SOC618 – Social Network Analysis
Spring 2025

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Office Hours: Monday, 4:00-6:00pm, 8111 Sewell Social Science

Lectures: Tuesday, 9:30-10:45am, Van Vleck B131
Seminars & Computer Classes: Wednesday, 9:30-10:45am, Van Vleck B131

Credit Hours: 3

Course Description

This course focuses on data about connections, forming structures known as networks. Networks and network data describe an increasingly vast part of the modern world, through connections on social media, communications, financial transactions, and other ties. This course covers the fundamentals of network thinking, network tools, and the analysis and presentation of network data. Students will work directly with network data, and structure and analyze these data using R.

Social networks have always been at the center of human interaction, but especially with the explosive growth of the internet, network analysis has become increasingly central to all branches of the social sciences. How do people influence each other, bargain with each other, exchange information (or germs), or interact online? A diverse array of deep questions about social behavior can only be answered by examining the social networks encompassing and shifting around us. Network analysis has emerged as a cross-disciplinary science in its own right, and has in fact proven to be of even greater generality and broader applicability than just the social, extending to economics, history, public health, computer science, and other domains.

This course will examine key ideas in the development of social network analysis, and will develop the theory and methodological tools needed to describe and model networks in a wide range of social settings. The core of the course will comprise the essential tools of network analysis, from centrality, homophily, and community measurement, to random graphs and network formation. Alongside this we will read a series of substantive and foundational papers, shaped in part by the interests of the students and their various backgrounds. The course will also provide an introduction to network modeling and network visualization using R.

Course Objectives

By the end of the course, students will possess the skills necessary to identify when data are suitable for network analysis, choose the appropriate network analysis techniques to answer their research questions, and use the R software and packages to perform them. Students will also be able to critically read network studies from across the social sciences.

Software

The course will use R. No previous knowledge of R is required. R can be downloaded here, and is most easily run with the help of RStudio, which can be downloaded here. R uses dedicated packages for specific types of analysis. Throughout this course, we will use the igraph and statnet packages.

Reading Materials

We will draw from three different textbooks throughout the course:

- Scott, John. 2017. *Social Network Analysis*. Sage. 4th Ed.
- Newman, Mark E. J. 2010. *Networks: An Introduction*. New York & Oxford: Oxford University Press.
- Easley, David, and Jon Kleinberg. 2010. *Networks, Crowds, and Markets: Reasoning About a Highly Connected World.* New York: Cambridge University Press. Available freely online here.

The Scott and Easley & Kleinberg are approachable overviews that focus on social network analysis. The Newman book gives a broad overview of network analysis in social worlds and beyond, and is more technical. When your weekly readings include sections from multiple textbooks, I recommend tackling Newman last, as you should be better situated to understand the details. Each week we will also read a number of case studies from across the social sciences that apply the concepts and techniques we will cover. Many are recommended, not required readings, but I highly suggest that you read some of them, especially those that feel close to your research interests. If you would like further directions on readings, please reach out to me.

Course Requirements

Assessment for this class will be as follows:

60% Class Assessment. In order to get the most from this course, you are expected to attend lectures and seminars/computer class sessions, and to actively participate in both. This will count toward 20% of your grade (see the UW-Madison template I am using for evaluating class participation below). Participation will be facilitated by doing the readings associated with each week, and that you are expected to complete before the weekly lecture. In addition, you will be expected to produce weekly problem sets. Three of these problem sets will be graded and you will be able to retain two of your grades to count toward your final assessment (40% of your grade). Weekly

problem sets will be given during our computer class sessions. Unless otherwise mentioned, completed problem sets are due before the next lecture. These will be submitted as R or RMarkdown files through Canvas.

40% Individual Research Project. You will learn social network analysis in large part by *doing* social network analysis in a project of yours. Your project will be a case study that aligns as much as possible with your research interests. In it, you will apply the concepts and tools learned in the course to analyze your case. The final paper based on this research project is due at the end of our final week and will count toward 40% of your grade. Note that this class carries the Graduate Attribute. This means that the class is open to both graduate and undergraduate students, but that graduate students will need to do slightly more work than their graduate counterparts. For this class, graduate students' research projects will be expected to be more substantial than the projects of undergraduates: while undergraduates will be expected to analyze data and report on their findings (10-12p., not including tables, figures, and code), the projects of graduate students will be longer papers (20-25p., not including tables, figures, and code) engaging extensively with prior literature in their area of interest and discussing the implications of their findings. The section below describes the intermediary steps we will take together to help you complete your project and paper.

Steps Toward the Completion of Your Research Project

By the end of Week 6, you will submit a short project plan that will (1) provide a description and justification of your case, (2) identify a set of data that you might want to use, (3) briefly discuss the network concepts and tools that might apply, (4) explain your research strategy, and (5) present a short, tentative bibliography. Week 7 will consist of two peer-mentoring sessions in which we will collectively workshop your pre-posted project plans. You will be expected to provide constructive feedback based on the course material and aimed at generating both theoretical and practical suggestions for your peers. In the semester's last three weeks, you will report back to class on your project through 10- to 15-minute presentations. This will give you a final opportunity to receive feedback before submitting the paper based on your project.

Grading Scheme for this Class

92+ = A, 87+ = AB, 82+ = B, 72+ = C, 62+ = D, <62 = F

Citizenship

You are expected to show good citizenship in the classroom. When engaging in collective class discussions or peer-mentorship, listen carefully and courteously, respond respectfully, treat others as you would like to be treated.

Technology Policy

Please turn off your cell phone and store it during class. When you use a laptop, you may use it only for note-taking, consulting electronic copies of our readings, and participating in in-class exercises.

Guidelines for Evaluating Participation

Outstanding Contributor (will receive full credit = 20 out of 20 points):
Contributions in class reflect exceptional preparation. Ideas offered are always substantive, provide one or more major insights as well as direction for the class. Challenges are well substantiated and persuasively presented. If this person were not a member of the class, the quality of discussion would be diminished markedly.

Good Contributor (will receive 18 out of 20 points):
Contributions in class reflect thorough preparation. Ideas offered are usually substantive, provide good insights and sometimes direction for the class. If this person were not a member of the class, the quality of discussion would be diminished.

Adequate Contributor (will receive 16 out of 20 points):
Contributions in class reflect satisfactory preparation. Ideas offered are sometimes substantive, and provide generally useful insights. If this person were not a member of the class, the quality of discussion would be somewhat diminished.

Non-Participant (will receive 14 out of 20 points):
This person says little or nothing in class. Hence, there is not an adequate basis for evaluation. If this person were not a member of the class, the quality of discussion would not be changed.

Unsatisfactory Contributor (will receive 10 out of 20 points):
Contributions in class reflect inadequate preparation. Ideas offered are seldom substantive and provide few if any insights.

Weekly Schedule[1]

Week 1 (Tue. 01/21, Thu. 01/23) – *Introduction: The Unity and Diversity of Social Network Research*

We will begin by demonstrating the wide range of things in the social world that can be productively represented as a network, and we will introduce some of the questions that can be addressed with network data.

Required Readings

- Borgatti, Stephen P., Ajay Mehra, Daniel J. Brass, and Giuseppe Labianca. 2009. "Network Analysis in the Social Sciences." *Science* 323: 892-895.
- Butts, Carter T. 2009. "Revisiting the Foundations of Network Analysis." *Science* 325: 414–416.
- Newman, Chapter 3

Recommended Readings

- Smith, Sandra S. 2005. "'Don't put my name on it': Social Capital Activation and Job-Finding Assistance among the Black Urban Poor." *American Journal of Sociology* 111: 1-57.
- Papachristos, Andrew V. 2009. "Murder by Structure: Dominance Relations and the Social Structure of Gang Homicide." *American Journal of Sociology* 115: 74-128.
- Tilly, Charles. 2006. *Identities, Boundaries, and Social Ties*. New York: Paradigm (Chapter 1, "The Ties that Bind. . . and Bound").
- Jackson, Matthew O. 2014. "Networks in the Understanding of Economic Behaviors." *Journal of Economic Perspectives* 28(4): 3–22.

Seminar

In the seminar you will describe your academic background and interests, and share your hopes (and worries!) about this course. We will also start building a network by introducing ourselves relationally.

Week 2 (Tue. 02/28, Thu. 01/30) – *Networks and Social Behavior: Three Sociological Traditions*

In the lecture and seminar this week, we will seek to organize the diversity of social network research by identifying three theoretical visions of how networks shape social behaviors. The three required readings for this week are empirical case studies that illustrate each of these visions.

Required Readings

- Burt, Ronald S. 2004. "Structural Holes and Good Ideas." *American Journal of Sociology* 110: 349-399.

[1] The schedule and readings are subject to minor modification to allow for flexibility in the specific content and timing of the course.

- Gould, Roger V. 1996. "Patron-Client Ties, State Centralization, and the Whiskey Rebellion." *American Journal of Sociology* 102: 400-429.
- Bearman, Peter S., James Moody, and Katherine Stovel. 2004. "Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks." *American Journal of Sociology* 110: 44-91.

Recommended Readings

- Podolny, Joel M. 2001. "Networks as the Pipes and Prisms of the Market." *American Journal of Sociology* 107: 33-60.
- Erikson, Emily. 2013. "Formalist and Relationalist Theory in Social Network Analysis." *Sociological Theory* 31: 219-242.
- Emirbayer, Mustafa, and Jeff Goodwin. 1994. "Network Analysis, Culture, and the Problem of Agency." *American Journal of Sociology* 99: 1411-1454.
- Mische, Ann. 2011. "Relational Sociology, Culture, and Agency." p. 80-97 in John Scott and Peter S. Carrington (eds.), *The Sage Handbook of Social Network Analysis*. London: Sage.
- Gould, Roger V. 1995. *Insurgent Identities: Class, Community, and Protest in Paris from 1848 to the Commune*. Chicago: University of Chicago Press.

Computer Class

In computer class we will briefly start exploring sources of network data based on a critical discussion of this week's three required readings. We will then start getting up to speed with our software through a crash course in what you'll need to know in R for the purposes of this course.

Week 3 (Tue. 02/04, Thu. 02/06) – *Basic Network Concepts*

We will start our journey into network analysis proper by giving an overview of basic network terminology. We will go over different types of networks (one-mode, two-mode – also known as affiliation or bipartite networks –, ego networks, complete networks), and how these can be represented mathematically.

Required Readings

- Scott, Chapters 4 & 5.
- McPherson, Miller, Lynn Smith-Lovin, and Matthew E. Brashears. 2006. "Social Isolation in America: Changes in Core Discussion Networks over Two Decades." *American Sociological Review* 71: 353-375. Read alongside the following for an unforgettable experience of a great methodological debate:
- Fischer, Claude S. 2009. "The 2004 GSS Finding of Shrunken Networks: An Artifact?" *American Sociological Review* 74: 657-669.

Recommended Readings

- Breiger, Ronald L. 1974. "The Duality of Persons and Groups." *Social Forces* 53: 181-190.
- Lazega, Emmanuel. 2001. *The Collegial Phenomenon: The Social Mechanisms of Cooperation Among Peers in a Corporate Law Partnership*. New York: Oxford University Press. A little gem of a book.

Computer Class
We will start using R to create, manipulate, and visualize network objects.

Week 4 (Tue. 02/11, Thu. 02/13) – *Properties of Nodes (1): Centrality*

Having established the fundamental concepts of network theory, we will begin to explore the various ways in which the position of a node can be described.

Required Readings

- Newman, Chapter 7, Sections 7.1 to 7.7.
- Benjamin, Beth A., and Joel M. Podolny. 1999. "Status, Quality, and Social Order in the California Wine Industry." *Administrative Science Quarterly* 44: 563-589.
- One of the following examples:
  - Zhang, Simone, and Rebecca A. Johnson. 2023. "Hierarchies in the Decentralized Welfare State: Prioritization in the Housing Choice Voucher Program." *American Sociological Review* 88: 114-153.
  - Alderson, Arthur S., and Jason Beckfield. 2004. "Power and Position in the World City System." *American Journal of Sociology* 109: 811-851.
  - Smith, Chris M. 2020. "Exogenous Shocks, the Criminal Elite, and Increasing Gender Inequality in Chicago Organized Crime." *American Sociological Review* 85: 895-923.
  - Burt, Ronald S. 1998. "The Gender of Social Capital." *Rationality and Society* 10: 5-46.
  - Burris, Val. 2004. "The Academic Caste System: Prestige Hierarchies in PhD Exchange Networks." *American Sociological Review* 69: 239-264.
  - Fowler, James H. 2006. "Connecting the Congress: A Study of Cosponsorship Networks." *Political Analysis* 14: 456-487.

Recommended Readings

- Scott, Chapter 6
- Granovetter, Mark S. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78:1360-1380.
- Bourdieu, Pierre. 1986. "The Forms of Capital." pp. 241-258 in Richardson, John G. (ed.) *Handbook of Theory and Research for the Sociology of Education*. Westport, CT: Greenwood Press.

Computer Class
We will calculate a variety of centrality measures on a network representing school friendships (in class) and social connections between Florentine families (in the problem set), and explore what they uniquely capture about social position.

Week 5 (Tue. 02/18, Thu. 02/20) – *Properties of Nodes (2): Structural Equivalence, Roles, and Positions*

This week we will focus on understanding the position of nodes in relation to one another, evaluating the similarity and comparability of nodes in different network positions.

Required Readings

- Scott, Chapter 8
- Anheier, Helmut K., Jürgen Gerhards, and Frank P. Romo. 1995. "Forms of Capital and Social Structure in Cultural Fields: Examining Bourdieu's Social Topography." *American Journal of Sociology* 100: 859-903.
- Padgett, John. F., and Christopher K. Ansell. 1993. "Robust Action and the Rise of the Medici, 1400-1434." *American Journal of Sociology* 98: 1259-1319. (This is not strictly speaking a required reading, but one I encourage you to read as it relates directly to your problem set; it is also a great – and classic – article).
- One of the following examples:
  - Bearman, Peter S. 1997. "Generalized Exchange." *American Journal of Sociology* 102: 1383-1415.
  - Galaskiewicz, Joseph, and Ronald R. Burt. 1991. "Interorganization Contagion in Corporate Philanthropy." *Administrative Science Quarterly* 36: 88-105.
  - Maoz, Zeev, Ranan D. Kuperman, Lesley Terris, and Ilan Talmud. 2006. "Structural Equivalence and International Conflict: A Social Networks Analysis." *Journal of Conflict Resolution* 50: 664-689.

Recommended Readings

- Newman, Chapter 7, Section 7.12

Computer Class

In computer class, we will identify how different women (in the Southern Women Study) and different families (from the Florentine dataset) positioned themselves in their respective social worlds.

Week 6 (Tue. 02/25, Thu. 02/27) – *Properties of Dyads and Triads: Mutuality, Homophily, Transitivity*

This week, we turn our attention from nodes to edges, and describe the many ways in which nodes may be connected to one another.

Required Readings

- Easley and Kleinberg, Chapter 5
- Newman, Chapter 7, Sections 7.9 to 7.11; Section 7.13
- Carpenter, Daniel P., Kevin M. Esterling, and David M. J. Lazer. 2004. "Friends, Brokers, and Transitivity: Who Informs Whom in Washington Politics?" *Journal of Politics* 66: 224-246.
- One of the following examples:
  - Szell, Michael, Renaud Lambiotte, and Stefan Thurner. 2010. "Multirelational Organization of Large-Scale Social Networks in an Online World." *Proceedings of the National Academy of Sciences* 107:13636-13641.

- Chase, Ivan. 1980. "Social Process and Hierarchy Formation in Small Groups." *American Sociological Review* 45: 905-924.

Computer Class
We will revisit the school friendship networks to look at the evidence of reciprocity, homophily, and transitivity in computer class. For the problem set, you will study support relationships between the households of a rural Indian community.

Note: You may turn in our problem set for this week in Week 8. For Week 7, you will instead submit your individual project plans and read your peers' plans in order to prepare for our peer-mentoring sessions.

Week 7 (Tue. 03/04, Thu. 03/06) – *Peer-Mentoring Sessions*

This week, we will start collectively workshopping your project plans in two peer-mentoring sessions. You will provide live feedback on each other's pre-posted project plans, with the hope that your projects can also grow from their exposure to one another. You should frame your comments as constructive feedback based on your understanding of the course material, and aimed at generating theoretical ideas and/or practical suggestions for your peers.

Week 8 (Tue. 03/11, Thu. 03/13) – *Properties of Networks (1): Community Structures*

Real social networks are not random – various social forces make some people more or less likely to associate with one another, and make networks have distinct structure, instead of the messy jumble of random networks. This week, we will discuss how we can measure and describe that community structure.

Required Readings
- Scott, Chapter 7
- Girvan, Michelle, and Mark E. J. Newman. 2002. "Community Structure in Social and Biological Networks." *Proceedings of the National Academy of Sciences* 99: 7821-7826.
- Gruzd, Anatoliy, Barry Wellman, and Yuri Takhteyev. 2011. "Imagining Twitter as an Imagined Community." *American Behavioral Scientist* 55: 1294-1318.
- One of the following examples:
  - Moody, James, and Douglas R. White. 2003. "Structural Cohesion and Embeddedness: A Hierarchical Concept of Social Groups." *American Sociological Review* 68: 103-127.
  - Phillips, Damon J. 2011. "Jazz and the Disconnected: City Structural Disconnectedness and the Emergence of a Jazz Canon, 1897-1933." *American Journal of Sociology* 117: 420-483.
  - Porter, Mason A., Peter J. Mucha, Mark E. J. Newman, and A. J. Friend. 2007. "Community Structure in the United States House of Representatives." *Physica A: Statistical Mechanics and Its Applications* 386(1): 414-438.

Recommended Readings

- Newman, Mark E. J. 2002. "Assortative Mixing in Networks." *Physical Review Letters* 89: 208701.

Computer Class

In the computer class, we will study a classic network – Zachary's karate club network – and use different techniques to identify its community structure. In the problem set, you will generate networks using block models and study the community structure of the Indian village.

Week 9 (Tue. 03/18, Thu. 03/20) – *Properties of Networks (2): Small Worlds*

There are some properties that almost all social networks hold in common. One of these is that they are "small worlds" – sometimes colloquially referred to as "six degrees of separation." This week, we will discuss this phenomenon and its implications.

Required Readings

- Newman, Chapter 3, Section 3.6; Chapter 8, Section 8.2; Chapter 15, Section 15.1
- Watts, Duncan J., and Steven H. Strogatz. 1998. "Collective Dynamics of 'Small-World' Networks." *Nature* 393: 440-442. The "comic"-like, interactive version of the paper.
- Davis, Gerald F., Mina Yoo, and Wayne E. Baker. 2003. "The Small World of the American Corporate Elite, 1982-2001." *Strategic Organization*, 1: 301–326.
- One of the following examples:
  - Kogut, Bruce, and Gordon Walker. (2001). "The Small World of Germany and the Durability of National Networks." *American Sociological Review* 66: 317-335.
  - Uzzi, Brian, and Jarrett Spiro. 2005. "Collaboration and Creativity: the Small World Problem." *American Journal of Sociology* 111: 447-504.
  - Centola, Damon. 2010. "The Spread of Behavior in an Online Social Network Experiment." *Science* 329: 1194-1197.

Recommended Readings

- Watts, Duncan J. 1999. "Networks, Dynamics, and the Small-World Phenomenon." *American Journal of Sociology* 105: 493-527.
- Easley and Kleinberg, Chapter 20

Computer Class

We will create random and small world networks and calculate their average path length and transitivity. Most importantly, we will learn how to compare empirical networks to random networks with the same size and density. For the problem set, you will study a coauthorship network.

Week 10 (Tue. 03/25, Thu. 03/27) – *No class this week (Spring Break)*

Week 11 (Tue. 04/01, Thu. 04/03) – *Network Modeling and Hypothesis Testing: Exponential Random Graph Models*

This week, we will move beyond description to test hypotheses about how networks and network ties develop. To do this, we will introduce exponential random graph models, also known as p* models, which predict the likelihood of a tie between two nodes, given properties of the nodes, the dyad, and the larger network.

Required Readings

- Newman, Chapter 15, Section 15.2
- Robins, Garry, Pip Pattison, Yuval Kalish, and Dean Lusher. 2007. "An Introduction to Exponential Random Graph (p*) Models for Social Networks." *Social Networks* 29: 173-191.
- Papachristos, Andrew V., David M. Hureau, and Anthony A. Braga. 2013. "The Corner and the Crew: The Influence of Geography and Social Networks on Gang Violence." *American Sociological Review* 78: 417-447.
- One of the following examples:
  - Goodreau, Steven M., James A. Kitts., and Martina Morris. 2009. "Birds of a Feather, or Friend of a Friend? Using Exponential Random Graph Models to Investigate Adolescent Social Networks." *Demography* 46: 103-125.
  - De la Haye, Kayla, Garry Robins, Philip Mohr, and Carlene Wilson. 2010. "Obesity-Related Behaviors in Adolescent Friendship Networks." *Social Networks* 32: 161-167.

Recommended Readings

- Hunter, David R., Mark S. Handcock, Carter T. Butts, Steven M. Goodreau, and Martina Morris. 2008. "ergm: A Package to Fit, Simulate and Diagnose Exponential-Family Models for Networks." *Journal of Statistical Software* 24(3).
- Smith, Chris M., and Andrew V. Papachristos. 2016. "Trust Thy Crooked Neighbor: Multiplexity in Chicago Organized Crime Networks." *American Sociological Review* 81: 644-667.
- Faraj, Samer, and Steven L. Johnson. 2010. "Network Exchange Patterns in Online Communities." *Organization Science* 22: 1464-1480.
- Erikson, Emily, and Peter S. Bearman. 2006. "Malfeasance and the Foundations for Global Trade: the Structure of English Trade in the East Indies, 1601-1833." *American Journal of Sociology* 112: 195-230. For a different approach to testing hypotheses about the formation of network ties (see also Bearman, Moody, and Stovel (2004) listed in Week 3)

Computer Class

In the computer class, we will try to predict friendship ties between students using exponential random graph models. In the problem set, you'll do the same with the rural Indian household network.

Week 12 (Tue. 04/08, Thu. 04/10) – *Dynamic Networks*

To wrap up the class, we will get a taster of cutting-edge network analysis techniques, most notably stochastic actor-oriented models, which can be used to model how networks change over time.

Required Readings

- Snijders, Tom A. B., Gerhard G. van de Bunt, and Christian E. G. Steglich. 2010. "Introduction to Stochastic Actor-Based Models for Network Dynamics." *Social Networks* 32: 44-60.
- Lazega, Emmanuel, Lise Mounier, Tom A. B. Snijders, and Paola Tubaro. 2012. "Norms, Status, and the Dynamics of Advice Networks: A Case Study." *Social Networks* 34: 323-332.
- One of the following examples:
  - Lewis, Kevin, Marco Gonzalez, and Jason Kaufman. 2012. "Social Selection and Peer Influence in an Online Social Network." *Proceedings of the National Academy of Sciences* 109: 68-72.
  - Schaefer, David R., Steven A. Haas, and Nicholas J. Bishop. 2012. "A Dynamic Model of US Adolescents' Smoking and Friendship Networks." *American Journal of Public Health* 102: e12-e18.

Recommended Readings

- Ripley, Ruth, Tom A. B. Snijders, Zsófia Boda, András Vörös, and Paulina Preciado. 2021. *Manual for RSiena*. University of Oxford, University of Groningen. Link here.

Computer Class

We will learn how to specify simple stochastic actor-oriented models with RSiena and how to interpret the coefficients they estimate, using multiple networks of the relationships between and habits of some teenage friends. For the problem set, you'll fit and interpret the results of your own stochastic actor-oriented model.

Week 13 (Tue. 04/15, Thu. 04/17) – *In-class Project Presentations (1)*

Week 14 (Tue. 04/22, Thu. 04/24) – *In-class Project Presentations (2)*

Week 15 (Tue. 04/29, Thu. 05/01) – *In-class Project Presentations (3)*