Who Would You Like to Work With?
Use of Individual Characteristics and Social Networks in Team Formation Systems

Diego Gómez-Zará\textsuperscript{1,2}  
with Matthew Paras\textsuperscript{1}, Marlon Twyman\textsuperscript{1}, Jacqueline N. Lane\textsuperscript{3}, Leslie A. DeChurch\textsuperscript{1}, and Noshir S. Contractor\textsuperscript{1}

1. Northwestern University, 2. Pontificia Universidad Católica de Chile, 3. Harvard Business School

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Introduction

Online platforms are reconfiguring how people are teaming up with others.

(Ng, Leonardi, and Contractor, 2017; Anagnostopoulos, Retelny et al., 2014; Uzzi et al., 2014; Becchetti, Castillo, Gionis, and Leonard, 2010)
Introduction

However, little is known about how users search for and choose teammates on these platforms.
Introduction

How people use these systems has **direct consequences** for the formation of their teams.

Previous studies have acknowledged that weak team formation processes **lead to disharmony** among members, lack of cohesion, organization, and **diversity** (Bell, 2007; Mannix and Neale, 2005; Mathieu et al., 2014).
We studied how users’ traits and social networks influenced their teammate searches, teammate choices, and team composition when they assemble teams online.
Related Work & Theoretical Background
Related work

Self-assembled teams
Users search for and choose teammates

Ad-hoc teams
Teams are assembled by a user

Staffing

Team Builder
Systems assign users into teams

Algorithmic formation driven

Recommendation systems
Users receive suggestions from the system

User search driven

Hupa et al., 2010
Alkan, Daly, and Vejsbjerg, 2018
Lykourentzou, Kraut, and Dow, 2017
Gómez-Zará et al., 2019
Jahanbakhsh et al., 2017
Fu et al., 2007
Retelny et al., 2014; Valentine et al., 2017
Kittur et al., 2014
Zhou, Valentine, and Bernstein, 2018
Xiao, Zhou, Fu, 2019
Datta, Yong, Ventresque, 2011

Northwestern University
Theoretical background - Searching for Capital

**Human Capital**
- Competence
  (Fiske, Cuddy, and Glick. 2007; Balthazard, Potter, and Warren, 2004)
- Warmth
  (Fiske, Cuddy, and Glick. 2007)

**Social Capital**
- Bonding capital
  (Hinds, Carley, Krackhardt, and Wholey. 2000; Granovetter, 1977)
- Bridging capital
  (Burt 1997; Gao, Hinds, and Zhao, 2013)
Research questions

[RQ1] What do users search for?

[RQ2] Who do users invite?

[RQ3] Who do users accept?

[RQ4] What kinds of teams form?
Methodology
Methodology

● We conducted a **field study** to observe team self-assembly in an online setting.

● We developed an **online team formation system** where users assemble teams by *searching*, *inviting*, and *accepting* (or declining) invitations from others.

● We analyzed the research questions based on the **human and social capital** dimensions.
Participants

- 9 classes in the U.S.
- 530 participants
  - 314 undergraduate students
  - 216 graduate students
- 90 teams were assembled
- 54% were women
- Median age: 24
- Team task goals depended on the class: from *class projects* to *small discussion groups*. 
Team formation system steps

1. Users complete an initial survey
2. Users search for teammates
3. Users view potential teammates’ profiles
4. Users invite and assemble teams
Interfaces of team formation system

1. Initial survey assessing human and social capital

- Demographic information
- Project skills
- Creativity (Tierney and Farmer, 2002)
- Leadership experience (Mumford et al., 1993)
- Psychological collectivism (Jackson et al., 2006)
- Social skills (Ferris et al., 2005)
- Personality (Donnellan et al., 2006)
- Social networks
Measures of Capital

1. Initial survey assessing human and social capital

- **Human Capital:**
  - *Competence*: Project related skills
  - *Warmth*: Team values, Social skills, Creativity, Leadership, Personality

- **Social Capital:**
  - *Bonding Capital*: Friends, Prior collaborators, Shared Collaborators
  - *Bridging Capital*: Social Broker, Number of contacts, Number of friends, Number worked with
Interfaces of team formation system

2. Searching for teammates

- Users made *search queries* to find teammates.
- Users selected criteria and rated their importance.
- Displayed a ranked list.
Interfaces of team formation system

3. Ranked list

System displayed: picture, percentage match to query, a link to their profile, and an invite button.

Users sent invitations to assemble a team.
4. Team Assembly

The receiver of the invitation had the choice to accept, decline, or ignore the invitation.

If the receiver accepts, then the sender’s team and the receive form a new team.
Results
Research Questions

[RQ1] What do users search for?

[RQ2] Who do users invite?

[RQ3] Who do users accept?

[RQ4] What kinds of teams form?
RQ1: What do users look for?

Users preferred **human capital** (competence and warmth) over social capital (bonding and bridging) when they searched for potential teammates.
Research Questions

[RQ1] What do users search for?

[RQ2] Who do users invite?

[RQ3] Who do users accept?

[RQ4] What kinds of teams form?
Research Questions

Who is more likely to receive an invitation?

<table>
<thead>
<tr>
<th></th>
<th>Initiating a team</th>
<th>Growing a team</th>
<th>Finalizing a team</th>
</tr>
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<tbody>
<tr>
<td>1</td>
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</table>
RQ2. Who do users invite?

Bonding capital (Friends, Contacts, Prior Collaborators), was more likely to explain which users were going to receive an invitation.

Women were more likely to receive invitations when people were looking for the final member(s) for their teams.

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<tbody>
<tr>
<td>1</td>
<td>Friends</td>
<td>Prior collaborators</td>
<td>Friends</td>
</tr>
<tr>
<td>2</td>
<td>Prior collaborators</td>
<td>Contacts</td>
<td>Prior collaborators</td>
</tr>
<tr>
<td>3</td>
<td>Contacts</td>
<td>Friends</td>
<td>Women</td>
</tr>
</tbody>
</table>

Who is more likely to receive an invitation?

Estimates calculated using Hierarchical Logistic Models. The dependent variable is an invitation sent between two different users. No overdispersion was found.
Research Questions

[RQ1] What do users search for?

[RQ2] Who do users invite?

[RQ3] Who do users accept?

[RQ4] What kinds of teams form?
RQ3. Who do users accept?

**Who is more likely to be accepted?**

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<th>Finalizing a team</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>The first user who sent the invitation</td>
<td>Contacts</td>
<td>Those mentioned as <em>friends</em> by many</td>
</tr>
<tr>
<td>2</td>
<td>Those who reported having many <em>collaborators</em></td>
<td>Those mentioned as <em>collaborators</em> by many</td>
<td>Those with higher social skills</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>Those who reported having many <em>collaborators</em></td>
<td>Those who reported having many <em>friends</em>.</td>
</tr>
</tbody>
</table>

**Bonding and bridging capital** of invitation senders explained users’ acceptances.

In contrast, **invitation senders with higher expertise** were less likely to be accepted.

Estimates calculated using Hierarchical Logistic Models. The dependent variable is an invitation accepted between two different users. No overdispersion was found.
Research Questions

[RQ1] What do users *search for*?

[RQ2] Who do users *invite*?

[RQ3] Who do users *accept*?

[RQ4] What *kinds of teams* form?
RQ3. What kinds of teams form?

Distinct clusters based on Human Capital

Clusters made using k-means and Principal Component Analysis. Variables: creativity, leadership experience, psychological collectivism, project skills, social skills, personality. SSE = 70; Silhouette Coefficient = 0.24
RQ3. What kinds of teams form?

Distinct clusters based on Social Capital

Clusters made using k-means and Principal Component Analysis.
Variables: participants' indegree, outdegree, betweenness, and closeness. SSE = 201; Silhouette Coefficient = 0.42
Discussion
Users’ search queries focused primarily on **competence** and **warmth** attributes.
1. Teams assembled online

However, bonding capital was ultimately determinant in users invited.
1. Teams assembled online

Users’ decisions to accept or decline invitations relied on inviter’s bonding capital and bridging capital.
Users’ behaviors aggregated perniciously to create teams that were segregated by users’ human capital and social capital.
1. Teams assembled online

Our results are consistent with the literature on team formation: *social connections are fundamental for teammate selection.*

**And what did we find?** *Online platforms replicate - even exacerbate - those behaviors.*
2. Emergence of segregated teams

- Team formation systems can unintentionally enable greater **segregation**.
- Future systems should complement **hybrid approaches** (i.e., augmenting users’ agency with interfaces and algorithms).
3. Next steps: Augmenting team formation processes

**Computational Augmentation**
(Ackerman, 2000; Zhou, Valentine, and Bernstein, 2018)

**Simulating teams**
(Alkan, Daly, and Vejsbjerg, 2018)

**Social Agents**
(Nass and Moon 2000; Xiao, Zhou, and Fu, 2019)
Limitations

- The system configuration and design may have affected users’ behavior and team formation processes.
- Study relied on users’ self-reported traits and networks.
- There was no control over students’ interactions outside of the platform.

Future Work

- Lab experiments
- Team’s performance and cohesion
Conclusion

1. This study reveals the high relevance of competence and warmth as factors that drive users’ searches.

2. However, bonding capital was the most important factor in choosing teammates.

3. Users’ decisions led to segregated teams.
Conclusion

1. This study reveals the high relevance of \textbf{competence} and \textbf{warmth} as factors that drive users’ searches.

2. However, \textit{bonding capital} was the most important factor in \textbf{choosing teammates}.

3. Users’ decisions led to \textbf{segregated teams}.

Thank you!

Questions?

Twitter: @dgzara | Email: dgomezara@u.northwestern.edu
http://sonic.northwestern.edu/mdt

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Software development team

Anup Sawanth
IITM

Xiang Li
SONIC Lab