Economics 46: Networks and Human Behavior
Syllabus, March 2021

Professor Matthew O. Jackson

Office: 241 Landau
Email: jacksonm@stanford.edu

Overview.

How does a person's position in a network determine their power? What systematic errors do we make when forming opinions based on what we learn from our friends? How do financial contagions work and why are they different from the spread of a flu? How do splits in our social networks feed inequality, immobility, and polarization? How is globalization changing international conflict and wars?

Despite human networks' primary role in structuring our lives, there is a chasm between our scientific knowledge of how networks determine human behavior and what the general public and policy makers know. This course helps close that gap. It should also make you more aware of the variety of networks in which you are embedded and how they affect your life.

One can easily distinguish a network formed by humans from one picked uniformly at random. A handful of simple and quantifiable features of human networks yield enormous insight into why we behave the way we do. In this course two threads will be interwoven: why human networks have special features, and how those features determine our power, opinions, opportunities, behaviors, and accomplishments. This understanding of networks answers the questions posed above.

Prerequisites.

This course will be largely self-contained conceptually. There will be a lot of data analysis and so comfort with basic statistics (hypothesis testing, regressions) and some linear algebra will be presumed (e.g., matrix multiplication).

Textbooks. The main text that we will consult for the course is:

The Human Network, Matthew O. Jackson, Pantheon Publishing.

Additional Background Readings: The above provides conceptual background and discussion, but no technical detail. The main technical detail is

covered in the slides. If you want more background and technical detail, the following texts cover parts of the material at varying levels of depth.

Networks, Crowds and Markets, David Easley and Jon Kleinberg, Cambridge University Press.

Six Degrees: Science of a New Age, Duncan Watts, W. W. Norton & Company.

Social and Economic Networks, Matthew O. Jackson, Princeton University Press. (This is a much more mathematical treatment of many of the topics.)

Data and Analysis.

The course involves analysis of a variety of data sets, and some work with Python. It is self-contained and so you do not need prior experience with Python.

Grading. There are five problem sets, roughly every two weeks, and then a final project. The problem sets will count for forty percent of the grade, attendance and participation for ten percent, and the final project the other half. It is ok to miss a couple of our meetings, but please let us know in advance.

Final Project.

You can work in groups of up to four on the final projects (and you may work in smaller groups or alone if you prefer). They can be analysis of a data set, or some work with a network-based model (e.g., simulations). You should apply some of the concepts and tools you have learned in the course in your analysis. You should pose a question or a hypothesis, and then provide an answer. The analysis should concern some aspect of network features, and some of their implications. The write-up should include up to ten pages of text explaining the questions that are being explored, why they are interesting, what methods are being used, and then what you find, and what the broader conclusions are, and you should include a brief bibliography of any studies or readings that are closely related. Beyond the ten pages you can include any additional supporting tables or figures, code, and other materials. Longer is not better - please stay within the ten page limit.

It is a good idea to start thinking about the topic, approach, and looking for any data relatively early in the quarter, and feel free to talk with me and/or the TAs for feedback or suggestions on your project.

You can find a more detailed description of the final project on canvas as well as sample final projects, and you can find links to a variety of network data sets on my webpage https://web.stanford.edu/ jacksonm/Data.html .

Syllabus

Abbreviations: HN = *The Human Network*, SEN = *Social and Economic Networks*, NCM = *Networks Crowds and Markets*, SD = *Six Degrees*.

Week 3.2 indicates the second lecture of week 3.

- Week 1: *Introduction: Networks and Human Behavior, and Measurements of Networks*

  Introduction to representing relationships in networks, basic measurements and features of networks, and an overview of the course.

  (HN: Chpt. 1, SEN Chpt. 1-3, NCM Chpt. 1, SD Chpt. 1-3)

- Week 2: *Power and Influence: Central Positions in Networks*

  We will examine a variety of different ways in which people can be influential and influenced, focusing on different definitions of centrality and social capital. A person can have few friends or contacts and still be very influential if those few friends and contacts are themselves highly influential. This sort of indirect reach is often where power resides, and we can see this sort of influence very clearly via network concepts. Iterative, network-based measures of power and influence will help us understand how to best seed a diffusion, as well as what it was that made Google an innovative search engine. When it comes to measuring power, another way in which people can be important, and one that is particularly evident when seeing networks, is being a key connector or coordinator. Understanding how networks embody power and influence will be very useful when we later discuss things like financial contagions, inequality, and polarization. Thus, this is our natural point of departure.

  (HN: Chpt. 2, SEN Chpt. 2)

- Week 3: *Diffusion and Contagion*

  We will examine how contagion and diffusion are driven by the structure of our networks, beginning with an examination of component structure

and basic reproduction numbers and then going on to examine complex contagion. Beyond immediate insights into the spread of diseases, this understanding will also be instrumental in comprehending the spread of ideas, financial contagions, as well as inequality in employment and wages – topics of some of the following weeks.

(HN: Chpt. 3, SEN Chpt. 4,7, NCM Chpt. 21 SD Chpt. 6)

- Week 4: *Homophily: Houses Divided*

  Although our world is highly connected, those connections are far from being spread uniformly. Friends are remarkably similar to each other. How many of your friends could almost be your twin, as least on some dimensions? Although such patterns are so natural and normal to us that we rarely notice them, they have profound consequences. The pervasive tendency of relationships to form among people similar in age, religion, ethnicity, and profession can insulate one group from another and can allow very different beliefs, norms, and behaviors to thrive, even among proximate groups. These tendencies are a, if not the, major driver of persistent inequality and a lack of social and economic mobility. We will also talk about techniques for inferring the divides and community structures in networks.

  (HN: Chpt. 5, SEN Chpt. 3, NCM Chpt. 4)

- Week 5: *Network Formation*

  Beyond homophily, networks form in ways that give them special features. We will explore two main approaches to understanding various features of networks: random network formation and strategic formation. We will explore why we expect strong asymmetries in degree distributions in some contexts and not others, and explore the implications of rich-get-richer phenomena in a network context. We will also explore why networks have high clustering. In addition, we will examine how networks form when people make explicit choices of partners, and the inefficiencies that can result.

  (HN: Chpt. 5,9, SEN Chpt. 3,5,6,11, NCM Chpt. 18,20, SD Chpt. 3,4)

- Week 6: *Social Learning: The Wisdom and Folly of the Crowd*

We will explore how we learn from each other and when we get things right and when we go wrong. There are systematic errors that we make in interpreting information that we obtain from friends and acquaintances. For instance, we often treat similar information from different sources as being independent confirmation of a fact, even though it may emanate from a common (unreliable) source. Divisions in networks – and homophily in particular - can lead to persistent differences in beliefs and norms across groups. Our ability to communicate in the abstract makes us susceptible to deception, and it enables errors and even fake news to crowd out the absorption of facts and real news. Despite all of these challenges, there are situations in which we get things right. We will see how our networks determine when the crowd really is wise and when it is prone to folly.

(HN: Chpt. 7, SEN Chpt. 8, NCM Chpt. 16 SD Chpt. 7)

- Week 7: *Peer Effects: The Influence of Our Friends and Our Local Network Structures*

  There are many reasons that our behaviors match those of our friends, from strategic complementarities to caring about how others perceive us - reacting to peer pressure. These influences add another layer to understanding learning and diffusion beyond simple contagion and opinion formation: people care to deliberately match actions of others. This leads to additional principles concerning how network structure relates to diffusion and patterns of behavior, and is the topic of this week Here we will explore herding and cascading behaviors, and gain more insight into why some products diffuse while others fail, and how this can depend on local patterns of friendships. We can see how people can coordinate on bad behaviors, and how homophily plays a role in shaping norms of behavior.

  (HN: Chpt. 8, SEN Chpt. 9, NCM Chpt. 19, SD Chpt. 7,8)

- Week 8.1 *Immobility and Inequality: Network Feedback and Poverty Traps*

  Here we will look indirectly at inequality and more directly at immobility: how people end up trapped by the social circumstances into which they are born. The communities and networks in which they are embedded provide them with the information and opportunities that help

determine whether they succeed. Homophily plays the starring role in our story of immobility and inequality. We will begin with overview of what is known about inequality, immobility, and education, and how they fit together. That background will enable us to understand the roles of networks and homophily.

(HN: Chpt. 6, SEN Chpt. 9,10)

- Weeks 8.2, 9.1 *Markets and Financial Networks: Too Connected to Fail*

  Contagion provides a point of departure for understanding the spread of financial distress. Increasingly inter-connected economies make it possible for a collapse of real estate prices in Las Vegas to affect financial markets in London and Hong Kong. However, financial contagion operates fundamentally differently from contagion of a disease. A countervailing effect is that globalization leads to more diversified investments and safer portfolios overall. This diversification effect that comes as a financial network becomes denser has no counterpart in the spread of a plague or flu. We will examine the structure of financial networks, from the structure of core-periphery networks, to the correlation in banks' investment portfolios. We will also examine the incentives of financial institutions to form their network, and the resulting externalities and inefficiencies.

  (HN: Chpt. 4)

- Week 9.2: *Globalization: Our Changing Networks*

  Changes in technology are a mixed blessing, as they change the world in which we live. Technological changes have led to the most rapid decrease in extreme poverty that the world has ever seen. But it has also increased the premium to higher education, increasing inequality. Our discussions of human networks make clear some of tradeoffs that come with our increased connectivity, homophily and economic globalization.

  (HN: Chpt. 9, SD Chpt. 1)