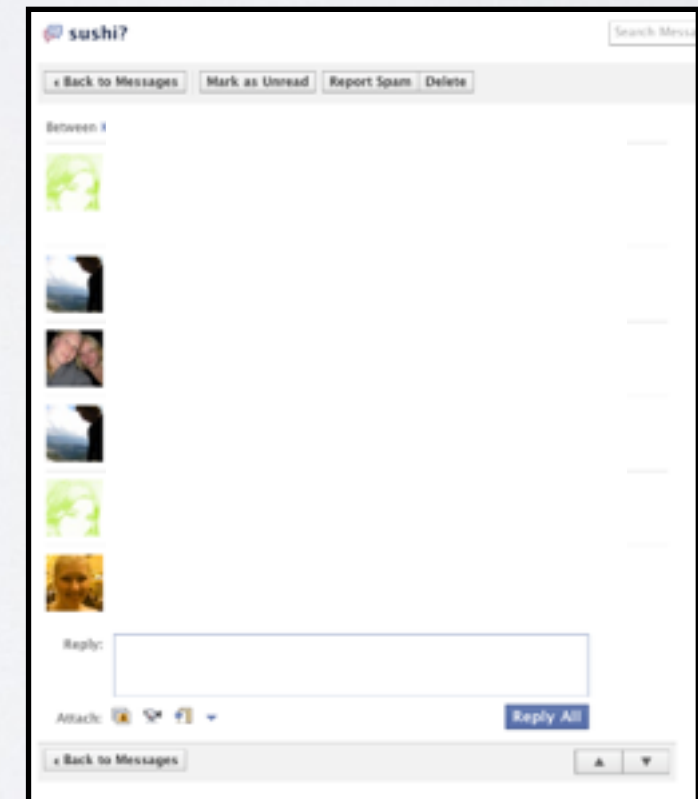you

Competing experience: mass email.

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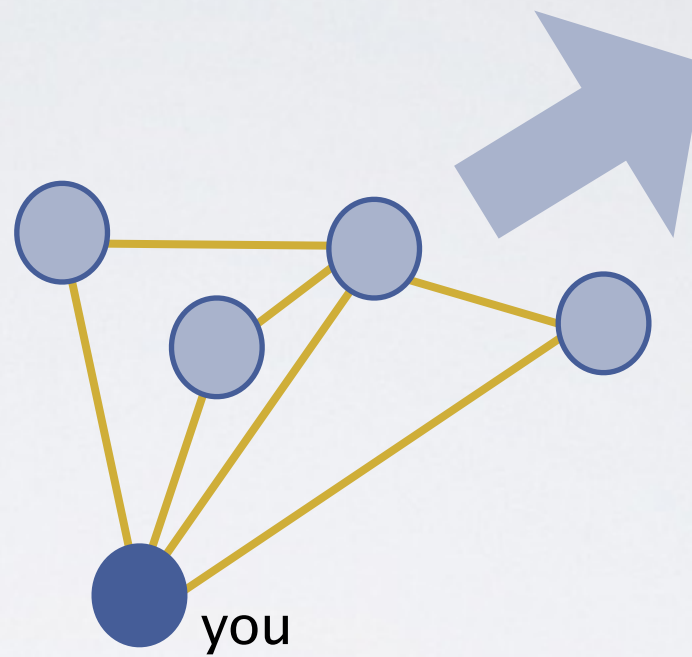
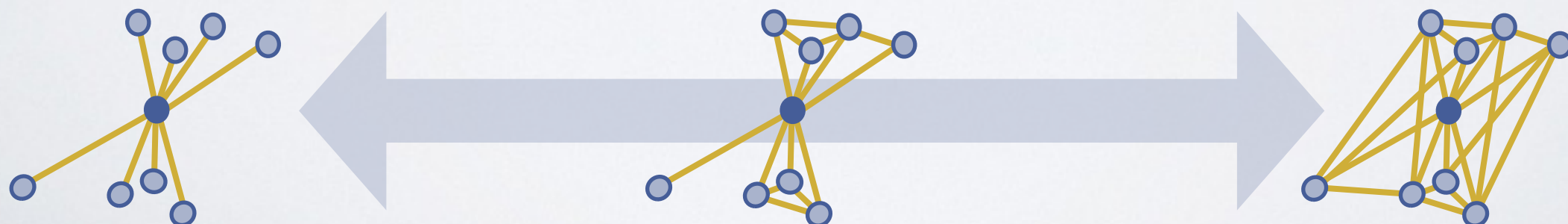Competing experience: email.

you

Unique experience.

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Engagement: social utility

you

Unique experience.

How does user engagement vary with structure?

Engagement and structural diversity

- All users registered during 2010. Neighborhood 1 week after registration.
- Are they logging in 6+ days per week, three months later?
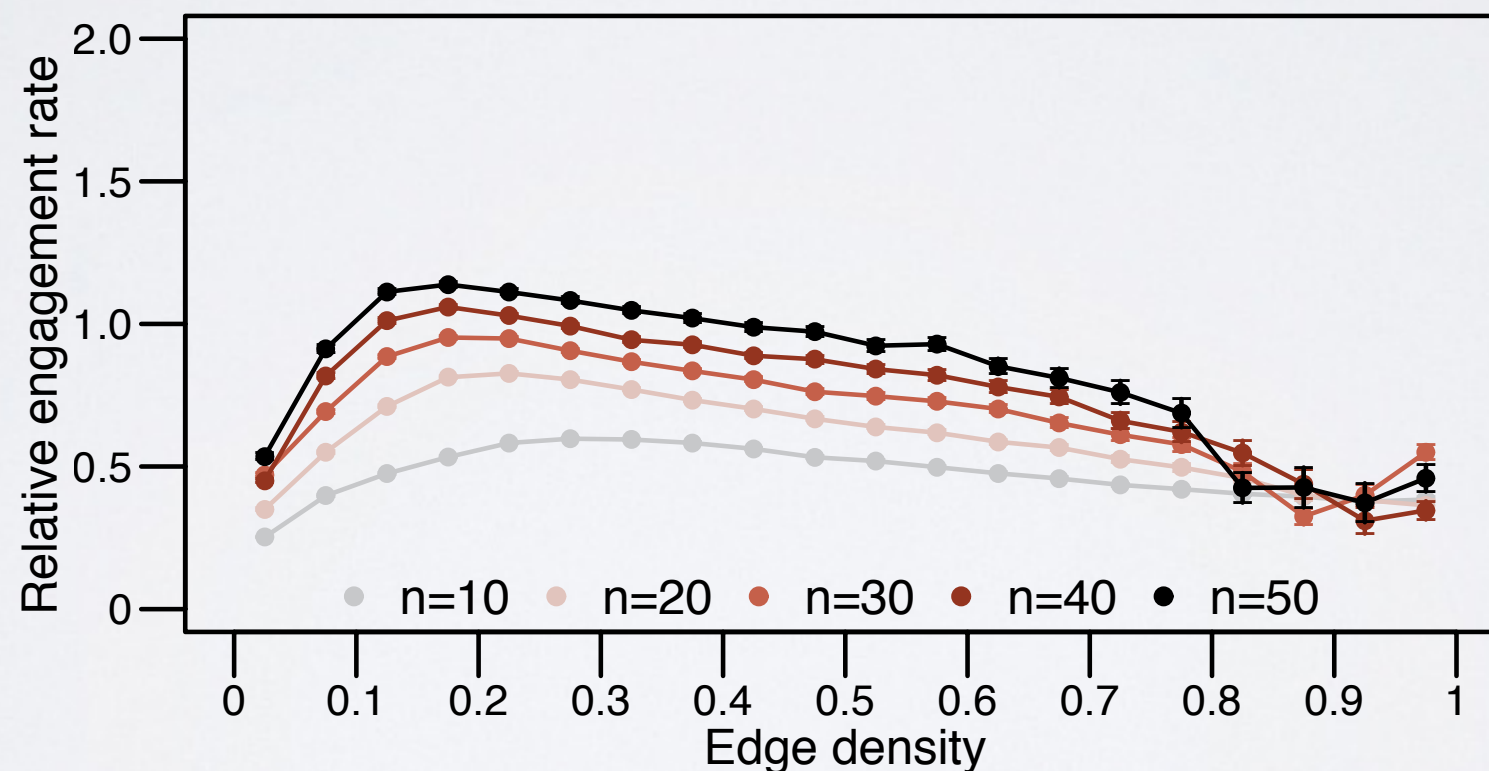
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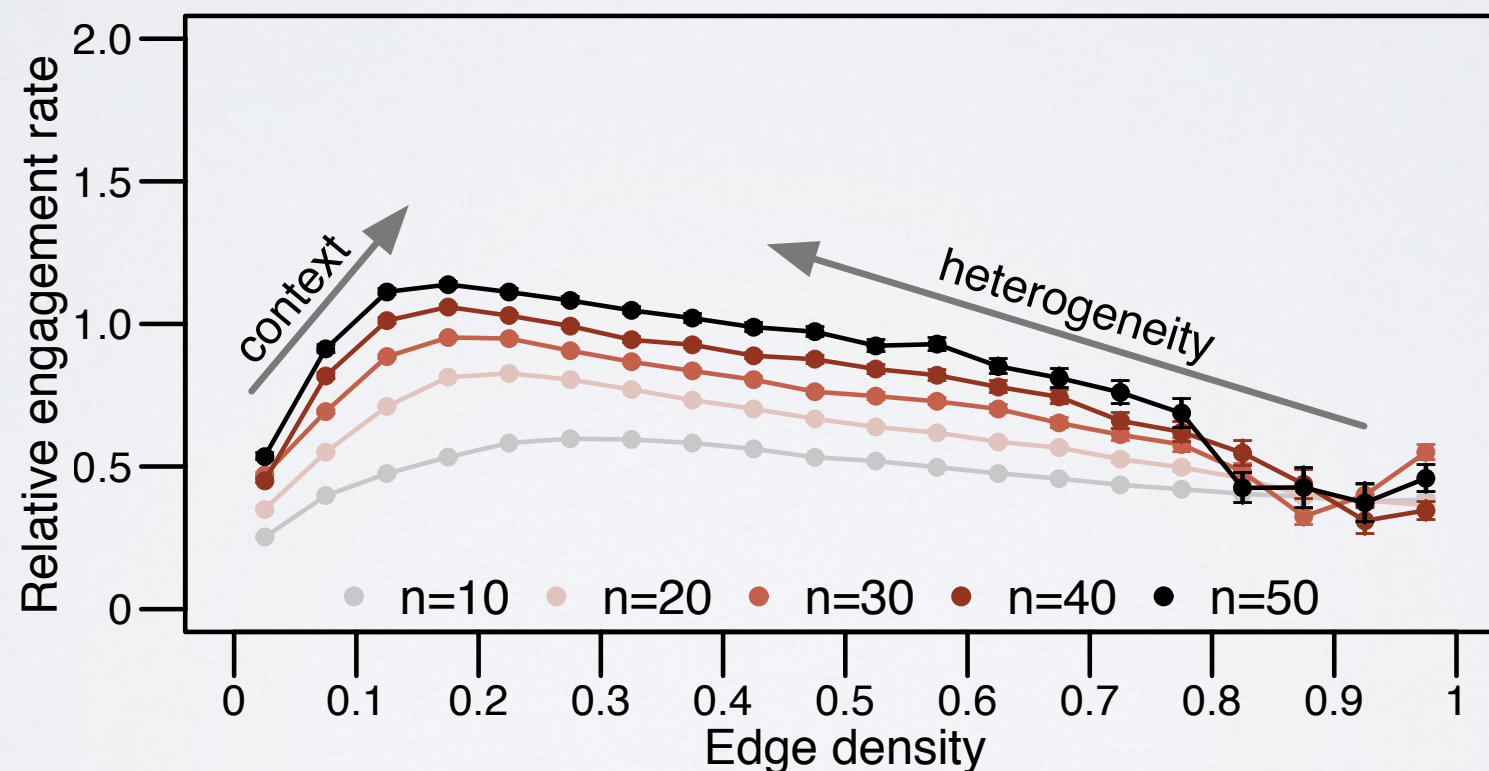
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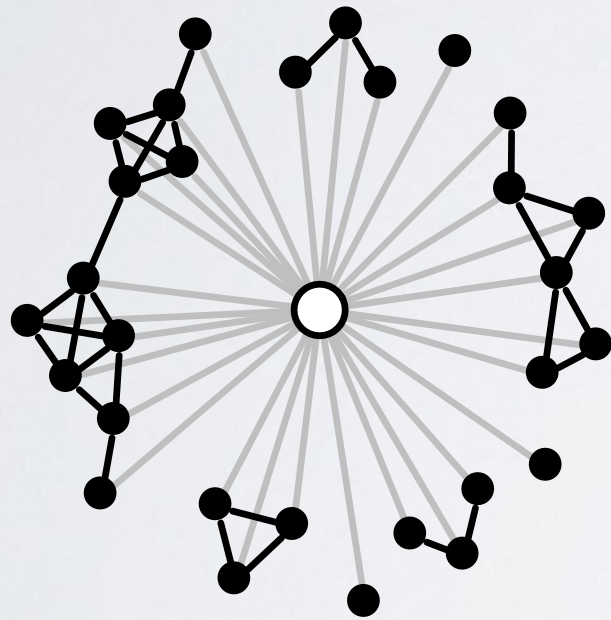- Clouded view.
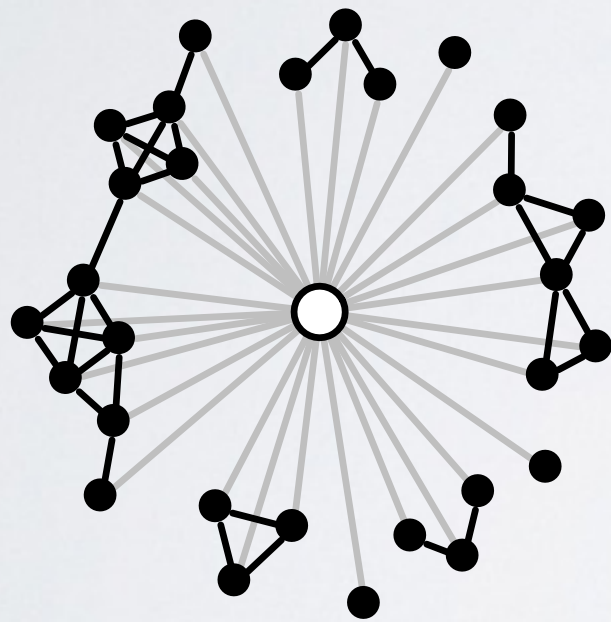
Engagement and structural diversity

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User 1 week after registration.

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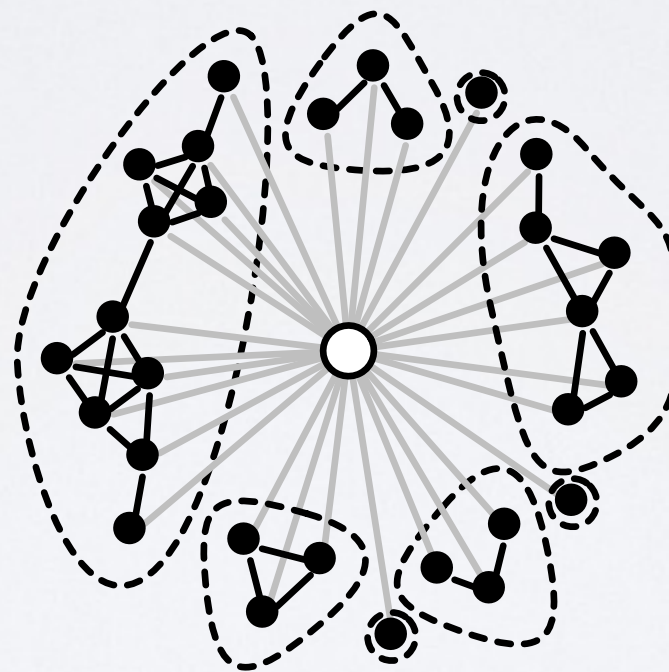
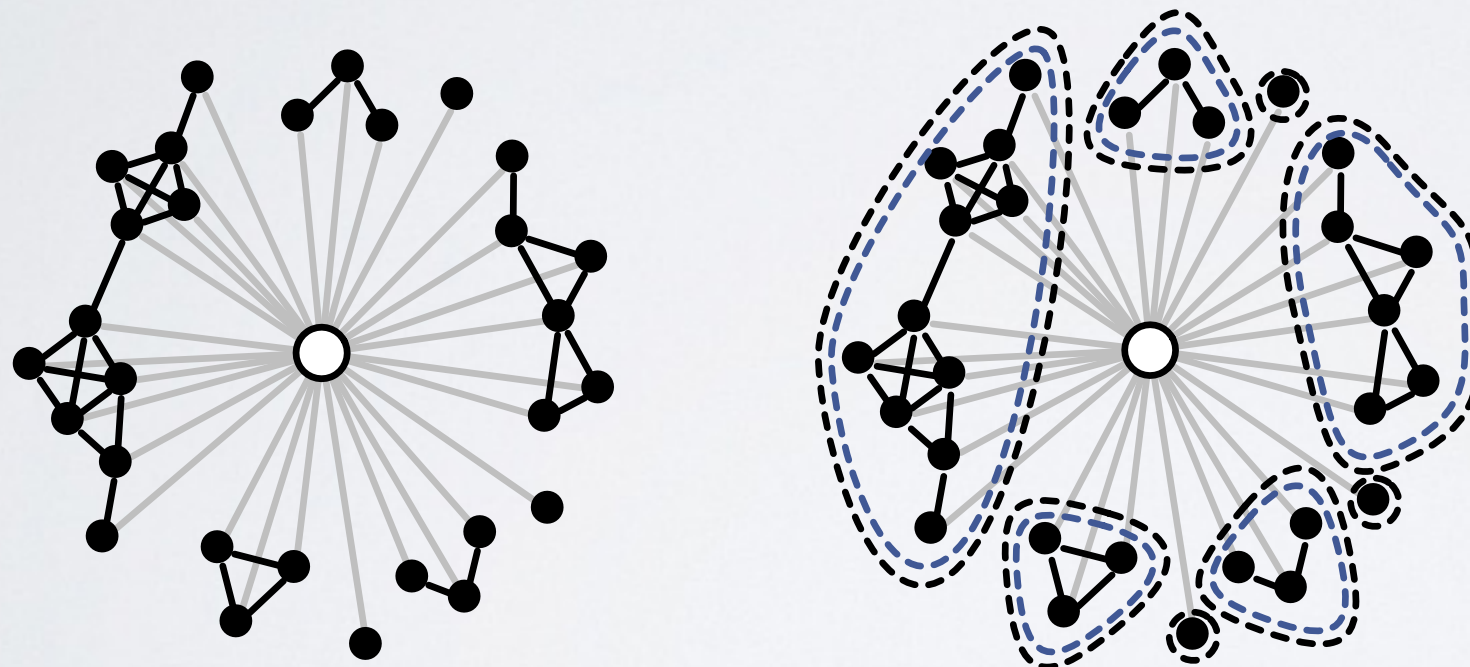- Engagement as a function of **component structure**:

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Connected components

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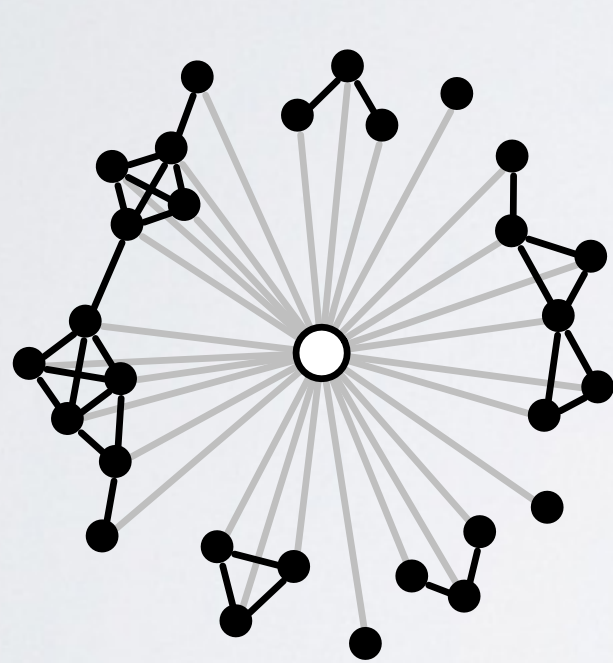- Engagement as a function of **component structure**:
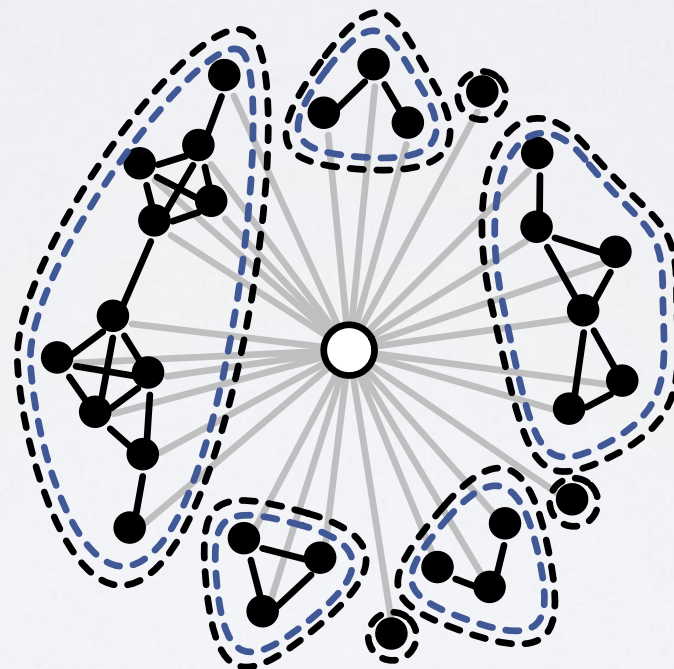

User 1 week after registration.

◌ Connected components
◌ Components of size ≥ 3

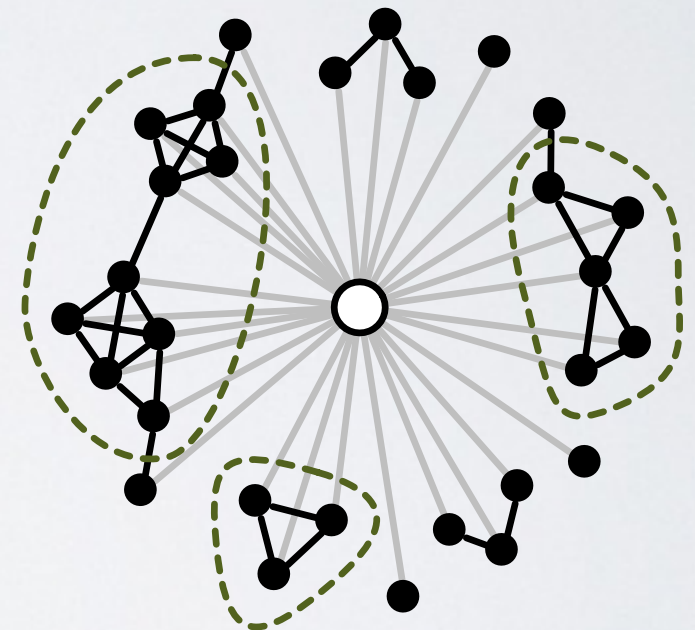# Engagement and structural diversity

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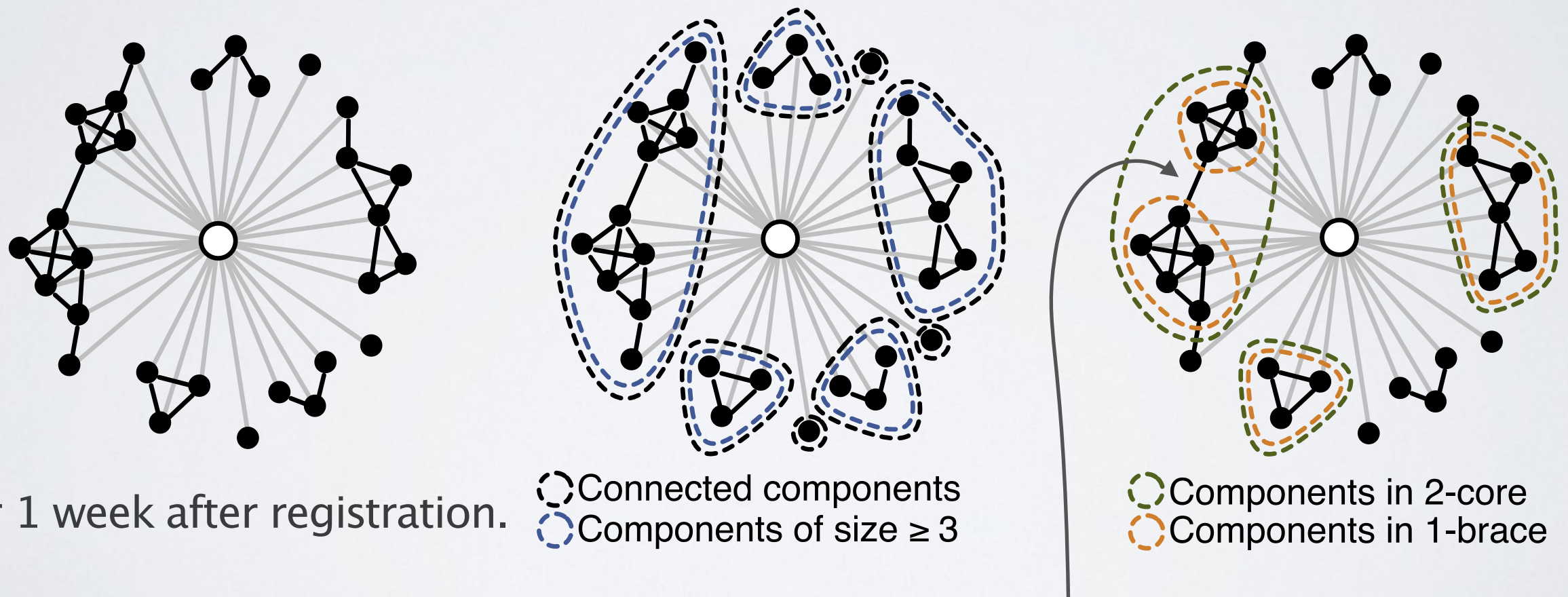
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Connected components
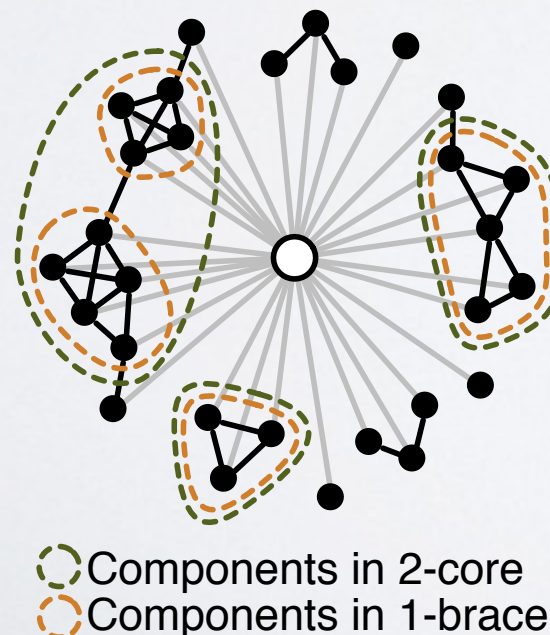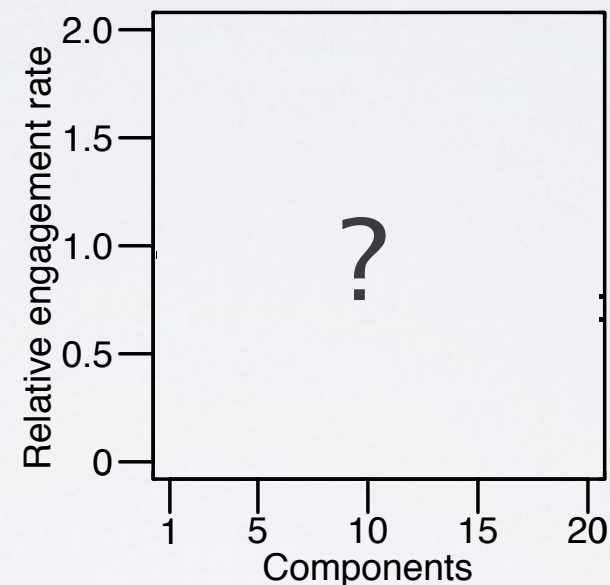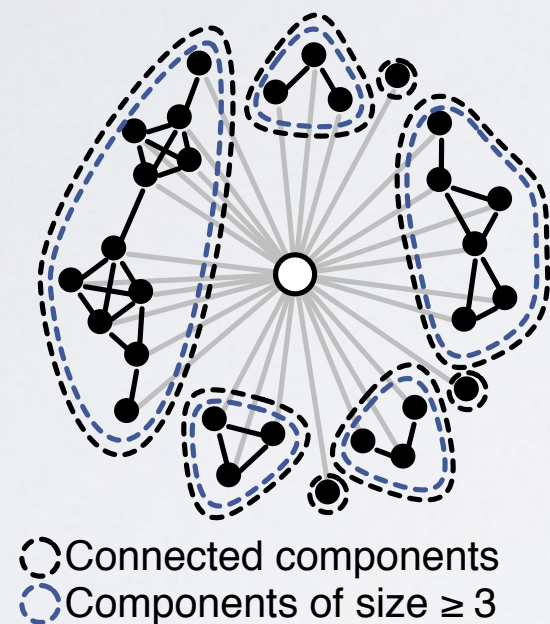Components of size ≥ 3

Components in 2-core

Engagement and structural diversity

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◯ Connected components
◯ Components of size ≥ 3

◯ Components in 2-core
◯ Components in 1-brace

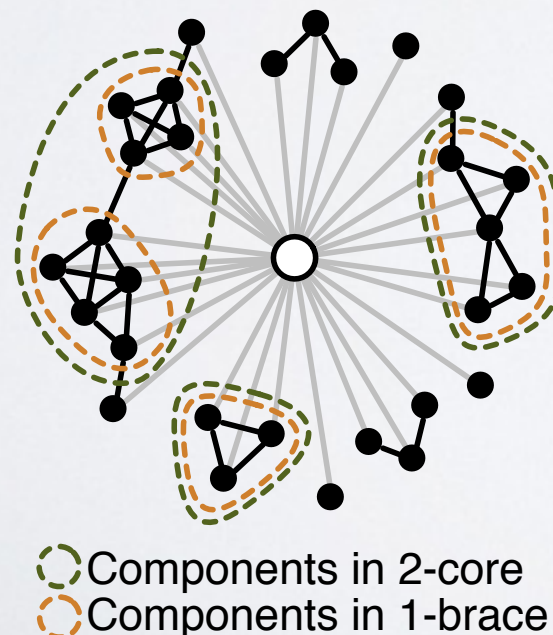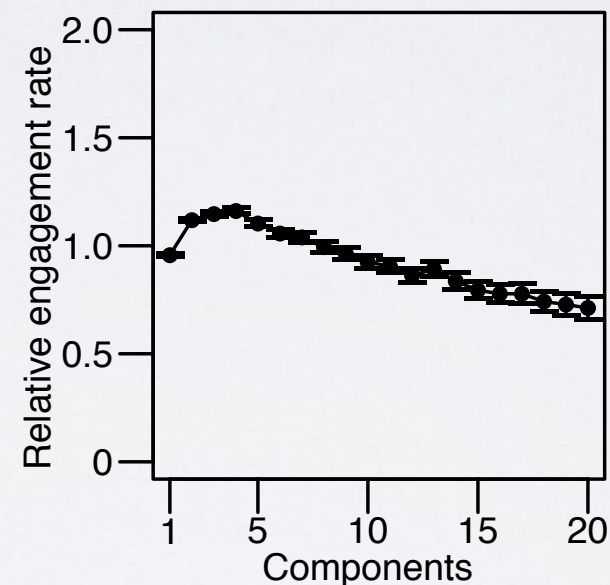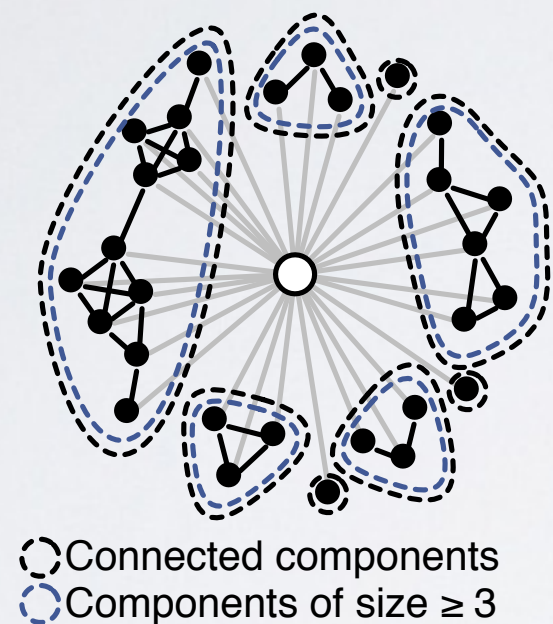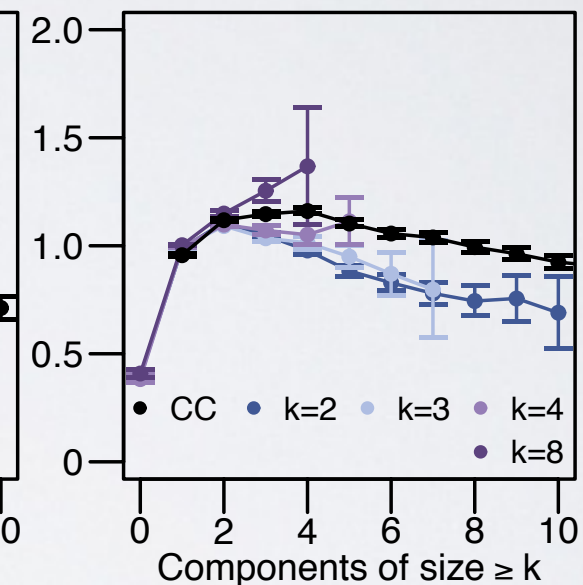The 1–brace cuts edges with embeddedness <1.

Engagement and structural diversity

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Connected components
Components of size ≥ 3
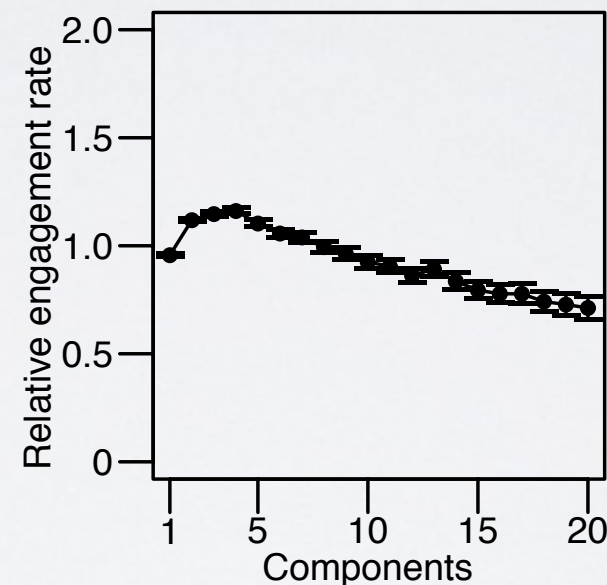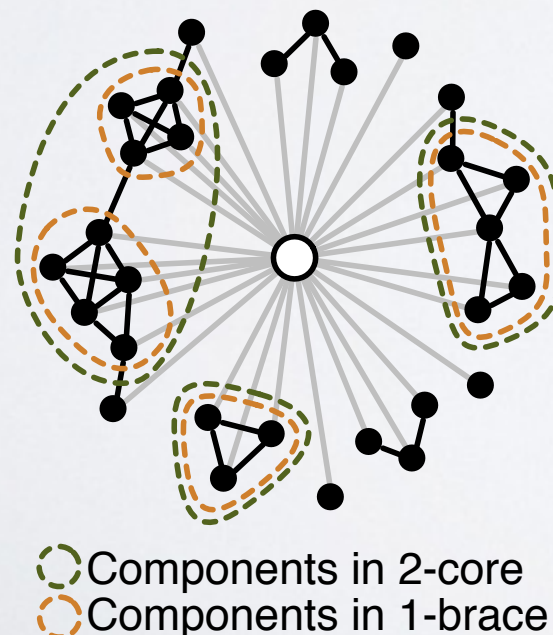
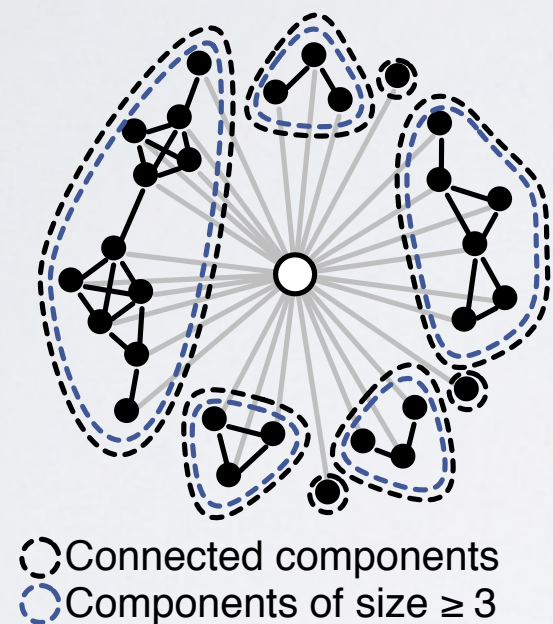Components in 2-core
Components in 1-brace

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- Engagement as a function of **component structure**:

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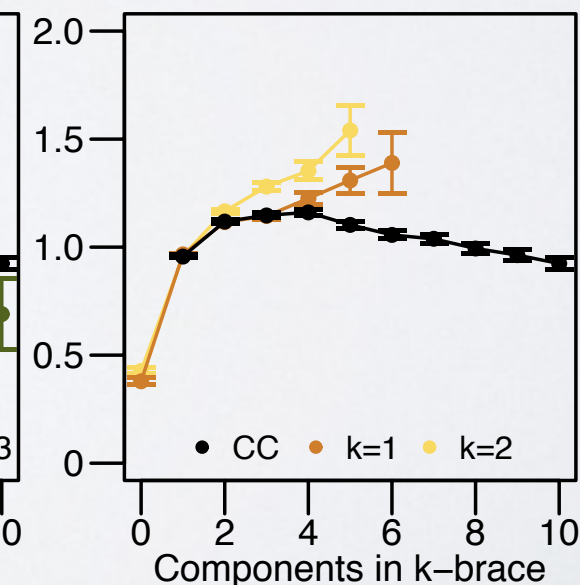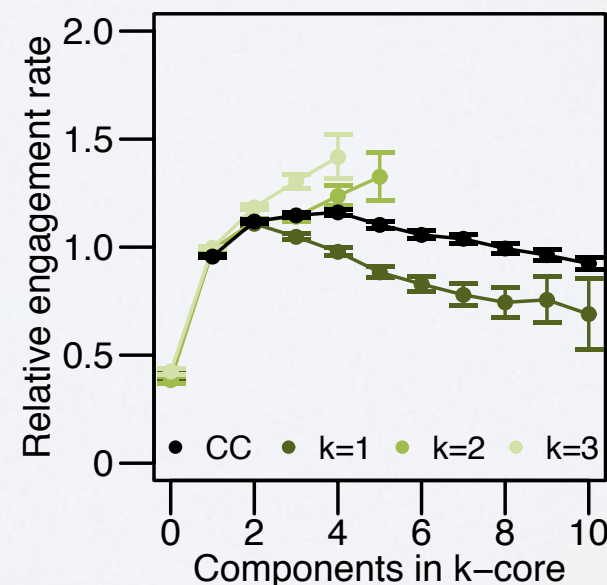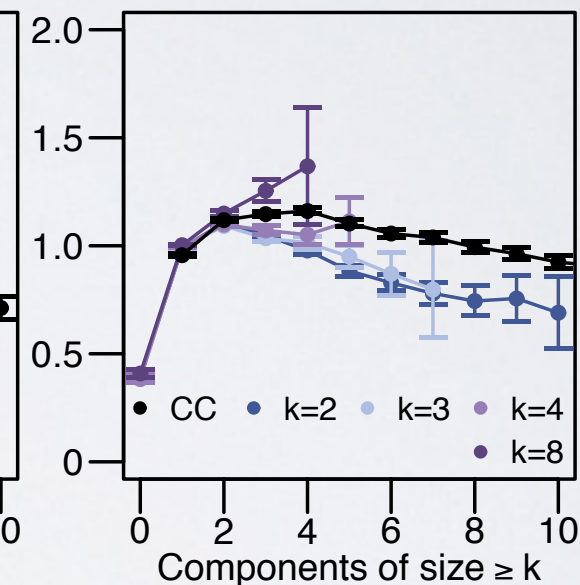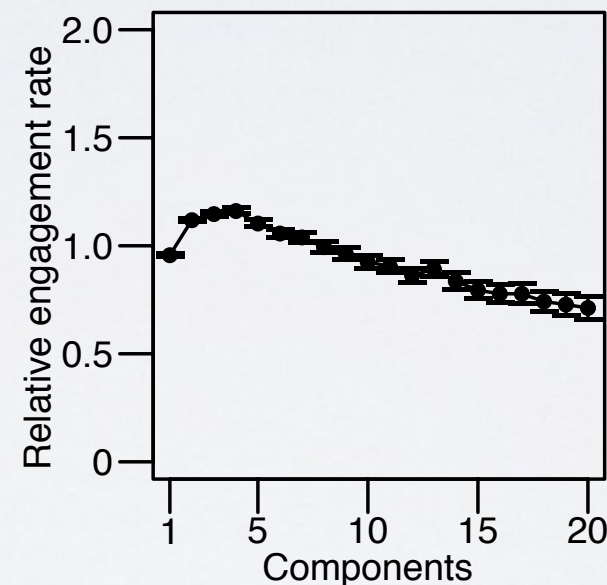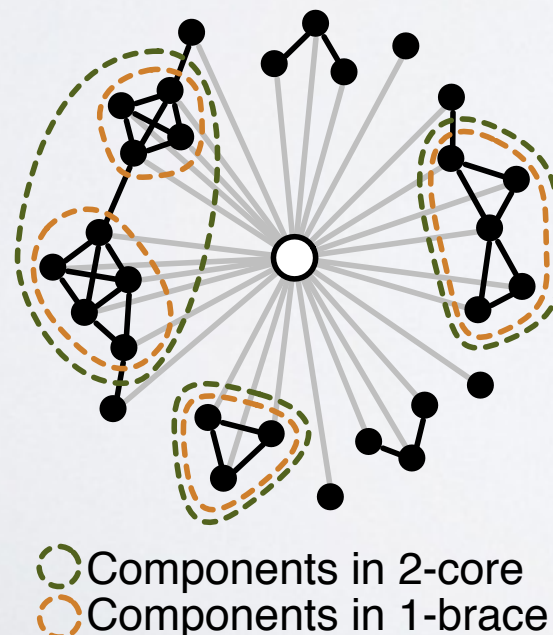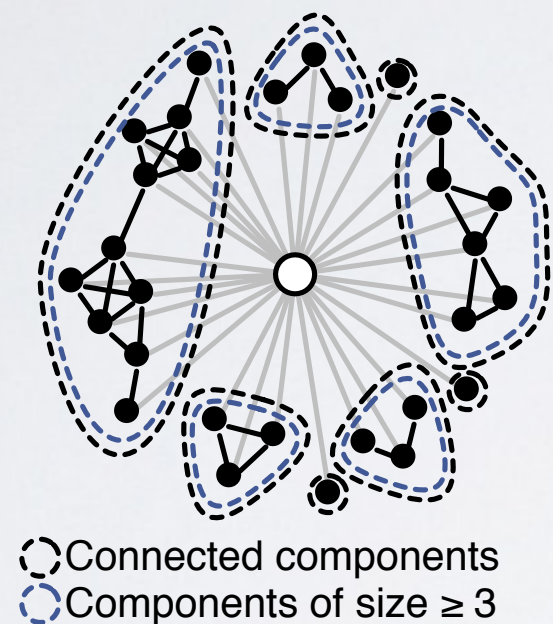- Engagement as a function of **component structure**:

Part I: Predicting recruitment

Part II: Predicting engagement

Conclusions

Structural diversity: conclusions

- Social contagion driven by more than contact count.

- **Recruitment to FB**:   more graph components = higher conversion

- **Engagement with FB**:   more 'substantial' components = higher engagement

- Paper: Ugander J., Backstorm L., Marlow C., Kleinberg J. (2012) Structural diversity in social contagion, PNAS.

- Thanks: Facebook, MacArthur Foundation, NSF.