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

Fall Quarter 2024 – (4 Credits)
Tue-Thu 8:30-9:50
Gould 208J

Instructor: Marina Alberti (malberti@uw.edu)

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 projects. 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. Student teams will produce a pilot application and a poster 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: This course has a required set of readings and recommended books. The papers are available on canvas. The books include: 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 L. (2021) Introduction to urban science: evidence and theory of cities as complex systems. MIT PRESS

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	09/26 Class Overview	10/01 What is Urban Science?
II. Research Design	10/03 Research Process	10/08 Pilot Projects: Brainstorming
	10/10 Research Questions	10/15 Pilot Projects: Defining a Research Question
III. Observations	10/17 Research Approaches	10/22 Co-Production of Knowledge (Michal Russo)
	10/24 Sampling, Measurements and Observations	10/29 Pilot Projects: Selecting a Methodology
IV. Modeling	10/31 Agent-Based Modeling & Scenario Planning	11/05 Reading Discussion: Social & Environmental Heterogeneity
	11/07 Using Machine Learning to Detect Urban Form (Karen Chen)	11/12 Pilot Projects: Applying the Methodology
V. Inference	11/14 Internal & External Validity	11/19 Reading Discussion: Urban Legacies and Social Inequities
	11/21 Thanksgiving	11/26 Pilot Projects Review
VI. Synthesis	11/28 Synthesis	12/03 Pilot Projects Teams preparation
Final Presentations 12/05 Final Presentations		

I. THE EMERGENCE OF A NEW URBAN SCIENCE

Lecture 1. Course Overview (09/26)
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. 2017. "Simulation and Design of Hybrid Ecosystems." Technology|Architecture + Design.Volume 1, 2017 - Issue 2

Lecture 2. What is Urban Science? (10/01)

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

Krueger, E. H., Constantino, S. M., Centeno, M. A., Elmqvist, T., Weber, E. U., & Levin, S. A. (2022). Governing sustainable transformations of urban social-ecological-technological systems. *npj Urban Sustainability*, *2*(1), 1-12

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.

II. RESEARCH DESIGN AS AN EMERGENT PROCESS

Lecture 3. The Process of Scientific Research (10/03)

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.

Pilot Projects 1: Brainstorming (10/08)
Examining indicators of socio-ecological wellbeing across US Metro Areas.

Lecture 4. 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?

Pilot Projects 1: 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.

III. OBSERVATIONS AND ANALYSIS

Lecture 5. Research Approaches (10/17)

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

Invited lecture: Co-Production of Knowledge (Michal Russo) (10/22)

Lecture 6. Sampling, Measurements, and Observations (10/24)

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.

Pilot Projects 3: Selecting a Methodology (10/29)

IV. MODELING

Lecture 7. Agent Based Modeling and Scenario Planning (10/31)

Liu et al. 2007. Complexity of Coupled Human and Natural Systems. Science Vol. 317. no. 5844, pp. 1513 – 1516

Levin, S., et all. 2013. Social-ecological systems as complex adaptive systems: modeling and policy implications. Environment and Development Economics 18:111132. http://dx.doi.org/10.1017/ S1355770X12000460

Railsback and Grimm 2012. Models, Agent-Based Models, and the Modeling Cycle, chapter 1 in Agent-Based and Individual-Based Modeling: A Practical Introduction

Kim H, Peterson G, Cheung W et al (2021) Towards a better future for biodiversity and people: modelling. Nat Futures. https://doi.org/10.31235/osf.io/93sqp

Reading Discussion: Social and Environmental Heterogeneity (11/05)

Brelsford, C., Lobo, J. Hand, J, and L.M.A. Bettencourt (2017). Heterogeneity and scale of sustainable development in cities Proc. Natl. Acad. Sci., 114 pp. 89638968, 10.1073/pnas.1606033114

Lecture 8. Using Machine Learning to Detect Urban Form (Karen Chen) (11/07)

TBA

Pilot Project: Applying a Methodology (11/12)

VI. SCIENTIFIC INFERENCE

Lecture 9. Internal Validity & External Validity (11/14)

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.

Reading Discussion: Urban Legacies and Social Inequities (11/19)

Pickett, S. T. A., Grove, J. M., Boone, C. G., & Buckley, G. L. (2023). Resilience of racialized segregation is an ecological factor: Baltimore case study. Buildings and Cities, 4(1), pp. 1–18. DOI: https://doi.org/10.5334/bc.317

Pilot Projects 4: Projects Review (11/26)

VII. SYNTHESIS

Lecture 10. Synthesis (11/28)
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 5: Pilot Projects Team Preparation (12/03)

Final Presentations 12/05

Final Papers due: Dec. 11 @5:00 pm

CLASS POLICIES
1. Religious Accommodation
Washington State law requires that UW develop a policy for accommodating student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request Form (https://registrar.washington.edu/students/religious-accommodations-request/).

2. Diversity, Equity And Inclusion

The University of Washington supports an inclusive learning environment in which diverse perspectives are recognized, respected, and seen as a source of strength. In this course, I will strive to create welcoming spaces where everyone feels included and engaged regardless of their social and cultural backgrounds.

DISABILITY ACCESS AND ACCOMMODATION
It is the policy and practice of the University of Washington to create accessible learning environments consistent with federal and state law, including establishing reasonable accommodations for all students. If you have already established accommodations with Disability Resources for Students (DRS), please activate your accommodations via myDRS so that we can discuss how they will be implemented in this course.
If you have not yet established services through DRS, and you have a temporary health condition or permanent disability that requires accommodations, contact DRS directly (disability.uw.edu) to set up an Access Plan. DRS facilitates the interactive process that establishes reasonable accommodations. Conditions requiring accommodation include but are not limited to: mental health, attention-related, learning, vision, hearing, physical or health impacts.

In assessing whether you require reasonable accommodations through DRS, please note that full participation in this course requires the following types of engagement: [to be described by the instructor. See example here.

3. Academic Integrity
The University of Washington Student Conduct Code (WAC 478-121) defines prohibited academic and behavioral conduct and describes how the University holds students accountable. I expect that you will know and follow university policies regarding all forms of academic and other misconduct.

4. Artificial Intelligence

Artificial Intelligence (AI) has rapidly become an integral part of various fields, offering opportunities to enhance both scientific and communicative tasks also pose significant practical and ethical challenges. In this course, AI is viewed as a natural progression in the evolution of tools available to augment our academic endeavors. It can serve as a valuable assistant for a range of activities, including brainstorming ideas, structuring arguments, troubleshooting code, searching for information, analyzing literature, and enhancing written communication by checking for grammatical accuracy. Students opting to utilize AI in their coursework are required to transparently acknowledge its use. Responsibility for the final submission lies with the student, which means you must critically evaluate the AI-generated content for accuracy, authenticity, and potential biases. It is imperative to ensure that AI assistance does not lead to the dissemination of false information, perpetuate biases, or result in plagiarism or copyright infringement. Proper use of AI tools, coupled with diligent oversight, can contribute to the integrity and excellence of your academic work.