

Sociology 273A Syllabus
Advanced Seminar in Research Methods:
Agent-Based Modeling—Practical Implementation and Epistemological Reflections
Spring 2017 – Thursday, 9am-12noon – 402 Barrows Hall

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This course serves as a uniquely “Berkeley Sociology” introduction to the extended particle simulation method of agent-based modeling. As such, the course has four aims: 1)expose participants to exemplary agent-based models; 2)teach participants how to code many such models; 3)teach participants how to conduct the additional stages of a serious agent-based model study, and 4)sensitize participants to the many epistemological and philosophical questions and implications agent-based models might pose.

In order to accomplish these aims, class meetings will be structured such that substantial class time will be spent working to develop coding skill, studying exemplary models, conveying elementary and advanced aspects of successful conduct of an agent-based model analysis, and discussing fundamental epistemological questions.

Attendance

Attendance at every class is expected. Please do not make travel plans that interfere with class activities.

Reading Materials

Most of the reading is available via JSTOR or Google Scholar. Articles on JSTOR are noted in the syllabus with a bold **JSTOR** after the citation; those available via Google Scholar have a bold **Google Scholar** after the citation. A few articles are available at one or more other sites if accessed from a machine on the UC-Berkeley network; in such cases either a correct web-site for the journal will appear in bold after the citation, or the word **OskiCat** will appear in bold after the citation, signifying that you need to call up the journal on OskiCat, find the issue and then obtain the paper. Other article-length material can be found in a Reader you may purchase at Copy Central, 2560 Bancroft; such work is labelled **READER** below.

Only one book is assigned for this course, and you may order it from amazon.com or whatever online means you prefer:

Railsback, Steven F., and Volker Grimm. 2012. *Agent-Based and Individual-Based Modeling: A Practical Introduction*. Princeton, NJ: Princeton University Press.

Assignments and Grading

There are two types of writing assignments: 1)model analysis problem sets and, 2)final paper (and associated preparatory documents for the final paper).

Model Analysis Problem Sets

Some weeks students will be asked to complete one or more assigned problems, either from the book or from a handout provided. Problems will entail writing netlogo code to produce an agent-based model or

analyzing results of such models. The completed assignment is due at the start of class for the week.

Final Paper

There are two options for the final paper. Students may write an *agent-based modeling paper* that reflects the material the class has engaged. Or students may write an *agent-based modeling research proposal* that engages the material the class has engaged. In both cases working netlogo agent-based modeling code will need to accompany the text of the paper.

To aid your efforts, I ask you to complete and submit six preparatory documents over the course of the term: 1)the “Substantive Problem Statement”; 2)the “Input Parameters, Values, and Sources” statement; 3)the “Output Parameters and Meaning” statement; 4)the “ODD” document; 5)the “Revised ODD” document, and 6) the “Paper outline.”

Although the final paper is given the greatest weight, the final course grade is also based on attendance, class participation, and weekly submitted problems. (The preparatory documents are graded only Pass/NoPass to provide information on your progress; it is believed that successful completion of preparatory documents will aid successful completion of the final paper). The grading formula is as follows (on the 4.0 scale):

Course grade=Paper grade-(missed classes × .1)-(classes w/o participation × .1)-(failed problem sets × .1)

Specifically, the paper will be graded on the 4.0 scale. The course grade will be the paper grade reduced by .1 grade points for every missed class, .1 grade points for every class without verbal participation, and .1 grade points for every failed problem set.

The grading formula reflects the expectation that every member of the class will attend every class, speak in class every class without prompting from others, and successfully complete the vast majority of problem sets. Late work will not be accepted. No Incompletes will be given in this course.

Week 1, Jan 19 -- Introduction

Week 2, Jan 26 – Starting Netlogo and Causality

A)Written Assignment: “Substantive Problem Statement” due

B)Text: Railsback & Grimm, Chs 1-4 inclusive

C)Epistemology: Introduction to Mechanisms

Hedström, Peter. 2005. “The Analytical Tradition in Sociology,” pp. 1-10 (Chapter 1) of *Dissecting the Social: On the Principles of Analytical Sociology*. New York, NY: Cambridge University Press.

D)Example Model:

Schelling, Thomas C. 1971. “Dynamic Models of Segregation.” *Journal of Mathematical Sociology* 1: 143-186. **Google Scholar**

Week 3, Feb 2 -- From Animation to Science: But, what is a scientific simulation, anyway?

A)Written Assignment: Problem Set due

B)Text: Railsback & Grimm Chs 5-6 inclusive

C)Epistemology: What is a simulation?

Winsberg, Eric. 2013 (revised 2015). “Computer Simulations in Science.” *Stanford Encyclopedia of Philosophy* **OskiCat**

Humphreys, Paul. 2009. “The Philosophical Novelty of Computer Simulation Methods.” *Synthese* 169: 615-626. **Google Scholar**

D)Example Model:

Hegselmann, Rainer and Ulrich Krause. Under Review. “Opinion Dynamics Under the Influence of Radical Groups, Charismatic Leaders, and Other Constant Signals: A Simple Unifying Model.” **Google Scholar**

Week 4, Feb 9 – Modeling Emergence in Netlogo

A)Written Assignment: “Input Parameters, Values, & Sources” due

B)Text: Railsback & Grimm Chs 7-8 inclusive

C)Epistemology: No assigned reading

D)Example Model:

Kohler, Timothy A., R. Kyle Bocinsky, Denton Cockburn, Stephani A. Crabtree, Mark D. Varien, Kenneth E. Kolm, Shaun Smith, Scott G. Ortman, Ziad Kobi. 2012. “Modelling prehispanic pueblo societies in their ecosystems.” *Ecological Modelling* 241: 30-41. **Google Scholar**

Week 5, Feb 16 – Observation in Netlogo and Are Simulations Experiments?

A)Written Assignment: Problem Set due

B)Text: Railsback & Grimm Ch 9

C)Epistemology:

Barberousse, Anouk, Sara Franceschelli, and Cyrille Imbert. 2009. "Computer Simulations as Experiments." *Synthese* 169: 557-574. **Google Scholar**

Beisbart, Claus, and John D. Norton. 2012. "Why Monte Carol Simulations are Inferences and Not Experiments." *International Studies in the Philosophy of Science* 26: 403-422. **Google Scholar**

Morrison, Margaret. 2015a. "Why Materiality Is Not Enough: Models, Measurement, and Computer Simulation," Chapter 6 of *Reconstructing Reality: Models, Mathematics, and Simulations*. New York, NY: Oxford University Press. **READER**

D)Example Model: No assigned reading

Week 6, Feb 23 – Sensing in Netlogo and the ODD Statement

A)Written Assignment: "Output Parameters and Meaning" due

B)Text: Railsback & Grimm Ch 10

C)Epistemology: No assigned reading

D)Example Model:

Grimm, Volker, Uta Berger, Donald L. DeAngelis, J. Gary Polhill, Jarl Giske, and Steven F. Railsback. 2010. "The ODD protocol: a review and first update." *Ecological Modelling* 221 (23), 2760-2768. **Google Scholar**

Müller, Birgit, Friedrich Bohn, Gunnar Dreßler, Jürgen Groeneveld, Christian Klassert, Romina Martin, Maja Schlüter, Jule Schulze, Hanna Weise, and Nina Schwarz. 2013. "Describing human decisions in agent-based models—ODD + D, an extension of the ODD protocol." *Environmental Modelling & Software* 48: 37-48. **Google Scholar**

Week 7, Mar 2 – Adaptive Behavior in Netlogo and Epistemic Opacity

A)Written Assignment: Problem Set due

B)Text: Railsback & Grimm Ch 11

C)Epistemology:

Kuorikoski, Jaako. 2012. "Simulation and the Sense of Understanding," pp. 168-187 in *Models, Simulations, and Representations*, edited by Paul Humphreys and Cyrille Imbert. New York, NY: Routledge. **READER**

Epstein, Brian. 2011. "Agent-Based Modeling and the Fallacies of Individualism," pp. 115-144 in *Models, Simulations, and Representations*, edited by Paul Humphreys and Cyrille Imbert. New York, NY: Routledge. **READER**

D)Example Model: No assigned reading

Week 8, Mar 9 – Prediction and the ODD

A)Written Assignment: ODD due

B)Text: Railsback & Grimm Ch 12

C)Epistemology: No assigned reading

D)Example Model:

Railsback, Steven F., and Matthew D. Johnson. 2011. "Pattern-oriented modeling of bird foraging and pest control in coffee farms." *Ecological Modelling* 222: 3305-3319. **Google Scholar**

Railsback, Steven F., and Matthew D. Johnson. 2014. "Effects of land use on bird populations and pest control services on coffee farms." *Proceedings of the National Academy of Sciences* 111: 6109-6114. **Google Scholar**

Week 9, Mar 16 – Interaction in Netlogo and Philosophical Emergence

A)Written Assignment: Problem Set due

B)Text: Railsback & Grimm Ch 13

C)Epistemology:

Humphreys, Paul. 2008. "Computational and Conceptual Emergence." *Philosophy of Science, Vol. 75, No. 5, Proceedings of the 2006 Biennial Meeting of the Philosophy of Science Association, Part II: Symposia Papers*, pp. 584-594. **JSTOR**

Miller, Kent D. 2015. "Agent-Based Modeling and Organizational Studies: A critical realist perspective." *Organization Studies* 36: 175-196. **OskiCat**

D)Example Model: No assigned reading

Week 10, Mar 23 – Scheduling, Stochasticity, and Models of Economic Activity

A)Written Assignment: Revised ODD due

B)Text: Railsback & Grimm Ch 14-15

C)Epistemology: No assigned reading

D)Example Model:

Farmer, J. Doyne, and Duncan Foley. 2009. "The economy needs agent-based modelling." *Nature* 406: 685-686. **Google Scholar**

Klimek, Peter, Sebastian Poledna, J. Doyne Farmer, and Stefan Turner. 2015. "To bail-out or to bail-in? Answers from an agent-based model." *Journal of Economic Dynamics and Control* 50: 144-154. **Google Scholar**

Geanakoplos, John, Robert Axtell, Doyne J. Farmer, Peter Howitt, Benjamin Conlee, Jonathan Goldstein, Matthew Hendrey, Nathan M. Palmer, and Chun-Yi Yang. 2012. "Getting at Systemic Risk via an Agent-Based Model of the Housing Market." *American Economic Review* 102: 53-58.

JSTOR

Week 11, Apr 6 – Collectives in Netlogo

A)Written Assignment: No written assignment

B)Text: Railsback & Grimm Ch 16

C)Epistemology: No assigned reading

D)Example Model: No assigned reading

Week 12, Apr 13 – Analyzing ABMs and Philosophical Issues Concerning Validation

A)Written Assignment: Problem Set due

B)Text: Railsback & Grimm Ch 21-22

C)Epistemology:

Di Paolo, Ezequiel A., Jason Noble, and Seth Bullock. 2007. "Simulation Models as Opaque Thought Experiments." **Google Scholar**

Morrison, Margaret. 2015b. "Legitimizing Simulation: Methodological Issues of Verification and Validation." Chapter 7 of *Reconstructing Reality: Models, Mathematics, and Simulations*. New York, NY: Oxford University Press. **READER**

D)Example Model: No assigned reading

Week 13, Apr 20 – Sensitivity, Uncertainty, and Robustness Analysis

A)Written Assignment: "Paper outline" due

B)Text: Railsback & Grimm Ch 23

C)Epistemology: No assigned reading

D)Example Model: No assigned reading

Week 14, Apr 27 – How Real Are Simulations? How Simulated is the Real?

A)Written Assignment: No written assignment

B)Text: No textbook assignment

C)Epistemology:

Grüne-Yanoff, Till, and Paul Weirich. 2010. "The Philosophy and Epistemology of Simulation: A Review." *Simulation & Gaming* 41: 20-50. **Google Scholar**

Hanson, Robin. 2001. "How To Live In A Simulation." *Journal of Evolution and Technology* V.7,

September. **Google Scholar**

Tegmark, Max. 2008. "The Mathematical Universe." *The Foundations of Physics* 38: 101-150. **Google Scholar**

D)Example Model: No assigned reading

Week 15, May 4 -- Student Presentations (RRR week)

Final Papers due by 12noon on May 11