

**Social Network Analysis\***  
 May 18-22  
 Institute of Behavioral Sciences, Boulder CO

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**Course Folder:** Canvas (<https://umich.instructure.com/>) will be used to share materials

### **Course Description & Aims**

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"[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**

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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

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There is no assigned textbook for this class. The recommended readings will all be provided in a shared folder. If possible, I recommend reading these before the course starts.

*Strongly Recommended:*

- O'Malley JA & Marsden PV. The Analysis of Social Networks. *Health Services Outcomes Research Methodology* 2008;8(4): 222–269.

*Recommended:*

- adams j, Santos T, Williams VN. 2019. "Strategies for Gathering Social Network Data: An Overview and Evaluation." In Light RA & Moody J (eds.) *Oxford Handbook of Social Network Analysis*, forthcoming. <https://osf.io/zgawf>
- Olgnyanova K. 2016. "Network Visualization with R." Sunbelt Workshop. Available here: <http://kateto.net/network-visualization>. (skim)
- Snijders TAB. Statistical Models for Social Networks. *Annual Review of Sociology* 2011;37:129-151.

*As needed:*

- Torfs, P & C Brauer. 2014. "A (very) Short Introduction to R." <https://goo.gl/j82hKu>.

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:

- Kadushin, C. 2012. *Understanding Social Networks: Theories, Concepts, and Findings*. Oxford University Press.
- Scott, J. 2012. *Social Network Analysis: A Handbook*. (3<sup>rd</sup> Edition) Sage.
- Borgatti SP, Everett MG, Johnson JC. 2013. *Analyzing Social Networks*. SAGE.
- Scott J, Carrington PJ. 2011. *The SAGE Handbook of Social Network Analysis*. SAGE.
- Valente, TW. 2010. *Social Networks and Health: Models, Methods and Applications*. Oxford University Press.
- Hanneman, R, & M Riddle. 2005. *Introduction to Social Network Methods*. Riverside, CA. Available online: <http://bit.ly/Hanneman>.
- Wasserman S, Faust K. 1994. *Social Network Analysis: Methods and Applications*. Cambridge University Press.

## Software, Prerequisites & Tutorials

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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 a shared folder (I will provide a link at a later time). 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.

### 18 May – Frameworks, Data Formats, & Data Collection

1. Terminology
  - Borgatti SP. 1994. "A Quorum of Graph Theoretic Concepts." *Connections* 17:47-49.
2. Theoretical Frameworks
  - Borgatti SP, Mehra A, Brass DJ, & Labianca G. 2009. "Network Analysis in the Social Sciences." *Science* 323:892-895.
3. Data Formats & Network Visualization
  - Olgnyanova K. 2016. "Network Visualization with R." Sunbelt Workshop. Available here: <http://bit.ly/2tYC84B>.

#### Tutorial – Graph Visualization

4. Strategies of Data Collection & Ethical Considerations
  - adams j, Santos T, Williams VN. 2019. "Strategies for Gathering Social Network Data: An Overview and Evaluation." In Light RA & Moody J (eds.) *Oxford Handbook of Social Network Analysis*, forthcoming. <https://osf.io/zgawf>
5. Ego Network Composition
  - Bojanowski M & Corten R. 2014. "Measuring Segregation in Social Networks." *Social Networks* 39(0):14-32.

#### Tutorial – Ego Networks

### 19 May – Descriptive Measures I – Distance, Density, Social Balance

6. Small Worlds
  - Milgram S. 1967. "The Small World Problem." *Psychology Today* 1:61-67.
7. Structural Holes
  - Burt RS, Kilduff M, Tasselli S. 2013. "Social Network Analysis: Foundations and Frontiers in Advantage." *Annual Review of Psychology* 64:527-47.
8. Social Balance
  - Holland PW, Leinhardt S. 1970. "A Method for Detecting Structure in Sociometric data." *American Journal of Sociology* 70:492-513.

#### Tutorial – Dyad/Triad Census & Permutation Tests

### 20 May – Descriptive Measures II – Centralities, Clustering/Cohesion, & Equivalence

9. Centralities
  - Rothenberg RB, Potterat JJ, Woodhouse DE, Darrow WW, Muth SQ, Klovdahl AS. 1995. Choosing a Centrality Measure: Epidemiologic Correlates in the Colorado Springs Study of Social Networks." *Social Networks* 17:273-97.
10. Cohesion & Clustering
  - Moody J & White DR. 2003. "Structural cohesion and embeddedness: A hierarchical concept of social groups." *American Sociological Review* 68(1):103-27.

#### Tutorial – K-Cores & Communities

## 11. Equivalence

- Fujimoto K, Valente TW. 2012. "Social network influences on adolescent substance use: disentangling structural equivalence from cohesion." *Social Science and Medicine* 74(12):1952-60.

Tutorial – Blockmodeling

## **21 May – Dynamics on Networks & Dynamics of Networks; Preliminary Models**

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### 12. Diffusion & Influence

- Christakis NA & Fowler JH. 2007. "The Spread of Obesity in a Large Social Network over 32 Years." *New England Journal of Medicine* 357(4):370-379.

Tutorial – Stochastic & Threshold Diffusion

### 13. Dynamics of Networks

- Moody J. 2009. "Network Dynamics." in *The Oxford Handbook of Analytical Sociology*, edited by Hedstrom P & Bearman PS. New York: Oxford University Press.

### 14. Permutation Tests

- Snijders TAB. 2011. "Statistical Models for Social Networks." *Annual Review of Sociology* 37:129-51.

### 15. Preliminary Models (QAP, LNAM, p1)

Tutorial – Catch up & Exploratory Analysis

## **22 May – Statistical Modeling Frameworks**

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### 16. Exponential Random Graph Models

- Robins G, Pattison P, Kalish Y, & Lusher D. 2007. "An Introduction to Exponential Random Graph (p\*) Models for Social Networks." *Social Networks* 29(2):173-91.

Tutorial – ERGMs

### 17. Stochastic Actor Based Models

- Schaefer DR & Marcum. 2018. "Modeling Network Dynamics." In Light RA & Moody J (eds.) *Oxford Handbook of Social Network Analysis*, forthcoming. <https://osf.io/6rm9q>

Tutorial – SABMs (if time permits)