Models and Simulations

Course Mechanics

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Office Hours:	Monday 16:00 - 18:00 and By Appointment
Course Website:	http://www.mayowilson.org/Models.htm

Course Description

Computer simulations have become an important tool in philosophy of science, epistemology, and value theory. In particular, simulations of so-called "agent-based models" (ABMs) have been used to address two central philosophical topics: (1) the optimal "social structure(s)" of scientific communities, (2) the emergence/evolution of norms and morality. The course is divided into two halves, which are respectively dedicated to those two topics.

The course is "practice-based" in the following sense. In addition to discussing contemporary philosophical papers, students will learn how to construct and analyze the types of models that are employed regularly in philosophical debates. To this end, students will learn how to program in NetLogo, a programming language designed for the construction of ABMs. No previous programming experience is required.

Course Goals

The course has three central goals. First, in the beginning of the semester, students will learn the types of questions that ABMs are used to address, how ABMs differ from models in classical economics and mathematical biology, and the difficulties in interpreting and validating ABMs. Second, by the end of the semester, students should be able to explain the central philosophical questions that are being addressed with ABMs and to identify new questions that have not yet been asked. Finally, students will learn to implement an ABM in NetLogo that addresses one such new question.

Requirements

The central requirement is to design and implement an ABM with the purpose of answering some question about either the social structure of scientific communities or the evolution of norms or morality. Students will write a final paper that (i) describes the question that model is intended to answer and (ii) the results they obtained from computer simulations of said model. Each student must submit a detailed proposal (about three pages) of his or her final project after two months. Further details about the proposal and final project can be found on the course website.

There will also be programming assignments due every week for the first six weeks of the course. One cannot learn to program without practicing regularly. The weekly assignments are designed to help you practice the skills and employ the concepts taught in class.

Grading

Your final grade will be calculated via a weighted average using the following weights:

- Final Paper/Project ($\sim$ 10 pages) - 50 %
- Project Proposal ($\sim$ 3 pages) - 20 %
- Weekly Programming Assignments - 30%

Turning in Assignments

To submit an assignment, follow the procedure described in the document called "Instructions for Assignment Submission" on the website. Doing so will ensure that I can easily find your programs if they go missing, and more importantly, it ensures that I can evaluate your work and return it with feedback in a quick and orderly fashion.

Schedule

Date	Topic	Readings
16/4	Intro. to ABMs	Railsback and Grimm. Chapter 1.
23/4	ABMs vs. Population Models	Morality. Chapters 1 and 2
30/4	Evolution of Cooperation: Replicator Dynamics and Network Models	Morality. Chapter 3. Pages 53-83.
6/5	Cooperation: More Network Models	Morality. Chapter 3. Pages 83-101.
14/5	Evolution of Trust	Morality. Chapter 4. Pages 101-131.
21/5	No Class	None
28/5	Multi-player Games	Morality. Pages 238-250.
4/6	Aims and Limits of ABMs	Morality. Chapter 8. Epstein. "Why Model?"
11/6	The "Social Structure" of Science	Kitcher. "The Division of Cognitive Labor."
18/6	Strevens.	"The Role of the Priority Rule in Science"
25/6	Diversity I	Weisberg and Muldoon. "Epistemic Landscapes and the Division of Cognitive Labor"
2/7	Diversity II	Zollman. "The Epistemic Benefits of Transient Diversity."
2/7	Communication II	Zollman. "The Communication Structure of Scientific Communities."

Programming Schedule

Date	Programming Concepts	Assignment
16/4	NetLogo Interface	Tutorial 1 (In Class)
23/4	Manipulating Basic Data Types	Tutorial 3
30/4	If-then Statements and Loops	Assignment 1
7/5	Procedures and Reporters, Writing Pseudo-code	Assignment 2
14/5	World Commands, Patches, Agents, Links, and Agentsets	Assignment 3
21/5	No Class	None
28/5	World Commands, Patches, Agents, Links, and Agentsets	Assignment 4
6/4	Recursion and NetLogo Extensions	Assignment 5
11/6	Running Simulations: Plotting and Behaviorspace	Assignment 6
18/6	Randomization and Debugging	Final Project Proposal
25/6 - 15/7	None	Work on Final Projects
27/9		**Final Project Due**