UNL STEM Faculty Networks & Climate

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Acknowledgments

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- BOSR
- Megumi Watanabe
  - graduate research assistant
- Mary-Anne Holmes
  - director of ADVANCE-Nebraska
Two Surveys: Topics & Response Rates

1) **Network Survey**  
*(administered by BOSR March 2008)*

**Topics**
- Network Integration
  - research exchange
  - friendship
  - committee co-membership

**Response Rate**
- Department (55%-95%)
  - 19 out of 26 departments that contain 341 faculty
Two Surveys: Topics & Response Rates

2) COACHE Survey
(administered by Harvard April 2008)

<table>
<thead>
<tr>
<th>Topics</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Departmental Climate Perceptions</td>
<td>Faculty (54%)</td>
</tr>
<tr>
<td>Tenure &amp; Promotion Process Clarity</td>
<td>245 out of 452 faculty across 26 departments</td>
</tr>
<tr>
<td>Organizational Commitment</td>
<td></td>
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</tbody>
</table>
Overview

Part 1: Department
a) describe the characteristics of department network structure
b) investigate how department network characteristics associate with measures of academic climate

Part 2: Individual
a) describe characteristics of a faculty member’s location within the departmental network
b) investigate how actor location:
   • associates with climate perceptions
   • varies across race and gender
Social Networks (15 actor network at UNL)

Net 26 midsize res.x3d

Net 26 midsize soc.x3d

Net 26 midsize com.x3d
A **social network** is a finite set of actors and the relations among them.

**Two Components**

1. **Network Actors** (nodes or dots)
   - 341 UNL Faculty in 19 STEM departments

2. **Relational ties** (lines)
   - any form of social interaction that connects two actors in the network
     - research collaboration/consultation, friendship interactions, committee service
Network Integration Questions (Relational Ties)

• **Research Exchange**
  - provide or receive research help, advice, or equipment

• **Friendship**
  - non-work related interactions: spent free time together or discussed personal matters

• **Committee Co-membership**
  - serve on a service or graduate student committee together
Department Level Research Question #1

How can we characterize the network structure of STEM departments at UNL?

**Social network analysis**: a set of *relational* methods for systematically identifying connections among actors in a network.

- **Centralized**
- **Clustered**
- **Dense**
• **Density**
  - the percentage of possible ties within an network that are actual ties (range: 0% to 100%)

![25% Density](image1)

![40% Density](image2)

two 12 actor networks

• **Clustering**
  - the tendency towards dense local neighborhoods in a network (range: 0= no clusters to 1= high clustering)
- **Centralization**
  - the extent to which one actor in the network is more prominent than the other actors in the network
  - range: 0 = not centralized to 1 = centralized

Centralization = 0

Centralization = 1
## Department Level Network Structure Measures

<table>
<thead>
<tr>
<th>Research Exchange</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>.40</td>
<td>.18</td>
<td>.15</td>
<td>.71</td>
</tr>
<tr>
<td>Clustering</td>
<td>.65</td>
<td>.10</td>
<td>.39</td>
<td>.83</td>
</tr>
<tr>
<td>Centralization</td>
<td>.46</td>
<td>.17</td>
<td>.19</td>
<td>.79</td>
</tr>
</tbody>
</table>

N= 19 STEM departments
Committee Co-Membership

den. = 55%

den. = 32%

high density

den. = 89%

low density

den. = 25%
Friendship

- Moderate centralization: cent. = .36
- High centralization: cent. = .57
Research Exchange

moderate clustering
clust. = .49

very high clustering
clust. = .77
Summary

How can we characterize the network structure of STEM departments at UNL?

On average, UNL STEM Department Networks:
- are highly clustered
- have moderate levels of density and centralization
Department Level Research Question #2

How are department network structures associated with academic climate?

• Department Average for:
  – Climate Perceptions
    • collegiality, belonging, vitality, work value
  – Tenure & Promotion Process Clarity
    • criteria, standards, body of work
  – Organizational Commitment
    • intention to remain at UNL
Clustering within Research Networks is good!

![Graph showing the correlation between Research Clustering and Department Average Satisfaction with Climate. The correlation coefficient is r = .48*]
Centralization within Friendship Networks is good!

\[ r = 0.48^* \]

\[ r = 0.79^* \]
Clustering within Friendship Networks is bad!

Department Average Organization Commitment vs. Friendship Clustering:
- High organizational commitment: $r = -.45^*$
- Low organizational commitment: $r = -.42^*$

Department Average Promotion Criteria Clarity vs. Friendship Clustering:
- Clear criteria: $r = -.42^*$
- Unclear criteria: $r = -.42^*$
Summary

How are departmental network structures associated with academic climate?

a) Departmental climate perceptions are more positive in departments with:
   • higher clustering in research exchange networks
   • higher centralization in friendship networks

b) Departments with higher clustering within friendship networks tend to have:
   • less clarity in the promotion process
   • less organizational commitment
Overview

Part 1: Department
a) describe the characteristics of department network structure
b) investigate how department network characteristics associate with measures of academic climate

Part 2: Individual
a) describe characteristics of a faculty member’s location within the departmental network
b) investigate how actor location:
   • associates with climate perceptions
   • varies across race and gender
Individual Level Research Questions #1 & 2

In general, how connected are faculty within their departments?

How is a faculty member’s location within their department networks associated with their perceptions of climate?

- Departmental Climate Perceptions
- Tenure & Promotion Process Clarity
- Organizational Commitment
Actor location within a network

Net 6 midsize res.x3d
Actor Location Measures

- **Degree** (*isolated or integrated*)
  - the number of direct ties
  
  ![Diagram showing the highest actor degree]

- **Betweenness** (*intermediary*)
  - number of times that an actor lies along the shortest path between two actors without a direct connection

![Diagram showing the highest betweennessness actor]
Actor Location Measures

• **Actor Power** (*central actor*)
  - the extent to which an actor is well connected to actors who are also well connected (weighted degree)
### Actor Level Network Integration

<table>
<thead>
<tr>
<th>Degree (isolated or integrated)</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>5.9</td>
<td>3.2</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Friendship</td>
<td>5.3</td>
<td>3.4</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Committees</td>
<td>7.5</td>
<td>4.4</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

N = 305 faculty
Isolation- bad! Integration- good!

![Graph showing the relationship between faculty satisfaction with department climate and degree of isolation or integration. The graph indicates a positive correlation, with higher levels of integration correlating with higher levels of faculty satisfaction.]
Isolation - bad!  Integration - good!

Faculty Satisfaction with Department Climate

Degree (isolated or integrated)

Research  
Friendship  
Committees
Isolation - Bad!  Integration - Good!

Faculty Satisfaction with Department Climate

Degree (isolated or integrated)

Research  Friendship  Committees
Central actors in research or social networks have more positive climate perceptions.

![Graph showing the relationship between faculty satisfaction with department climate and power (central actor) for research, friendship, and committees. The graph indicates a positive correlation, with higher power associated with higher faculty satisfaction.]
The predicted probability of staying at UNL by type of network connections

Faculty Predicted Probability of Staying at UNL

Degree (isolated or integrated)

Research  Friendship  Committees
The predicted probability of staying at UNL by type of network connections

Friendships matter for retention!
Summary

How connected are faculty within their departments?

• on average, faculty engage in research exchanges with six other faculty, have five friends in their departments and serve on committees with eight different faculty

How is a faculty member’s location within their department network associated with their perceptions of climate?

• marginalization in research, friendship or committee networks is associated with less positive perceptions of climate

• marginalization in friendship networks is also associated with less organizational commitment
Individual Level Research Question #3

Does a faculty member’s location within their department network vary by race and gender?

• comparing across three groups of faculty:
  – white men
  – non-white men
  – white women

*note: unable to compare non-white women because the subgroup size is too small*
Women have fewer friends!
Intermediaries also differ by race and gender.
Friendship Network

Node size is proportional to betweenness (intermediary) score

- White females
- Non-white males
- White males
Non-white men are less likely to be the most central actors in all networks!
Research Network

node size is proportional to power (central actor) score

- white females
- non-white males
- white males
Summary

Does a faculty member’s location within their department network vary by race and gender?

- women and non-white men are more likely to be peripheral actors in departmental networks
  - women have fewer direct connections to other faculty and are less often intermediaries
  - non-white faculty members are less likely to be connected to well-connected faculty

*remember:* peripheral actors in the network have less positive climate perceptions and lower organizational commitment
next data collection
Spring 2011

Wait there is more!
Academic Climate Measures

• **Work Value:** The value faculty in your department place on your work

• **Belonging and Comfort:** How well you "fit" (e.g., your sense of belonging, your comfort level) in your department

• Collegiality

• Tenure/Promotion Clarity
Faculty Outcomes

• **Job Satisfaction**
  – All things considered, how satisfied or dissatisfied are you with your department as a place to work?

• Organizational Commitment

• Research Productivity
Network Map A: Faculty Friendship
(node size is proportional to betweenness centrality)
## Actor location and climate perceptions

<table>
<thead>
<tr>
<th></th>
<th>Work Value</th>
<th>Belonging &amp; Comfort</th>
<th>Job Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Exchange</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Betweenness</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Bonacich</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td><strong>Social Connections</strong></td>
<td></td>
<td></td>
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<tr>
<td>Degree</td>
<td>++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
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<tr>
<td><strong>Committees</strong></td>
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<tr>
<td>Degree</td>
<td>++</td>
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<td>Bonacich</td>
<td>++</td>
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<td>++</td>
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High Clustering – social ties
Department Network Structure Measures

- **Density**
  - the percentage of possible ties within a network that are actual ties (range: 0% and 100%)

\[
density = \frac{L}{g(g - 1)/2}
\]

- $L$ = number of lines present
- $g$ = number of actors
Research Exchange

high centralization

cent. = .79
Centralization in Research Networks is good!

\[ r = .44^* \]
Implications

- faculty need to be integrated within research, friendship, and committee co-membership networks to promote positive climate perceptions
- friendship connections might be the most important factor for faculty retention
- ???
Possible Implications

• ????
Research (isolated to integrated)

Degree

White Men  Non-White Men  White Women  Non-White Women

Research

Friendship

Committees

*
Betweenness (Intermediary)

<table>
<thead>
<tr>
<th></th>
<th>White Men</th>
<th>Non-White Men</th>
<th>White Women</th>
<th>Non-White Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td></td>
<td></td>
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<tr>
<td>Friendship</td>
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<td>*</td>
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<td>Committees</td>
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