Fall 2018
Sociology 952: Causal Peer Effects
(Seminar–Mathematical and Statistical Applications in Sociology)

Course location: 6125 Social Science
Meeting time: Wed 9:30am-12:00 noon
Website: https://canvas.wisc.edu/courses/117273

Instructor: Prof. Felix Elwert, Ph.D.
Office Hours: Tue 10:45-11:45am (by appointment)
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Instructional Mode: Face-to-face
Credits: 3 (2.5 hours of class and 6-10 hours of work out of class per week)

Course Description
Economist Bruce Sacerdote recently noted that "[u]nderstanding and measuring peer effects are often viewed as a Holy Grail of social science" (2014:254). One finds it hard to disagree: peer effects—social interactions, network influence, contagion, spillover, interference, or whichever term you prefer for interpersonal influence—are what's "social" about social science.

Peer effects exist if one person's behavior or characteristics affect the behavior or characteristics of another person. The past decade has seen a veritable explosion in careful methodological work and empirical applications on peer effects. Examples are everywhere, e.g. in education (Does one disruptive student spoil it for everybody? Should schools be tracked by ability?); in medicine and public health (Does the death of one spouse kill the other? Does weight-gain spread among friends? Is teenage motherhood contagious?); in business (Do so-called social influencers actually influence anybody? How do innovations spread through markets?); and elsewhere.

The study of peer effects is a truly multidisciplinary endeavor. Sociologists, with some justification, like to stake a claim for historical primacy. The modern methodological literature, however, is largely anchored in statistics and economics.

This course has two goals. As a methods seminar, it introduces students to the concepts and statistical tools for causal inference for peer effects from several disciplines. We will emphasize statistical approaches in the potential-outcomes tradition as well as econometric work on social interaction. As a substantive seminar, we will give preference to applications from education and public health. It turns out that the world not only gets more complicated when analysts give up on the fiction of independent social actors, it also gets a whole lot more interesting.

Class structure
Class meetings will be split between lectures and seminar discussions. In some meetings, lecture will predominate, in others, we will work through key passages or results from the readings together. This requires that you have carefully read all required readings prior to coming to class.

Learning Outcomes
To establish some common ground, we will first review notation and tools commonly used in this literature (e.g. potential outcomes, directed acyclic graphs, instrumental variables estimation). We will then move to special methodological topics and empirical applications, including two-stage cluster randomized trials, partial interference, network interference, stratified inference,

personalized encouragement designs, linear-in-means models, the reflection problem, measurement error, and causal inference in observational studies.

Although we will read articles at the statistical and econometric research frontier, we will emphasize concepts and intuition over proofs. While we will often inspect clever mathematical moves—and appreciate that most notation is there for a reason—, this course is fundamentally geared toward applied researchers who want to consume and understand—but not develop—new methods for causal peer effects. There will be no software component to the course.

Prerequisites
This course is geared at graduate and professional students from all disciplines with a serious interest in causal peer effects. The minimal requirement for this seminar is a solid background in GLM, familiarity with basic instrumental variables estimation, and prior exposure to the potential outcomes framework of causal inference—all at least at the level of Angrist and Pischke's *Mostly Harmless Econometrics.* Neither linear algebra nor calculus is required beyond the basics, though neither will hurt.

Enrollment
This course is limited to regularly enrolled students. Auditors must demonstrate a compelling need and meet the same requirements as regularly enrolled students (exception: no term paper).

Requirements
Readings: It is essential that you commit to carefully completing all required readings prior to class. You will make a reasonable effort every week to complete some optional readings as well.

Abstracts: Every week, you will submit a half-page (single-spaced) abstract of the required readings. Every abstract has two parts. First, you will highlight one or two key methodological insights from your readings and explain them in your own words. Second, you will offer reflections on the implications of this insight for some substantive topic in your area of interest, ideally relating to your own research. Please proof your abstracts for content, style, spelling, and grammar. Abstracts are to be submitted as email attachments in .docx format (so that I can comment efficiently) and sent to elwert@wisc.edu on Tuesday afternoon (4PM). Write "Soc 952 Abstract, Week X" in the subject line—else I might miss it.

Paper: You will write a term paper on causal peer effects. The paper may be empirical or conceptual. In the past, successful papers often took the form of a study-design proposal, pre-analysis plan, or critical integration of the methodological insights gleaned in this class with an existing substantive literature. You may elaborate on an existing project, or thesis chapter, but you must disclose what part of the term paper is new. A one-page proposal for your paper in .docx-format is due on October 24. The final paper should not exceed 20 double-spaced pages, 12 point font, one-inch margin, including tables, figures, and references. I will stop reading after 20 pages. Papers are due on December 15 (no extensions).

There is no final exam during exam period.

Grading
20% participation, 20% abstracts, 60% final assignment.

Academic Integrity
By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension.

Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

Accommodations for students with disabilities
The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform me of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. I will work either directly with the you or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA.

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals. The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world."

Schedule
Material is arranged in the recommended order of reading
> R = Required
> O = Optional

September
> 5   **Causal inference: Review**
> R: Hernan 2004
> R: Angrist, Imbens, Rubin 1996
> R: Elwert 2013, pp.245-261, 265-266
>
> 12   **Spillover estimands**
> R: VanderWeele 2015 up to and including 15.2.
> O: VanderWeele & An 2013 p 353-363 (easier)
> R: Hudgens & Halloran 2008 (read entire, skim 4.2)
> R: VanderWeele 2015, sections 15.3 and 15.4
> O: Sobel 2006
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> 19   **Observational Data**
> R: VanderWeele 2015, sections 15.7-15.8
> O: Christakis and Fowler 2007
> R: Shalizi and Thomas 2009
> O: Cohen-Cole and Fletcher 2008
> O: VanderWeele 2011
> O: An 2016
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> 26   **Instrumental variables**
> R: O'Malley et al. 2014
> R: Kang and Imbens 2016
> 0: Kang and Keele 2018
> 0: Eckles et al. 2016

October

Readings

An, Weihua. 2016. "On the Directionality Test of Peer Effects in Social Networks." Sociological Methods and Research 45(4): 635-650.

Angrist, J.D. 2014. Perils of Peer Effects. Labour Economics. 30: 98-108.

Angrist, J. D., G. W. Imbens, and D. B. Rubin. 1996. Identification of causal effects using instrumental variables. Journal of the American Statistical Association 91(434), 444–455.

Baird, S., Bohren, A., McIntish, C., Özler, B. 2018. Optimal Design of Experiments in the Presence of Interference. Review of Economics and Statistics.

Blume, L.E., Brock, W.A., Durlauf, S.N., Ioannides, Y.M. 2011. Identification of Social Interactions. Handbook of Social Economics: 856-964.

Booij, A.S., Leuven, E., Oosterbeek, H. 2016. Ability peer effects in university: Evidence from a randomized experiment. Review of Economic Studies.

Christakis, N.A. and Fowler, J.H. 2007. The spread of obesity in a large social network over 32 years. New England Journal of Medicine, 357:370-379.

Cohen-Cole, E. and Fletcher. J.M. 2008) Detecting implausible social network effects in acne, height, and headaches: longitudinal analysis. British Medical Journal, 337.

De Giorgi, G., Pellizari, M., Redaelli, S., 2010. Identification of Social Interactions through Partially Overlapping Peer Groups. American Economic Journal—Applied Economics 2: 241–275.

Duflo, Esther, Pascaline Dupas, and Michael Kremer. 2011. Peer effects, teacher incentives, and the impact of tracking: Evidence from a random- ized evaluation in Kenya. American Economic Review 101(5):1739–1774.

Eckles, D., Kizilcec, R.F., Bakshy, E. 2016. Estimating peer effects in networks with peer encouragement designs. PNAS, 113(27): 7316–7322.

Elwert, Felix. 2013. "Graphical Causal Models." Pp. 245–73 in Handbook of Causal Analysis for Social Research, S. Morgan (ed.). Dodrecht: Springer.

Feld, J., Zölitz, U. 2017. Understanding Peer Effects: On the Nature, Estimation, and Channels of Peer Effects. Journal of Labor Economics 35(2): 387-428.

Guryan, J., Kroft, K., & Notowidigdo, M. J. (2009). Peer effects in the workplace: Evidence from random groupings in professional golf tournaments. *American Economic Journal: Applied Economics*, *1*(4), 34-68.

Hernan, M.A. 2004. A definition of causal effect for epidemiological research. Journal of Epidemiology and Community Health. 58:265–271.

Hoxby, Caroline M., and Gretchen Weingarth. 2005. ''Taking Race Out of the Equation: School Reassignment and the Structure of Peer Effects.'' Working Paper, Harvard University.

Hudgens, M.G. and Halloran, M.E. 2008. Towards causal inference with interference. Journal of the American Statistical Association, 103:832-842.

Kang, H., Imbens, G. 2016. Peer Encouragement Designs in Causal Inference with Partial Interference and Identification of Local Average Network Effects. arXiv:1609.04464v1.

Kang, H. Keele, L. 2018. Spillover Effects in Cluster Randomized Trials with Noncompliance. arXiv:1808.06418v1

Lu, F., & Anderson, M. L. (2014). Peer effects in microenvironments: The benefits of homogeneous classroom groups. *Journal of Labor Economics*, *33*(1), 91-122.

Manski, C.F. 1993. Identification of endogenous social effects: Thereflection problem. Review of Economic Studies 60(3):531–542.

Ogburn, E.L., VanderWeele, T.J. 2014. Causal Diagrams for Interference. Statistical Science 29(4):559–578.

O'Malley, A. J., F. Elwert, J. N. Rosenquist, A. M. Zaslavsky, and N. A. Christakis (2014). Estimating peer effects in longitudinal dyadic data using instrumental variables. Bio- metrics 70 (3), 506–515.

Sacerdote, B., 2001. Peer Effects with Random Assignment: Results for Dartmouth Roommates. Quarterly Journal of Economics 116:681–704.

Sacerdote, B. 2011. Peer effects in education: How might they work, how big are they, and how much do we know thus far? In Handbook of the economics of education, vol. 3: 249–277.

Shalizi, C.R., Thomas, A.C. (2011). Homophily and contagion are generically confounded in observational social network studies. Sociological Methods and Research, 40:211-239.

Sinclair, B., McConnell, M., Green, D. 2012. Detecting Spillover Effects: Design and Analysis of Multilevel Experiments

Sjölander, A., Frisell, T., Kuja-Halkola, R., Öberg, S., Zetterqvista, J. 2016. Carryover Effects in Sibling Comparison Designs. Epidemiology 2016.

Sobel, M.E. 2006. What do randomized studies of housing mobility demonstrate?: Causal inference in the face of interference. Journal of the American Statistical Association, 101:1398-1407.

VanderWeele, T.J. (2011). Sensitivity analysis for contagion effects in social networks. Sociological Methods and Research, 40:240-255.

VanderWeele, T.J. 2015. Explanation in Causal Inference: Methods for Mediation and Interaction. Oxford University Press.