Network Analysis
June 10-14, 2019
Institute of Behavioral Sciences, Boulder CO

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Course Description & Aims

"[A]s usually practiced, using random sampling of individuals, the survey is a sociological meatgrinder, tearing the individual from his social context and guaranteeing that nobody in the study interacts with anyone else in it...If our aim is to understand people's behavior rather than simply to record it, we want to know about primary groups, neighborhoods, organizations, social circles, and communities; about interaction, communication, role expectations and social control." (Allen Barton 1968)

This course lays the groundwork of social network analysis (SNA) from a conceptual, mathematical and computational perspective. SNA differs from other analytic perspectives in requirements for data collection, storage, and descriptive/statistical analyses. The course will address these by sampling from the most commonly used classes of analytic concepts, demonstrating for each their implementation in primary data collection efforts, empirical basis and computational implementation (in R).

We will address these concepts around two organizing principles: (1) the two primary theoretical frameworks capturing reasons networks “matter”; and (2) how each class of measures can be applied across different units of analysis: individuals, groups and “whole” networks. While by no means exhaustive, this course will develop students' beginning toolkit for SNA. SNA is a rapidly advancing field, and these tools are intended to provide the orienting frameworks that can guide further study of SNA on your own.

Objectives
By the end of the course, participants will be able to:

- Understand the primary theoretical & analytic frameworks that underpin SNA;
- Transform between the primary strategies for gathering & storing social network data;
- Compute & interpret several primary classes of measures, for varying analytic levels;
- Describe & visualize some of the most common patterns in empirical networks;
- Run descriptive & statistical analyses (in R) to identify these patterns in real data.

* This course benefited from syllabi/materials for similar courses taught by Jim Moody (Duke), Ryan Light (Oregon), David Schaefer (Arizona State), Omar Lizardo (UCLA), Ann McCranie and Bernice Pescosolido (Indiana), and from students who participated in previous iterations at Arizona State, American University, Columbia's EPIC program, ICPSR, and University of Colorado Denver. I gratefully acknowledge their influence in developing the course.
Readings

There is no assigned textbook for this class. The recommended readings will all be provided in the course Dropbox (http://bit.ly/SNA-ICPSR). If possible, I recommend reading these before the course starts.

**Strongly Recommended:**

**Recommended:**

**As needed:**

If you’d like a more in-depth treatment, there are numerous "overview" books available from a variety of perspectives on SNA. Several I recommend, in approximately descending order of their fit for purposes of our course:
- Borgatti SP, Everett MG, Johnson JC. 2013. *Analyzing Social Networks*. SAGE.
- Valente, TW. 2010. *Social Networks and Health: Models, Methods and Applications*. Oxford University Press.

Software, Prerequisites & Tutorials

All computational aspects of this course will be conducted in R. No formal statistical training or prior experience with R is assumed. However, students' prior familiarity with statistical and computing principles will enhance the course experience, easing the extension of coursework to your own research. Each course module's presentation will conceptually build only from prior material covered in this course. Code templates will be provided for the measurement and computation of each of the introduced concepts. All slides, scripts and data will be posted to Dropbox (http://bit.ly/SNA-ICPSR). Participants should bring a computer for personal use (Windows, Mac or Linux), with R previously installed. We will use a number of R packages, which will require that you have privileges on your machine that allow you to install programs/applications. If this is not possible, please contact me in advance for a complete list of the packages you should be sure to have pre-installed.
Tentative Course Schedule

Please note that this is subject to change; any changes will be announced in class. The readings listed here provide a solid overview of the topic to be covered. I have provided a separate list of additional recommended readings for further details about each topic.

**10 June – Frameworks, Data Formats, & Data Collection**

1. **Terminology**
2. **Theoretical Frameworks**
3. **Data Formats & Network Visualization**
   
   **Tutorial – Graph Visualization**

4. **Strategies of Data Collection & Ethical Considerations**
5. **Ego Network Composition**
   
   **Tutorial – Ego Networks**

**11 June – Descriptive Measures I – Distance, Density, Social Balance**

6. **Small Worlds**
   
   **Tutorial – Degree, Density, & Distance**

7. **Structural Holes**
   
   **Tutorial – Constraint**

8. **Social Balance**
   
   **Tutorial – Dyad/Triad Census & Permutation Tests**

**12 June – Descriptive Measures II – Centralities, Clustering/Cohesion, & Equivalence**

9. **Centralities**
   
   **Tutorial – Centralities**

10. **Cohesion & Clustering**
    
    **Tutorial – K-Cores & Communities**
11. Equivalence
   
   **Tutorial – Blockmodeling**

13. June – Dynamics on Networks & Dynamics of Networks; Preliminary Models

12. Diffusion & Influence
   
   **Tutorial – Stochastic & Threshold Diffusion**

13. Dynamics of Networks

14. Permutation Tests

15. Preliminary Models (QAP, LNAM, p1)
   
   **Tutorial – Catch up & Exploratory Analysis**


16. Exponential Random Graph Models
   
   **Tutorial – ERGMs**

17. Stochastic Actor Based Models
   
   **Tutorial – SABMs (if time permits)**