Introduction to Social Network Analysis

Joanna Weill, PhD Candidate, Psychology, UC Santa Cruz
Outline

- Social Network Analysis (SNA) Basics
- Data Collection
- Data Analysis and Hypothesis Testing
- Data Management
- Examples from Psychological Research
- Resources
Social Network Analysis (SNA)

- Growing field, with the number of articles published on the topic tripling in the first decade of the 21st century (Borgatti et al., 2009)

- Method for collecting and analyzing data

- Way of learning and thinking about the world that focuses on the relationships between units (McGloin & Kirk, 2010)
What is a network?

- Nodes
  - People
  - Organizations
  - Both (multi-modal network)

- Ties
  - Relationships or connectors between nodes
  - Sometimes called “edges”

- Sometimes node attributes

Crossley et al., 2015
Questions for SNA

- What type of people have the most influence on our eating habits?
- Who are the best resources to help new immigrants to find employment?
- Which politicians have the most influence on policy?
- Do racially diverse businesses function differently than homogeneous business, and if so, why?
Types of Social Network Analysis

- **Sociocentric** = Whole networks
  - Creates one network
- **Egocentric** = Personal networks
  - Creates many stand alone networks
Types of Social Network Analysis

- Halgin & DeJordy, 2008

- Sociocentric: “If your research question is about different patterns of interaction within defined groups”

- Egocentric: “If your research question is about phenomena of or affecting individual entities across different settings”
Sociocentric

Credit: Six Degrees of Spaghetti Monsters
Egocentric
Data Collection

- Construct the network yourself
  - Pre-existing dataset
  - Observation

- Surveys or interviews (create networks with the help of the people in them)

- Combination
Data Collection

- Who is in the network?
  - Nodes
- What are their characteristics?
  - Node attributes
- How are they related to each other?
  - Ties
Who is in the network? (Selecting Nodes)

- Where are the network boundaries?
- Sociocentric: Network boundaries often clear
  - Everyone working at a particular company
  - Everyone in one classroom of a school
- Egocentric: You have decisions to make...
  - Everyone an individual spoke with in one day
  - The 20 people they are closest with
  - Who they could ask to borrow money from
What are the characteristics of the people in the network? (Node Attributes)

- Need to choose what characteristics are you most interested in

- This information can be obtained in different ways, based on research question and practicality
  - Pre-existing data/database
    - How old is Bob according to institutional records?
  - Ask the individual themselves
    - How old are you?
  - Ask someone else about them
    - How old is Bob?
How are the people in the network connected? (Ties)

- Whether nodes are connected depends on your research question
  - Trust
    - Who would you go to for help with a personal problem?
  - Information flow
    - Who did you speak to yesterday?
    - Who emailed each other this week?
    - Do Person A and Person B speak to each other when you’re not around?
- Multiple relations between nodes (multiplex)
How are the people in the network connected? (Ties)

- Tie valance
  - Instead of:
    - Do Person A and Person B speak to each other when you’re not around? (Yes or no)
  - On a scale of 1 to 5 how likely is it that Person A and Person B speak to each other when you’re not around?
How are the people in the network connected? (Ties)

- Directed or undirected ties
  - Undirected
    - Do Bob and Sam speak to each other when you’re not around?
  - Directed:
    - Would Bob go to Sam with a personal problem?
    - Would Sam go to Bob with a personal problem?
Answer the following questions about yourself:
Department
Age
Gender

Put an X next to the names of co-workers you speak with every day.

Joanna
Doug
Brandon
Evan
Anjali
Josh
Survey Example #2 (Egocentric)

How old are you? ____

What is the highest level of education you have completed?
   No high school diploma or equivalency
   High school diploma or equivalency
   Some college
   Associates degree
   Bachelors degree
   Graduate/professional degree

The questions in this scale ask you about your feelings and thoughts since your most recent release from prison. In each case, you will be asked to indicate how often you felt or thought a certain way. Answer choices are “never” (0), “almost never” (1), “sometimes” (2), “fairly often” (3), and “often” (4).

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<thead>
<tr>
<th></th>
<th>Never</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Fairly Often</th>
<th>Very Often</th>
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<td>1. Since your release from J/P, how often have you been upset because of something that happened unexpectedly?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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<tr>
<td>2. Since your release from J/P, how often have you felt that you were unable to control the important things in your life?</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tbody>
</table>
Name Generator
Now we are going to come up with a list of people you “know.” You can list up to 25 people. If you know more than 25 people, pick the 25 you are closest to. The names you provide only need to be recognizable to you.

As we make this list, the people must fit the following rules:
- They are not currently incarcerated
- You recognize them and they recognize you by sight or by name
- You could reach them if you wanted to and needed to
- They are still living
Survey Example #2 (Egocentric)

**Name Interpreters**

How old is Sam? _______

Pick the category which best describes Sam’s relation to you?

<table>
<thead>
<tr>
<th>Family</th>
<th>Romantic partner</th>
<th>Friend</th>
<th>Acquaintance</th>
<th>Service provider</th>
<th>Colleague</th>
<th>Other</th>
</tr>
</thead>
</table>

On a scale of 1 to 5, how close are you with Sam?

| 1 | Not close | 2 | Slightly close | 3 | Moderately close | 4 | Very close | 5 | Extremely close |

How old is Bob? _______

Pick the category which best describes Bob’s relation to you?

<table>
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On a scale of 1 to 5, how close are you with Bob?

| 1 | Not close | 2 | Slightly close | 3 | Moderately close | 4 | Very close | 5 | Extremely close |
What is the likelihood that **Bob** and **Sam** talk to each other when you are not around?

<table>
<thead>
<tr>
<th></th>
<th>Not at all likely</th>
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<td>2</td>
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What is the likelihood that **Bob** and **Valerie** talk to each other when you are not around?

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What is the likelihood that **Sam** and **Valerie** talk to each other when you are not around?

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</tr>
<tr>
<td>2</td>
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Pre-existing Data Example

Campus Directory
Search for people, departments, or e-mail addresses.

Advanced People Search  One field is required

Full Name
First Name
Last Name
Position Title: Professor

Phone
Campus E-Mail
Other E-Mail

Division
Department/College/Unit
Faculty Expertise
Mail Stop

Clear all fields  Download CSV

Search directory
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<td>Abadi</td>
<td>(831) 459-480</td>
<td>abadi@ucsc</td>
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<td>Humanities</td>
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Common SNA Measures

- **Size**
- **Composition**
  - Proportion or number who have certain attributes
  - Homophily – common attributes between people in a network
Common SNA Measures

- Structure of the network
  - Density – Proportion of possible ties that could exist that do exist
Density

Stanojevska, Meckel, & Plotkowiak, 2010
http://www.slideshare.net/plotti/social-network-analysis-intro-part-i
Common SNA Measures

- Structure of the network
  - Density – Proportion of possible ties that exist
  - Number of components – Number of unconnected subgroups in a network
Components

Common SNA Measures

- Structure of the network
  - Density – Proportion of possible ties that exist
  - Number of components – Number of unconnected subgroups in a network

- An individual’s position in the structure
  - Centrality- how central is a node?
Centrality

http://www.fmsasg.com/socialnetworkanalysis/
Common SNA Measures

- Structure of the network
  - Density – Proportion of possible ties that exist
  - Number of components – Number of unconnected subgroups in a network

- An individual’s position in the structure
  - Degree centrality- number of relationships a node has
  - Closeness – distance of path between two nodes
Closeness

http://www.fmsasg.com/socialnetworkanalysis/
Hypothesis Testing

- For egocentric these types of measures (e.g. centrality, size, etc) can usually be used as normal variables
  - One calculated for each network collected

- For sociocentric, it’s more complicated…
  - Example questions:
    - Are people with more ties more successful?
    - Do people prefer to be friends with people of the same race?
  - But the “people” being looked at are all part of the same network…
  - Violates many standard assumptions of inferential statistics
  - Need to use non-standard hypothesis tests like permutation tests
Data Management

- Not your normal data matrix/spreadsheet...

- Two data matrices (at least):
  - Incidence matrix
    - 1) Standard questions about/attributes of our participant
    - 2) ... but if it's an egocentric network, also need the attributes of every alter in the network
  - Adjacency matrix
    - The relation between every alter in every network
    - One spreadsheet or multiple
## Incidence Matrix

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<tr>
<td>Bob</td>
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<td>8</td>
<td>15000</td>
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Halgin & DeJordy, 2008
Adjacency Matrix

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<th>Jim</th>
<th>Bob</th>
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<td>0</td>
<td>0</td>
</tr>
<tr>
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<td>1</td>
<td>1</td>
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<tr>
<td>Jim</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td>Bob</td>
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<td>3</td>
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Halgin & DeJordy, 2008
SNA and Psychology

- Early SNA work in psychology: Moreno and Lewin
- Not common in psychology today
- Psychology often sees stable behavior patterns across situations (personality)
- SNA more often used in sociology “where the prevailing assumption is that the dispositions of individuals reflect the structural positions that they occupy” - Burt, Kilduff, & Tasselli, 2013
Clifton, 2014

- How is personality expressed across different interpersonal relationships?

- Method
  - Two studies with undergraduates (n=52 and n=82)
  - Each participant listed 30 people in their social network (egocentric)
  - Asked how they would rate their personality (Brief Five Factor Model) when interacting with each member of their network
  - “Informants” selected from each cluster (area) of the network to contact and report on the personality of the ego
Clifton, 2014

- Findings
  - Personality expression varies across interpersonal situations
  - Informants ratings of the ego’s personality are similar to the ego’s ratings of their personality with those informants
  - In both studies egos rated themselves as more neurotic, more extroverted, and less conscientious with alters in the center of their network
Langhout, Collins, & Ellison, 2014

- 12 Latin@ and/or immigrant children in a yPAR afterschool program
- Multi-method: Interviews, self-defined goals, and SNA
- Examining students’ relational empowerment
- Research question for SNA: “How and in what ways do young people’s worlds link?”
- Used two-mode SNA technique
  - Asked students to nominate both “worlds” they occupied and people in those worlds
Family and friends were more likely to bridge worlds than were teachers and others.

In year 1 there were the most bridges/connections between home and family. In year 2 most bridges between other institutions.

Average density of networks increased from year 1 to year 2 (their networks became more integrated).
Time 2

Langhout, Collins, & Ellison, 2014
Weill Dissertation

- Previous research has demonstrated the need for social support for successful reentry after incarceration (e.g. Hairston, 2002; Laub & Sampson, 2001; Nelson, et al., 1999; Petersilia, 2003)

- How does incarceration experience predict differences in social support networks during reentry?
Method

- Mapping the networks of men returning from jail and prison in Santa Cruz County
- 1-2 hour interview/computer-assisted survey
- List up to 16 people they know (if know more list people they are closest with)
- Only non-incarcerated people included in networks
- ~50 networks collected to date
Incarceration History → Network Features → Success
Resources
Readings

- Social Network Analysis: Methods and Applications (Wasserman & Faust, 1994)
- Analyzing Social Networks (Borgatti, Everett, & Johnson, 2013)
- Social Network Analysis for Ego-Nets (Crossley et al., 2015)
- The SAGE Handbook of Social Network Analysis (Scott & Carrington, 2011) - by topic
  - Crime
  - Economics
  - Policy
  - Geography and neighborhoods
Software

- Data Collection
  - EgoNet, EgoWeb
  - Qualtrics and Survey Gizmo
  - Name Gen Web (Facebook app)

- Data Analysis and Data Visualization
  - UCINET
  - enet
  - NVIVO
  - NetDraw
Workshops

- LINKS Center, University of Kentucky. 5 day summer course
- Autonomous University of Barcelona – Personal Network Summer workshop (egocentric)
- Coursera
  - Social Network Analysis - University of Michigan
  - Social and Economic Networks: Models and Analysis - Stanford
Thank You!

Questions?

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