SOM MGT 874
Networks and Health

Tuesday, Thursday 2:40–4:00 p.m.
Spring Term 1 -- 2017
Location: Room 2200

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Course Description:

Decision-makers increasingly act in complex situations defined by formal and informal networks – networks of employees and institutions, of collaborators and competitors, of customers and brands, and of clients and providers. Novel big-data technologies and computational techniques make this complexity visible and even manipulable. Increasingly, we can intervene in networks to achieve public policy or management objectives.

We will explore new research and applications in network science, with an emphasis on health-related examples. The material covered will particularly equip students with the tools they need to analyze problems in public health, global health, and medicine, and to be leaders of companies, entrepreneurial efforts, and policy-making related to health and health care. But the topics and methods covered in the course are relevant to management topics in other industries, including marketing, forecasting, human resources, mergers, and so on.

Social Network Analysis (SNA) refers to both a set of methodological techniques and a theoretical perspective. As a methodological approach, SNA involves techniques steeped in graph theory, with statistical and computational applications. As a theoretical perspective, SNA stresses the interdependence among entities – such as patients, doctors, or institutions. SNA focuses on the relationships among interacting units and on how the interaction pattern (the architecture of connections, or the "topology") affects the behavior of the component entities and the system as a whole. Network structure can influence diverse outcomes: from technology adoption to group performance; from organizational mergers to firm relations; from brand awareness to consumer choice; from the spread of violence to the spread of infection.

We will explore both online and offline networks, and diverse applied topics like social capital, "big data" methods, online community formation, tipping points, team performance, demand forecasting, information cascades, online markets, and others. And we will also have four in-class exercises using novel software to explore social network structure and function.

Course Website:

A collection of links to the readings and other materials will be on Canvass

Teaching Fellow:

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Course Requirements:

• class attendance and participation (40%)
• business application memo (four pages) and presentation (20%) – probably to be done as teams, depending on class size
• take-home final exam (40%)

Participation is a key requirement. Much of the learning in this class will occur from the give-and-take among students especially during the in-class software-based experiences. This requires reading all of the materials and coming to class with something to say. You will be expected to be able to summarize the basic argument of every assigned reading.

For the memo and related presentation, you will choose a management problem you are familiar with, and apply a network perspective, outlining the ways in which the problem relates to network principles and/or ways in which it might be addressed using network principles.

The take home exam will likely be a mix of short answers and essays. There will be some choice of questions.

Collaboration and Citation:

Discussion and the exchange of ideas are essential to academic work. However, you should ensure that any written work you submit for evaluation is the result of your own research and writing, and that it reflects your own approach to the topic. You must also properly cite any books, articles, websites, lectures, etc., that have helped you with your work (I do not care what citation format you follow, so long as you follow one). It's really depressing for all involved when people don't take this seriously.

Readings:

Readings are available online at the course website. They are heavier in the earlier part of the course.

Also: Christakis, N.A. and Fowler J.H. *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. New York: Little Brown, 2009.

January 24 (Tuesday)
(1) Course Introduction
　　We will introduce what networks are, how they differ from mere groups, how they are mapped, and how they come to have special properties. We will consider how and why the whole comes to be greater than the sum of its parts.

NA Christakis and JH Fowler, *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. New York: Little Brown, 2009 – Chapter 1.

January 26 (Thursday)
(2) Social Contagion I – Face-to-Face Networks
　　How do diverse health-related phenomena, ranging from obesity to smoking to kindness to prescribing behavior spread across social ties within social networks, both offline and off? In what ways do people's behaviors, emotions, and attributes depend not only on their own choices and actions, but also on the choices and actions of other people to whom they are connected, directly or indirectly?
　　We will examine face-to-face and online networks in sequence.
　　We will also examine the concept of "social capital," first advanced by sociologist James Coleman in 1988, and the idea of "emergent" properties of social systems. How and why do groups of people come to have properties that do not inhere in the individuals themselves? And to what productive ends, both good and bad, might social capital be put, especially when it comes to health – by individuals on their own behalf and by policymakers on behalf of communities or firms?

NA Christakis and JH Fowler, *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. New York: Little Brown, 2009 – Chapters 2, 3, and 4.
R Iyengar, C Van den Bulte, and TW Valente, "Opinion Leadership and Social Contagion in New Product Diffusion," *Marketing Science* 2011; 30:195–212.
NA Christakis and JH Fowler, "The Spread of Obesity in a Large Social Network Over 32 Years," *New England Journal of Medicine* 2007; 357: 370-379.

January 31 (Tuesday)
(3) Social Contagion II – Online Networks

NA Christakis and JH Fowler, *Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives*. New York: Little Brown, 2009 – Chapter 8.
S Goel, A Anderson, J Hofman, and DJ Watts, "The Structural Virality of Online Diffusion," *Management Science* 2015; 62: 180-196.
L Coviella, Y Sohn, ADI Kramer, C Marlow, M Franceschetti, NA Christakis, and JH Fowler, "Detecting Emotional Contagion in Massive Social Networks," *PLoS One* 2014; 9(3): e90315.
ADI Kramer, JE Guillory, and JT Hancock, "Experimental Evidence of Massive-Scale Emotional Contagion Through Social Networks," *PNAS: Proceedings of the National Academy of Science*s 2014; 111: 8788-8790.

February 2 (Thursday)
(4) Social Network Interventions: Targeting and Social Marketing
    How can we exploit an understanding of social network structure and function to intervene in the world to achieve public health or management objectives? How can we foster social contagion to affect collective health-related behavior?

TW Valente, "Network Interventions," *Science* 2012; 337: 49–53.
TW Valente, A Ritt-Olson, A Stacy, JB Unger, J Okamoto, and S Sussman, "Peer Acceleration: Effects of a Social Network Tailored Substance Abuse Prevention Program Among High-Risk Adolescents," *Addiction* 2007; 102: 1804–1815.
DA Kim, AR Hwong, D Stafford, DA Hughes, AJ O'Malley, JH Fowler, and NA Christakis, "Social Network Targeting to Maximise Population Behaviour Change: A Cluster Randomised Controlled Trial," *The Lancet* 2015; 386: 145-153.
RM Bond, CJ Fariss, JJ Jones, ADI Kramer, C Marlow, JE Settle, and JH Fowler, "A 61-Million-Person Experiment in Social Influence and Political Mobilization," *Nature* 2012; 489: 295-298.

February 7 (Tuesday)
(5) Social Network Interventions: Manipulating Network Structure
    Changing the structure of the ties between members of a group affects the performance of the whole group and of the individuals within it – with respect to everything from cooperation to innovation to product adoption – in ways relevant to health and health behavior. The structure of the ties of employees (such as doctors within hospitals) also affects their performance. Can social structure be manipulated for the better?

D Centola, "The Spread of Behavior in an Online Social Network Experiment," *Science* 2010; 329: 1194–1197.
R Guimera, B Uzzi, J. Spiro, and LA Nunes Amaral, "Team Assembly Mechanisms Determine Collaboration Network Structure and Team Performance," *Science* 2005; 308: 697-702.
M Barnett, NA Christakis, AJ O'Malley, JP Onnela, NL Keating, and B Landon, "Physician Patient-Sharing Networks and the Cost and Intensity of Care in US Hospitals," *Medical Care* 2012; 50: 152-160.
BE Landon, N Keating, ML Barnett, JP Onnela, S Paul, AJ O'Malley, T Keegan, and NA Christakis, "Variation in Patient-Sharing Networks of Physicians Across the United States," *JAMA: Journal of the American Medical Association* 2012; 308: 265-273.

February 9 (Thursday)
(6) *Breadboard* Exercise I: Coordination in Groups
    In this session, we will use new *Breadboard* software developed in the Human Nature Lab, and used for many published experiments, to play network games, and to analyze the results. We will evaluate means to intervene in networks to make groups better able to *coordinate* their collective efforts to achieve solutions to hard problems.

M Kearns, S Suri, and N Montfort, "An Experimental Study of the Coloring Problem on Human Subject Networks," *Science* 2006; 313: 824-827.

February 14 (Tuesday)
(7) *Breadboard* Exercise II: Decision-Making in Groups
     In this session, we will use *Breadboard* to play network games, and to analyze the results. We will evaluate means to intervene in networks to make groups more *cooperative*.

D Rand, S Arbesman, and NA Christakis, "Dynamic Social Networks Promote Cooperation in Experiments with Humans," *PNAS: Proceedings of the National Academy of Sciences* 2011; 108: 19193-19198.

February 16 (Thursday)
(8) *Breadboard* Exercise III: Sharing in Groups
     In this session, we will use *Breadboard* to play network games, and to analyze the results. We will evaluate *information-sharing* in networks, for example in a situation where there is a natural disaster.

February 21 (Tuesday)
(9) Network Sensors Offline and Online
     We can use an understanding of network structure and function not only to deliver information and products *into* a network, with an eye towards changing actors' behavior, but also to extract information *from* a network. This in turn allows us to optimize forecasts about epidemic disease, pharmaceutical adoption, information diffusion, and other spreading processes.

NA Christakis, and JH Fowler, "Social Network Sensors for Early Detection of Contagious Outbreaks," *PLoS One* 2010; 5(9): e12948.
M Garcia-Herranz, EM Egido, M Cebrian, NA Christakis, and JH Fowler, "Using Friends as Sensors to Detect Global-Scale Contagious Outbreaks," *PLoS One* 2014; 9(4): e92413
J Cheng, LA Adamic, PA Dow, J Kleinberg, and J Leskovec, "Can Cascades Be Predicted?" *Proceedings of the 23rd International Conference on World wide web* (WWW '14). ACM, New York, NY, USA, 925-936.

February 23 (Thursday)
(10) Antagonistic Networks and Violence
     Networks can affect human populations adversely, for instance by facilitating or promoting violence or animosity. And not all ties between people are positive: many are negative, or antagonistic, and these can play important roles in the health and well being of communities of all sizes.

PS Bearman, and J Moody, "Suicide and Friendships Among American Adolescents," *American Journal of Public Health* 2004; 94: 89–96.
AV Papachristos, and C Wildeman, "Network Exposure and Homicide Victimization in an African American Community," *American Journal of Public Health* 2013; e1–e8.
L Glowacki, A Isakov, RW Wrangham, R McDermott, JH Fowler, and NA Christakis, "Formation of Raiding Parties for Inter-Group Violence Is Mediated by Social Network Structure," *PNAS: Proceedings of the National Academy of Sciences* 2016; 113: 12114-12119.

February 28 (Tuesday)
(11) Mapping Networks and *Trellis* Exercise

We will use new *Trellis* software developed in the Human Nature Lab to map our own class network. Network-mapping is finding wide application in schools, factories, hospitals, villages, and other venues where population behavior change, at scale, is desired, and new tools are available to discern networks.

B Uzzi and S Dunlap, "How to Build Your Network," *Harvard Business Review*, 2005.
R Cross and L Prusak, "The People That Make Organizations Stop – Or Go" *Harvard Business
    Review* 2002; 80: 104-112.
LJ Matthews, P DeWan, and EY Rula, "Methods for Inferring Health-Related Social Networks
    Among Co-Workers from Online Communication Patterns," *PLoS ONE* 2013; 8: e55234.

March 2 (Thursday)
(12) Case Presentations

We will present and discuss the network assessments students have made regarding management topics of interest.

March 7 (Tuesday)
(13) Case Presentations

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