UW URBDP 591A/598L Research Design in
Urban Science

Fall Quarter 2020
Gould 442
Tue-Thu 9:00-10:20
4 Credits

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Department of Urban Design and Planning

Subject

This course is designed to provide graduate students in the applied social and natural sciences the theoretical and practical skills for conducting research in complex urban settings. The objective is to develop critical and analytical skills for designing and conducting empirical and applied research in urban science. The emphasis is on integration and synthesis of theories, concepts, and data across multiple disciplines. Research design is framed as an emergent process. Students will be exposed to the issues involved in research decisions and to diverse problem-solving strategies, methods, and technical tools. The course examines the logic and limits of scientific inquiry, conceptualization and measurement of social and ecological phenomena in urbanizing systems, and principles of research design and practice.

The course is structured in two components: a theoretical/methodological component and an applied research component. The theoretical component consists of lectures on research design principles and approaches. Lectures cover statistical principles of research design, hypothesis testing and statistical inference, sampling strategies, and analytical approaches to randomized experimental, quasi-experimental, longitudinal, and cross-comparative studies. Major theoretical issues include: threats to internal validity, sampling and external validity, reliability of measures, causality, interpretation of statistical analysis, and ethics in research. The applied research component focuses on emerging problems across Metropolitan Areas. Students will apply their skills on selected themes and work in team on pilot prjoects. The class features interactions with diverse urban scientists including invited video lectures of experts of big data on research applications, challenges, and lessons learned through their experience.

Themes of inquiry include: Urban change and evolution, predicting and imagining the future city, urban ecology and climate change, social networks, transportation and virtual mobility, shared economies and innovation, urban analytics, urban sensors, and big data.

Prerequisites: Introduction to statistical methods, including the basic idea of random sampling, basic probability laws, regression analysis, and statistical tests.

Course Structure and Assignments

This course is based on lectures and interactive sessions. Students are expected to actively prepare for and participate in the discussions. The interactive sessions are discussions based on selected readings and applied projects and might feature invited video lectures and panels on urban science. We will learn from applied research, the challenges, and lessons learned through experience.

Research Design Paper. Focusing on their individual research topic, students are expected to develop a 15-page research design proposal which will articulate: a research question, testable hypotheses, appropriate research design and methods, and evaluation. To develop the research proposal, students will build on three exercises: 1) frame research question, 2) literature review, and 3) evaluation of alternative research design.

Team Project. The applied research design component will include a pilot application using data on socio-ecological indicators available for US Metropolitan Areas. We will have teams focusing on different questions on key themes of students' interest and for which data are readily available for the US Metropolitan Areas. Students teams will produce a pilot application and a brief blog report which will describe the main components of the research, data analysis, and findings.

Grading: Class Participation = 20%; Team Pilot Projects = 20%; Final Paper = 50%;

Team Presentations = 10%

Readings: his course has a required set of readings and four recommended books. The papers are available on the class web site. The books are: Robert Alford (1998), The Craft of Inquiry: Theories, Methods, Evidence, Oxford University Press. Jeffrey A. Gliner, George A. Morgan and Nancy L. Leech (2017), Research Methods in Applied Settings, Lawrence Erlbaum Associates, Publishers. David Ford (2000), Scientific Method for Ecological research, Cambridge University Press. Thomas S. Kuhn (1962), The Structure of Scientific Revolutions, The University of Chicago Press.

In addition the course is based on extracts from the following urban science books:

Alberti, M. Cities That Think Like Planets: Complexity, Resilience, and Innovation in Hybrid Ecosystems. UW Press. July 2016.

Batty, M. (2013) The New Science of Cities. MIT Press, Cambridge, MA.

Bettencourt LMA, Lobo J, Helbing D, et al. (2007) Growth, innovation, scaling, and the pace of life in cities. PNAS 104(17) : 7301–7306.

Boyd D and Crawford K (2012) Critical questions for big data. Information, Communication and Society 15(5): 662–679.

Elmqvist, T. et al. Edited by (2018). Urban Planet - Knowledge towards Sustainable Cities. Cambridge University Press. https://www.cambridge.org/core/books/urban-planet/05E1CEDF6B9DF4E4B95AB8B4474C3C71#

Kitchin R. (2014) The Data Revolution: Big Data, Open Data, Data Infrastructures & Their Consequences. Sage.

Townsend A. (2013). Smart Cities: Big Data, Civic Hackers and the Quest for A New Utopia. W.W. Norton & Co

Sessions	***Research Design***	***Urban Science***
I. Urban Science	10/01 Class Overview	
II. Research Design	10/06 Research Process	10/08 *Dig data and small data*
	10/13 Research Questions	10/15 *Urban Science: Defining research questions*
	10/20 Research Approaches	10/22 *Pilot Projects: Defining the research questions*
III. Observations	10/27 Sampling, Measurements and Observations	10/29 *Reading Discussion: Social Heterogeneity*
	11/03 No Class	11/05 *Pilot Projects: Modeling*
IV. Modeling	11/10 Integrated Modeling	11/12 *Reading Discussion: Social Equity*
V. Inference	11/17 Agent Based Models	11/19 *Pilot Projects: Modeling*
	11/24 Internal & External Validity	11/26 *Thanksgiving*
VI. Synthesis	12/01 Pilot Projects Reviews	12/03 *Pilot Projects Teams preparation*
	12/08 Synthesis	12/10 Teams work on Projects Reports & Presentations

THE EMERGENCE OF A NEW URBAN SCIENCE

Lecture 1 Course Overview (10/01)

Scope of Urban Research Problems: Patterns, Processes, and Change

Robert Alford (1998), The Craft of Inquiry: Theories, Methods, Evidence, Chp. 1 The Craft of Inquiry, pp. 1-20.

Alberti, M. 2017. Grand Challenges in Urban Science. Frontiers in Built Environment, *Urban Science* 3
DOI=10.3389/fbuil.2017.00006

Alberti, M. 2017b. "Simulation and Design of Hybrid Ecosystems." *Technology|Architecture + Design*.Volume 1, 2017 - Issue 2

Alberti, M. Cities That Think Like Planets: Complexity, Resilience, and Innovation in Hybrid Ecosystems. UW Press. July 2016. Ch 2

ebook

II. RESEARCH DESIGN AS AN EMERGENT PROCESS

Lecture 2 The Process of Scientific Research (10/06)

Robert Alford, (1998), Chp. 2 Designing a Research Project and Chp. 3: "The Construction of Arguments."

Thomas R. Black, Doing Quantitative Research in the Social Sciences: An Integrated Approach to Research Design, Measurement and Statistics (1999), Chp. 2: Beginning the Design Process

Thomas S. Kuhn, Structure of Scientific Revolutions (1962), The University of Chicago Press, pp.1-210.

Dewey, John. 1920. Reconstruction in philosophy. In The middle works, vol. 12. Jo Ann Boydston, ed. Carbondale, IL: Southern Illinois University Press.

Dewey, John. 1938. Logic: the theory of inquiry. In The later works, vol. 12. Jo Ann Boydston, ed. Carbondale, IL: Southern Illinois University Press.

Isadore Newman & Carolyn R. Benz (1998), Qualitative-Quantitative Research Methodology: Exploring the Interactive Continuum, Chp. 1: Qualitative–Quantitative Research: A False Dichotomy; Chp. 2: Qualitative and Quantitative Research Methods: An Interactive Continuum.

Seminar 1: Big data and Small Data (10/08)

P. M. Hurvitz, A. V. Moudon, B. Kang, B. E. Saelens, and G. E. Duncan, “Emerging Technologies for Assessing Physical Activity Behaviors in Space and Time,” Frontiers in Public Health, vol. 2, p. 15, 2014. https://www.frontiersin.org/articles/10.3389/fpubh.2014.00002/full

Kitchin, R. 2014. Big Data, new epistemologies and paradigm shifts https://doi.org/10.1177/2053951714528481

Lecture 3 Research Questions (10/10)

Gliner, J.A., Morgan G. A., and N. L. Leech Research Methods in Applied Settings: An Integrated Approach to Design Ch. 1, 2 and 3.

Arlene Fink (1998) , Conducting Research Literature Reviews. Chp. 1: Reviewing the Literature, Why? For Whom? How?

Interactive Session 1: Urban Science: Defining Research Questions (10/15)

"Alberti et al. 2018. Embracing Urban Complexity. In Elmqvist, T. et al. Edited by (2018). Urban Planet - Knowledge towards Sustainable Cities. Cambridge University Press.

Examining indicators of socio-ecological wellbeing across US Metro Areas.

Lecture 4 Research Approaches (10/20)

Gliner, J.A., Morgan G. A., and N. L. Leech Research Methods in Applied Settings: An Integrated Approach to Design Ch. 4-7.

Thomas R. Black (1999), Chp. 3: Initial Sources of Invalidity and Confounding and Chp. 4: Basic Designs.

Gary King, Robert Keohane, & Sidney Verba (1994), Designing Social Inquiry: Scientific Inference in Qualitative Research, Chp. 1: "The Science in Social Science"

The Oxford Handbook of Quantitative Methods II, Ch 2. Overview of Traditional/Classical Statistical Approaches

Interactive session 2: Team Pilot Project: Defining the research questions (10/22)

III. OBSERVATIONS AND ANALYSIS

Lecture 5 Sampling, Measurements, and Observations (10/27)

Gliner, J.A., Morgan G. A., and N. L. Leech Research Methods in Applied Settings: An Integrated Approach to Design Ch. 9-15.

David Ford, Scientific Method for Ecological research (2000), Chp. 6 The Art of Measurement and Experiment; Chp. 7: Methods of Reasoning in Research; Chp.:8: Assessment of Postulates.

Wentz, E. A., York, A. M., Alberti, M., Conrow, L., Fischer, H., Inostroza, L., Jantz, C., Pickett, S. T. A., Seto, K. C. & Taubenböck, H., Nov 1 2018. Six fundamental aspects for conceptualizing multidimensional urban form: A spatial mapping perspective, In : Landscape and Urban Planning. 179, p. 55-62 8 p.

Interactive Session 3: Reading Discussion on Social Heterogeneity (1/29)

Interactive Session 4: Team Pilot Project: Data modeling (11/05)

V. MODELING

Lecture 6 Modeling Coupled Human-Natural Systems (11/10)

Liu et al. 2007. Complexity of Coupled Human and Natural Systems. Science Vol. 317. no. 5844, pp. 1513 – 1516
Levin, S., T. Xepapadeas, A. S. Crépin, J. Norberg, A. de Zeeuw, C. Folke, T. Hughes, K. Arrow, S. Barrett, G. Daily, P. Ehrlich, N. Kautsky, K. G. Mäler, S. Polasky, M. Troell, J. R. Vincent, and B. Walker. 2013. Social-ecological systems as complex adaptive systems: modeling and policy implications. Environment and Development Economics 18:111

132. http://dx.doi.org/10.1017/ S1355770X12000460

Polhill, J.G., T. Filatova, M. Schlüter, A. Voinov. Modelling systemic change in coupled socio-environmental systems. Environmental Modelling and Software doi:10.1016/j.envsoft.2015.10.017

Interactive Session 5: Reading Discussion on Social Equity (11/12)

Lecture 7 Agent Based Models (11/17)

Chapin, S., Carpenter, S., Kofinas, G., Folke, C., Abel, N., Clark, W., et al. (2010). Ecosystem stewardship: sustainability strategies for a rapidly changing planet. Trends in Ecology & Evolution, 25 (4), 241-249.
The_Oxford_Handbook_of_Quantitative_Methods II, Ch. 8. Spatial Analysis.

- Grimm, V., Revilla, E., Berger, U., Jeltsch, F., Mooij, W.M., Railsback, S.F., Thulke, H.H., Weiner, J., Wiegand, T., DeAngelis, D.L., 2005. Pattern-oriented modeling of agent-based complex systems: lessons from ecology. Science 310 (5750), 987e991.

- Badham J. 2008 A Compendium of Modeling Techniques. Integration Insight. Australian National University

Interactive Session 6: Reading Discussion on Selected PNAS paper (11/19)

VI. SCIENTIFIC INFERENCE

Lecture 08 Internal Validity & Causality (11/24)

Gliner, J.A., Morgan G. A., and N. L. Leech Research Methods in Applied Settings: An Integrated Approach to Design Ch. 8, 9 and 12.

*Judea Pearl (2000) Causality: Models Reasoning, and Inference. Chp. 2 A Theory of Inferred Causation.

Interactive Session 7: Team Projects Review (12/01)

Interactive Session 8: Team Pilot Projects preparation (12/03)

VII. SYNTHESIS

Lecture 10 Synthesis (12/08)

Gliner, J.A., Morgan G. A., and N. L. Leech Research Methods in Applied Settings: An Integrated Approach to Design Ch16-26.

The_Oxford_Handbook_of_Quantitative_Methods I, Ch 22. Monte Carlo Analysis in Academic research.

How to write a first-class paper https://www.nature.com/articles/d41586-018-02404-4

Pilot Projects Team: Work on final reports and presentations (12/10)

Final Papers due: Dec. 15 @5:00 pm