

Revised 4.8.2010

Sociology 2960G

**Spatial Data Analysis Techniques for the Social Sciences**

Syllabus, Spring 2010: Brown University

**Where and When:** 108 Maxcy; Mondays, 2-4:50pm

**Instructor:** Margot Jackson, 303 Maxcy Hall, 3-3192, [margotj@brown.edu](mailto:margotj@brown.edu)

**Office Hours:** Thursdays, 10am-12pm; 303 Maxcy Hall

**Course website:** Accessible via <http://mycourses.brown.edu/>

**Goals:** This is a survey course providing an applied introduction to statistical methods for analyzing spatial and/or clustered data at the individual and aggregate levels. Attention will be given to methods for analyzing both the causes and consequences of clustering. Topics include multilevel analysis; fixed effects models; spatial choice; spatial autocorrelation, heterogeneity and dependence. Our focus will be applied—I will provide an introduction to underlying theory, but emphasis will be on application and interpretation rather than derivation. Overall goals include highlighting the framework and assumptions for each approach; studying applications; understanding disciplinary and theoretical preferences for particular approaches; providing experience with software; and studying issues that arise in empirical research.

Important: this is not a course about Geographic Information Systems (GIS) or mapping techniques. Pre-requisites include Sociology 2010 and 2020, or the equivalent (a strong background in the generalized linear model).

**A Note on Software:** I assume Stata proficiency. In addition to working in Stata I will introduce HLM and MPlus, along with freeware for more exploratory analysis.

**Format:** Weekly 3-hour sessions with lectures, demonstrations and student presentations.

**Requirements.** Regular class attendance, leading discussions of empirical papers (frequency dependent on enrollment), occasional computation assignments and oral presentation of results, and a written proposal and progress report on a piece of research that makes use of some of the methods discussed in class.

Paper proposal due on 3/22. Final progress report/paper due on Monday, 5/10.

**Readings:** There is one required text:

Hox, Joop. 2002. *Multilevel Analysis: Techniques and Applications*. Lawrence Erlbaum Associates: Mahwah, N.J.

Other readings are accessible via the web and/or website.

In addition, there is one strongly recommended text:

Rabe-Hesketh, Sophia and Anders Skrondal. 2008. *Multilevel and Longitudinal Modeling Using Stata, 2<sup>nd</sup> Edition*. Stata Press.

## COURSE OUTLINE

### February 1: **Introductions; Overview of Generalized Linear Model & Contextual Effects**

Wooldridge, Jeffrey M. 2009. Chapters 3 and 17 in *Introductory Econometrics: A Modern Approach, 4e.* Southwestern Cengage Learning: Mason, OH.

Logan, John, Weiwei Zhang and Hongwei Xu. Forthcoming. "Applying Spatial Thinking in Social Science Research." *GeoJournal*.

Voss, Paul R. 2007. "[Demography as a Spatial Social Science.](#)" *Population Research and Policy Review* 26: 457-476.

### ***Clustering Within Spaces: Space-Individual Relationships***

### February 8: **Random Effects: Continuous Outcomes**

Hox, Chapters 1-2.

Diprete, Thomas A. and Jerry D. Forristal. 1994. "[Multilevel Models: Methods and Substance.](#)" *Annual Review of Sociology* 20: 331-357.

Mason, William M. 2001. "Statistical Analysis: Multilevel Methods." Pgs. 14988-94 in *International Encyclopedia of the Social and Behavioral Sciences*, N.J. Smelser and P.B. Bates (Eds.). Pergamon: Oxford.

Mason, William M., George Y. Wong and Barbara Entwisle. 1983. "[Contextual Analysis through the Multilevel Linear Model.](#)" *Sociological Methodology* 14: 72-103.

Statacorp. 200X. *Stata Statistical Software: Release 10.* College Station, TX: Stata Corporation. In the Cross-Sectional Time-Series (XT) volume, read pages on the `xtreg` command.

*Empirical Examples:*

Lee, Valerie E. and Anthony S. Bryk. 1989. "[A Multilevel Model of the Social Distribution of High School Achievement.](#)" *Sociology of Education* 62(3): 172-192.

Ross, Catherine E., John R. Reynolds, and Karlyn J. Geis. 2000. "[The Contingent Meaning of Neighborhood Stability for Residents' Psychological Well-Being.](#)" *American Sociological Review* 65(4): 581-597.

\*Assignment 1 distributed\*

### February 15: **Random Effects: Continuous Outcomes, cont.**

Hox, Chapters 3-4

Kreft, I.G.G., J. de Leeuw, and L.S. Aiken. 1995. "[The Effect of Different Forms of Centering in Hierarchical Linear Models.](#)" *Multivariate Behavioral Research* 30:1-21.

Raudenbush et al. 2004. *HLM6: Hierarchical Linear and Nonlinear Modeling* Chapters 1-4.

*Empirical Examples:*

Sampson, R., Raudenbush, S.W., and T. Earls. 1997. "[Neighborhoods and Violent Crime: A Multilevel Study of Collective Efficacy.](#)" *Science* 227:918-24.

\*Assignment 2 distributed\*

**February 22: Brown Long Weekend: No Class**

**March 1: Random Effects: Binomial, Multinomial, and Ordinal Response**

Hox, Chapter 6

Guo, G., and H. Zhao. 2000. "[Multilevel Modeling for Binary Data.](#)" *Annual Review of Sociology* 26:441-62.

Rodriguez, G., and N. Goldman. 2001. "[Improved Estimation Procedures for Multilevel Models with Binary Response: A Case Study.](#)" *Journal of the Royal Statistical Society, Series A*, 164:339-55.

Wong, G.Y., and W.M. Mason. 1985. "[The Hierarchical Logistic Regression Model for Multilevel Analysis.](#)" *Journal of the American Statistical Association* 80:513-24.

Raudenbush et al. 2004. *HLM6: Hierarchical Linear and Nonlinear Modeling*, pp. 94-98, 103-122, 138-139.

Statacorp. *Stata Statistical Software: Release 10*. College Station, TX: Stata Corporation. In the XT volume, read pages on the -xtlogit- command.

*Empirical Examples:*

Rountree, Pamela Wilcox and Kenneth Land. 2000. "[The Generalizability of Multilevel Models of Burglary Victimization: A Cross-City Comparison.](#)" *Social Science Research* 29(2): 284-305.

Steele, F., I. Diamond, and D. Wang. 1996. "[The Determinants of the Duration of Contraceptive Use in China: A Multilevel Multinomial Discrete Hazards Modeling Approach.](#)" *Demography* 33:12-33.

\*Assignment 3 distributed\*

**March 8: Cross-Classified Designs;  
Longitudinal Designs**

Hox, Chapter 7

Raudenbush, W. 1993. "[A Crossed Random Effects Model for Unbalanced Data with Applications in Cross-Sectional and Longitudinal research.](#)" *Journal of Educational Statistics* 18:321-49.

*Empirical Example:*

Pickery, J., G. Loosveldt, and A. Carton. 2001. "[The Effects of interviewer and respondent characteristics on Response Behavior in Panel-Surveys: A Multilevel Approach.](#)" *Sociological Methods and Research* 29:509-23.

Hox, Chapters 5

### **March 15: Longitudinal Designs; Latent Growth Curves**

Hox, Chap. 14

Steele, Fiona. 2008 "[Multilevel Models for Longitudinal Data.](#)" *Journal of the Royal Statistical Society, Series A* 171(1): 5-19.

*Empirical Examples:*

Huttenlocher, J.E., W. Haight, A.S. Bryk, and M. Seltzer. 1991. "[Early vocabulary growth: relation to language input and gender.](#)" *Developmental Psychology* 27:236-49.

Sampson, Robert J. and Patrick Sharkey. 2008. "[Neighborhood Selection and the Social Reproduction of Concentrated Racial Inequality.](#)" *Demography* 45(1): 1-29.

\*Assignment 4 distributed\*

### **March 22: Fixed Effects**

Wooldridge, Jeffrey M. 2009. Chapters 13.3, 13.4, 14.1, 14.2 in *Introductory Econometrics: A Modern Approach, 4e.* Southwestern Cengage Learning: Mason, OH.

Duncan, G., and S. Raudenbush. 2001. "Neighborhoods and Adolescent Development: How Can We Determine the Links?" Pp. 105-36 in A. Booth and A.C. Couter (eds.), *Does It Take a Village: Community Effects on Children, Adolescents, and Families.* Lawrence Erlbaum: Mahwah, NJ.

Blundell, R., and F. Windmeijer. 1997. "[Cluster effects and Simultaneity in Multilevel Models.](#)" *Health Economics* 6:439-43.

*Empirical Examples:*

Aaronson, Daniel. 1998. "[Using Sibling Data to Estimate the Impact of Neighborhoods on Children's Educational Outcomes.](#)" *Journal of Human Resources* 33(4): 915-946.

**\*Paper proposal due\***

\*Assignment 5 distributed\*

**March 29: No Class (Spring Break)**

**April 5: Unobserved Heterogeneity and Endogeneity, Continued**

Solon, Gary, Marianne E. Page and Greg. J. Duncan. 2000. "[Correlations between Neighborhood Children in their Subsequent Educational Attainment.](#)" *Review of Economics and Statistics* 82(3): 383-392.

Johnson, Rucker C. 2009. "Health Dynamics and the Evolution of Health Inequality over the Life Course: The Importance of Neighborhood and Family Background." *Working Paper*.

Steele, Fiona, Wendy Sigle-Rushton and Øystein Kravdal. (2009) "[Consequences of Family Disruption on Children's Educational Outcomes in Norway.](#)" *Demography* 46(3): 553-574.

**April 12: Another Fixed Effects Example;  
Spatial Dependence and Regression**

Cherlin, Andrew J., P. Lindsay Chase-Lansdale, and Christine McRae. 1991. "[Effects of Parental Divorce on Mental Health Throughout the Life Course.](#)" *American Sociological Review* 63(2): 239-249.

Anselin, Luc. 1995. "Local Indicators of Spatial Association—LISA." *Geographical Analysis* 27(2): 93-115.

Messner, Steven D., et al. 1999. "[The Spatial Patterning of County Homicide Rates: An Application of Exploratory Spatial Data Analysis.](#)" *Journal of Quantitative Criminology* 15(4): 423-450.

White, Katherine J. Curtis. 2008. "[Sending or Receiving Stations? The Dual Influence of Railroads in Early 20th-Century Great Plains Settlement.](#)" *Population Research and Policy Review* 27(1): 89-115.

Voss, Paul R., David D. Long, Roger B. Hammer and Samantha Friedman. 2006. "[County Child Poverty Rates in the U.S.: A Spatial Regression Approach.](#)" *Population Research and Policy Review* 25(4): 369-391.

***The Formation of Clustering***

**April 19: Spatial Regression, Continued;  
Multilevel Spatial Models**

South, Scott J. and Kyle Crowder. 2010. "[Neighborhood Poverty and Nonmarital Fertility: Spatial and Temporal Dimensions.](#)" *Journal of Marriage and Family* 72(1): 89-104.

Morenoff, Jeffrey D. 2003. "[Neighborhood Mechanisms and the Spatial Dynamics of Birth Weight.](#)" *American Journal of Sociology* 108(5): 976-1017.

Chaix, Basile, Juan Merlo, S.V. Subramanian et al. 2005. "[Comparison of a Spatial Perspective with the Multilevel Analytical Approach in Neighborhood Studies: The Case of Mental and Behavioral Disorders due to Psychoactive Substance Use in Malmo, Sweden, 2001.](#)" *American Journal of Epidemiology* 162(2): 171-182.

\*Assignment 6 distributed\*

**April 26: Catch Up & Presentations of Student Work**

**May 3: No Class: Work on Final Papers**

**May 10: Final Paper Due**